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Evaluation of Technical University of Mombasa Competitiveness on Staff Competence and Infrastructure: Soft System Methodology

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Abstract: ***Technical University of Mombasa (TUM) has encountered stiff competition from other universities on a wide and diverse attributes. We analyze two of competitive attributes, staff competence and infrastructure, using Soft System Methodology (SSM). When attributes are inter-twine, complex, and difficult to analyze with traditional methods, Soft System Methodology becomes handy to tackle the messy situations using the "systems thinking" approach. The results of the work offers several recommendations to TUM notably marketing, investing in ICT facilities, creating research environment, improving sporting facilities, strengthening the new satellite campuses, facility management, among others.***

Keywords: Competitiveness, Soft System Methodology, Infrastructure and Staff Competence**.**

1. Introduction

There are many criteria used to rate the competitiveness of a university, such as those outlined by Ahmed and Kingi (2017). However, for the purpose of this study we narrow down on lecturer's competence and infrastructure. As expected, we start with definition of the three terms so as to set precedence for the rest of the paper. According to Gibb (2008) competence is defined as the capabilities of superior performers or as the proven ability to use knowledge (and) skills. It is also described in terms of responsibility and autonomy (Quendler et al., 2013). Several authors have dealt with the definition of desirable and undesirable competences of university lecturers, Blaskova, Blasko and Kucharcikova (2014); Kucharþíková (2013); Hoidn and Kärkkäinen (2014). On the other hand, Merriam-Webster Dictionary (2017), defines infrastructure as the underlying foundation or basic framework (as of a system or organization) or the resources (such as personnel, buildings, or equipment) required for an activity. University infrastructure is critical since it is the centre of the lives of many students – and in many cases, their actual home. Students start living independently, often in an unfamiliar environment for the first time, after transiting from secondary education. Therefore, the importance of a university's infrastructure cannot be over emphasized. Over the last decade or so, the term competitiveness has been widely used – and sometimes abused. In essence, it relates to the quality of being as good as or better than others of a comparable nature (Oxford Dictionary, 2017). In this study, the concept of competitiveness relates to student preference on lecturers competence and infrastructure (or how TUM should compete on the two attributes). The criteria on competence and infrastructure are defined and summarized in Table 1 that forms the basis of the study. The competence criteria is based on the previous study by Ahmed and Kingi while infrastructure criteria on QS (2017) ratings.

The general objective of the study is to evaluate TUM's competitiveness on staff competence and infrastructure using SSM. The specific objectives are (1) to analyze the effects of staff competence on TUM's competitive edge; (2) to analyze the effects of infrastructure on TUM's competitive edge; and (3) to come-up with recommendations that will make TUM competitive. The rest of the paper is organized as follows. In Section 2, we outline the SSM process. The application of the SSM on *staff competence* and *infrastructure* is presented in Section 3. The papers ends with conclusion in Section 4.

2. Literature Survey

SSM was born of the recognition that the real world is complex and messy primarily because we, human beings, inhabit it. Each of us will have a different perception of the same situation. That perception will be based upon concepts and beliefs we hold in our head – a mental model(s) that we use to make judgments about reality (Walsh, 2015).

If these concepts that form the mental models could be explicit rather than implicit, they could be used to compare against what was observed allowing each observer to defend their judgment. They may well disagree with the respective merits of their models, but the argument can now be carried out on a more rational and defendable basis. It is the two words "rational" and "defendable" that are important and form the basis of the SSM.

In simple terms SSM takes the messy arguments of the real world caused by people having different perceptions. These are then compared with defendable and rational models in the real world to help make judgments or recommendations as to the response to the issue or problem. These rational and defendable models are called *conceptual models* are based upon the use of defensible logic. The *conceptual models* are not models of the real world that we experience but logical models of what it could be like. SSM is not really problem solving in the sense of analyzing the real world to find the root causes of issues. Central though to the building of the models is the use defensible logic that is deduced from a

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statement of purpose captured in a *root definition* of a relevant system. It is very important to note that these *conceptual models* are models of what logically needs to be done to achieve the purpose expressed in the *root definition*. *Conceptual models* are a model of what "good" looks like that can be compared to reality in order to identify where change could be made. Unfortunately, the language of SSM is not one of every day use.

Table 1: Criteria on competence and infrastructure

Competence Measurements	
High retention rate	Number of years lecturer with PhD has worked in TUM
Easy progression	Time taken to progress in the hierarchical ladder e.g. from assistant lecture to lecturer, from lecturer to senior lecturer, senior lecturer to associate professor & full professor
Qualified lecturers	Pedagogy training with PhD holders vs Non-PhD holders
ICT competence	Competence to use ICT tools and applications for lecturers working in TUM
Teaching	Teaching quality assessments based on students feedback through class evaluation, further study rate and student faculty ratio.
Research	Indicators considered here include assessments of research quality amongst academics, productivity (i.e. number of papers published), citations (i.e. how recognized and referred to those papers are by other academics) and awards.
Infrastructure Measurements (QS, 2017)	
Sporting facilities	A good university will ensure that there are facilities in place for students to exercise their bodies as well as their minds. High score are awarded for swimming pools, gyms, indoor sports courts, outdoor sports courts, outdoor sports pitches, athletics tracks and full-time staff.
Medical facilities	Points are awarded for on-campus medical centre, with maximum points awarded to ones which employ either a full-time medical doctor or a full-time nurse for every 500 full-time students.
Student societies	Student societies are a great way to meet likeminded people, to involve yourself with causes in which you believe. A good university will make provisions for a wide range of student administered societies. Twenty or more, and the university will receive full marks.
Student accommodation	University comes with enough challenges without having to negotiate the many perils of the housing market in an unfamiliar environment. It is normal, therefore, for universities to provide accommodation for its first year students – and sometimes beyond that. Maximum points are awarded when the number of rooms available is equal to the total number of first-year students.
IT infrastructure	No student can be without access to a computer in the 21st Century, and access to the internet facilities. If a university can provide either one computer for every five students, internet access in every university provided room or WiFi access over 80% of the campus – excluding sports fields and parks – attract high marks.
Library facilities	No matter how great a role the internet has come to play, we are still a long way off the point at which having a well stocked library will not be absolutely essential. These are the places where many students will do the vast majority of their actual learning, where they will learn to work independently and develop a passion for their subject. A good university, therefore, must invest in its library – if it has invested Kshs 2500 per student over the past year, maximum points will be awarded.

Figure 1, has two parts, system thinking and real world. The system thinking is concerned with formulating the *root definition* (stage 3) and developing the *conceptual model* (stage 4). The real world has left hand side (stage 1 and 2) and right hand side (stage 5-7) that is concern with models comparison, identifying changes and taking action.

In stage 1 the problem perceived to be discomfort or poorly defined is stated. This is followed by modeling the real world (stage 2) where clarification of a messy problem situation is presented by a rich picture. Stages 1 and 2 involves entering the problem situation and identifying within it people, culture and politics. People means all those with an interest in the system or who are likely to be affected by changes to it. Culture is defined as social roles, norms of behaviour, or values; whereas politics are the commodities of power and how they are obtained, used, preserved and transmitted.

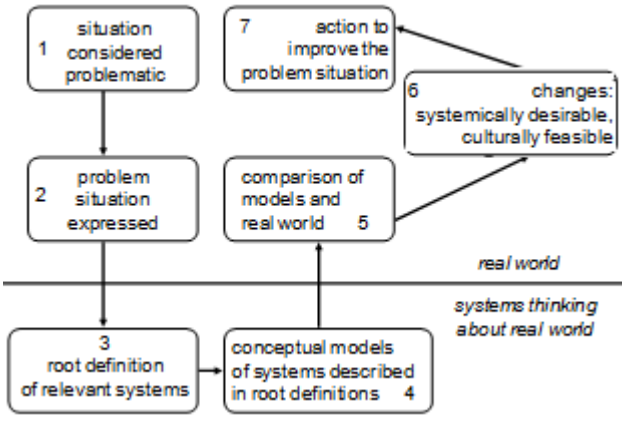

Figure 1: SSM steps

Stage 3 is the first step in the modelling process. It is a short textual statements which define the important elements of the relevant system being modelled - rather like mission statements. Here the root definition is described: "a system to do X by Y in order to achieve Z" (Checkland and Scholes, 1990). Normally, the root definition is formulated by considering the elements of CATWOE. Checkland and Scholes (1990) argued that a root definition formulated with attention to the elements of the CATWOE will be rich enough to be modellable. The CATWOE relates to

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Customers (C), Actors (A), Transformation process (T), Weltanschauung (W), Owners (O), and Environmental constraints (E). The 'customers' are the victims or beneficiaries of T. The 'actors' are those who would do T. The 'transformation process' is the conversion of input to output; T should be related to X of the root definition. The 'Weltanschauung' is the worldview which makes this T meaningful in context. The 'owner(s)' are those who could stop T. Most of the time, the owner is the person which formulates the longer term aim Z. The 'environmental constraints' are the elements outside the system which it takes as given; E visualises the systems border or systems level.

In stage 4 we start to construct conceptual models based on the root definition. In the conceptual activity model the minimum necessary activities are assembled in order to meet the requirements of the root definition and CATWOE. In general, they aim to express the main operations and bring about the transformation (in the light of the CATWOE) in a handful of activities. Next, a detailed description of the processes of communication and control is given. In its basic form this sub-system comprises the formulation of the criteria for effectiveness, efficacy and efficiency, a monitor and a control action. With the criterion of effectiveness, it is monitored in what way the longer term aim Z is achieved; 'is the transformation meeting the longer term aim?'. With the criterion of efficacy, it is monitored if the means chosen actually work in producing the output; 'does the means work?'. With the criterion of efficiency, it is monitored whether the transformation is being carried out with a minimum use of resources; 'the amount of output divided by the amount of resources used'. The monitor comprises a detailed description of the monitor activities by using the measures of performance from above. In the control action it is decided whether or not control action is necessary.

Stage 5, comparison of models with real world, aims to compare the defensible conceptual version of what might happen, with what really does happen in the situation. At this stage it is often easy to spot activities which are poorly done, or not done at all, and make recommendations for improvements. Comparisons may be simply set out in tabular form.

Stage 6 entails defining changes that are both desirable and feasible. It accounts for finite available resources (in terms of people and money) and cultural feasibility. Stakeholders involved in the potential change could hold conflicting views even if the logic of the *conceptual model* is undeniable. A typical *change management* tool that accounts for resources, ease of implementation and benefit quantification is called *Ease Benefit Matrix* and presented in section 3.6.

Stage 7 involves putting into practice the most appropriate changes identified in the previous stage. This implementation will result in new systems that will affect the bigger system leading to more opportunities and problems; and so the process starts again.

3. Methodology

As SSM is helpful for knowledge elicitation in complex and poorly defined areas (Finegan, 1994), the competitive elements are less formal, rather complex and poorly defined. For our purpose, the competitive elements selected were *lecturer's competence* and *infrastructure* that although an explicit form exists; is hardly followed and appears to contribute significantly in losing the competitive edge. These two competitive elements are difficult to tackle through a simple flow chart or other illustrating techniques. Further, a flow chart cannot capture the context and does not provide insight into competitiveness that contains interdependent human and technological factors. In this case, SSM serves as an ideal tool under the given circumstances as it aims to understanding the issues in a holistic manner (Finegan, 1994). Thus, in addition to a theoretical analysis, a physical inspection of the facilities was done in TUM and the competitor universities. The competitor universities were confined within the coastal region and included the following satellite campuses: University of Nairobi, Kenyatta University, Jomo Kenyatta University of Agriculture & Technology, Pwani University, Kenya Methodist University, Mount Kenya University and Moi University. To evaluate the competence ratings, interviews were done with selected Chairmen of Departments (CODs) and Deans if lecturers profiles were missing from the university website. The study is presented using a 7-stage approach as follows:-

3.1 Problematic Situation

TUM is battling with transition as a purely TIVET institute to a Technical University with a fluid but multiple inter-twine challenges. First, it has inherited a number of teachers from the *Teachers' Service Commission* (with pedagogy training) and took the burden of upgrading them to Masters and PhD level. However, the progression rate to PhD attainment has not only been slow (most lecturers lying at the bottom of the hierarchical ladder) but with a high turnover (searching for better prospects) after one attains the doctorate degree. This implies research activities are low with the mentality of "polytechnic" still hanging on (i.e. make money by teaching more). Attracting professors and qualified lecturers is not only difficult but expensive to TUM whose bulk of the programs and the student numbers are diploma and degree courses (compared to the handful students pursuing master and doctoral degree programs). While the Commission for University Education (CUE) stipulates university lecturers should be a PhD holder; this sounds like a myth to TUM whose bulk of the teaching staff are non-PhD holders and those with PhD lack pedagogy training. For instance, in the current academic year 2016-2017, statistic reveals unpleasant two scenarios. First, we have more non-PhD holders than PhD holders and second, the number of full-time *vs* part-time lectures is something like 1:5 against CUE recommendation of 2:1.

The challenge on infrastructure is no different and takes heavy toll on TUM competitiveness. Most of the buildings were constructed in 1958 when the institution was

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established as Mombasa Institute of Muslim Education (MIOME). In the book of Accounts; the buildings are obsolete assets but to date are large in use. On the foregoing basis, in spite of being in bad shape, their usage will continue for a long time without any major structural refurbishment.

Partly this could be due to lack of funds and space for constructing new buildings within the Main campus but mainly because the buildings have been declared as historic monuments. In an attempt to contain the surge in student numbers as well as part of the expansion strategy, several buildings have been constructed. The M-Block is a simple structure but not noise proof and lacks state-of-the-art essentials to make it competitive. The E-Learning Center and Kwale Campus sole building are incomplete, have structural issues and remains uncompetitive. In nearly all the buildings, the internet connectivity and cabling remains undesirable as characterized with low WiFi, lacks mounted projectors and poor cabling of the fiber wire. This depicts a scenario of unplanned expansion, under-funded campuses (Kwale and Lamu), that lacks basic social amenities for students. These campuses are not fit for purpose either because they do not function well with different pedagogies; they lack technological systems; and do not meet modern standards of construction and environmental comfort. Kwale Campus, for example, four years in operation down the line, lacks the following amenities: students canteen, recreational or outdoor facilities, health center, digital library, science laboratories and a state-of-the-art library. The sporting facilities, such as basketball pitch are incomplete but even worse, the proximity of the private-rented student hostels to the campus is 7 km, makes sub-optimal usage of the scanty facilities. While most competitive universities have GYM and swimming pool; the situation in TUM is deceptive. TUM seeks swimming services from a third party, but students are frequently chased away for delay payments. TUM, instead of having a medical doctor, operates with Clinical Officer supported with few nurses. If a nurse goes on retirement, it takes not less than six months to replace. This normally happens when students stage a demonstration and situation appears to be running out of control. This also explains why the satellite campuses have not broken-even, remains centralized in operation and heavily depends on support from the Main Campus. The accommodation facilities, rented from private landlords, are not only sub-standard but can hardly accommodate first year students let alone the continuing students. The rates charged on the accommodation are relatively higher for the rural market that makes the hostels half empty in the second semester. Unlike Kwale Campus that admits Kenya Universities and Colleges Central Placement Service (KUCCPs) students, the situation in Lamu Campus is worse. The campus is housed by Lamu Youth Polytechnic with an allocation of 4 classes and admits only self sponsored students, has no building or physical facility of its own - it has a relatively longer way to go before it can meet the CUE standards. Finally, the physical connectivity between the campus and amenities in the surrounding is wanting, the role of the university in the life of the community remains invisible and access to the campuses by transportation system is poor. Ideally TUM campuses should have a unique role to play in the realization of a sustainable society; that balances economic, social and ecological-dimensions

3.2 Problem Expression (Rich Picture)

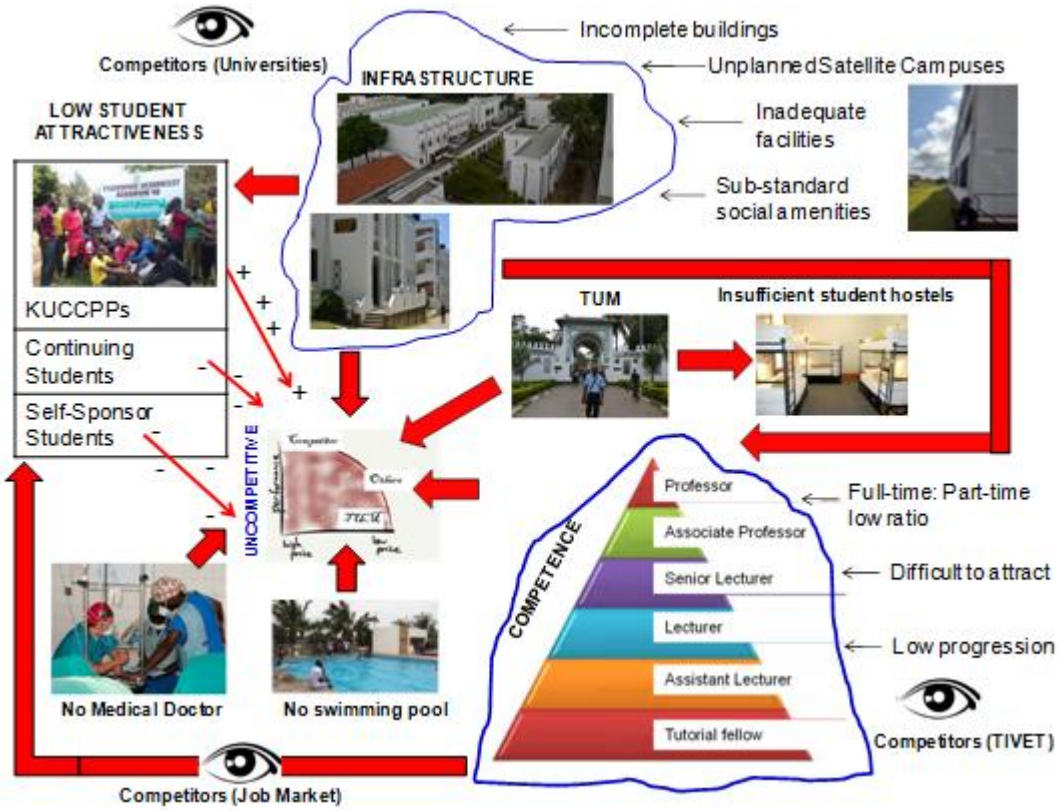

Figure 2: Rich picture

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3.3 Root Definition

Table 2: CATOWE analysis

	CATOWE	
A competitive university of global excellence that award degrees and diplomas to suitably qualified candidates, by means of quality education and conducive environment (in conformance with CUE standards), in order to fulfill the needs of potential employers.	**C**ustomers	Students
	Actors	Management
	Transformation	Students high enrollment
	Owner	Council, Senate, Management
	Weltanschauug	Competent lecturers and good campus infrastructure to attract more students
	Environment	CUE, Competition, quality, cost, social responsibility and TUM goals

3.4 Conceptual Model

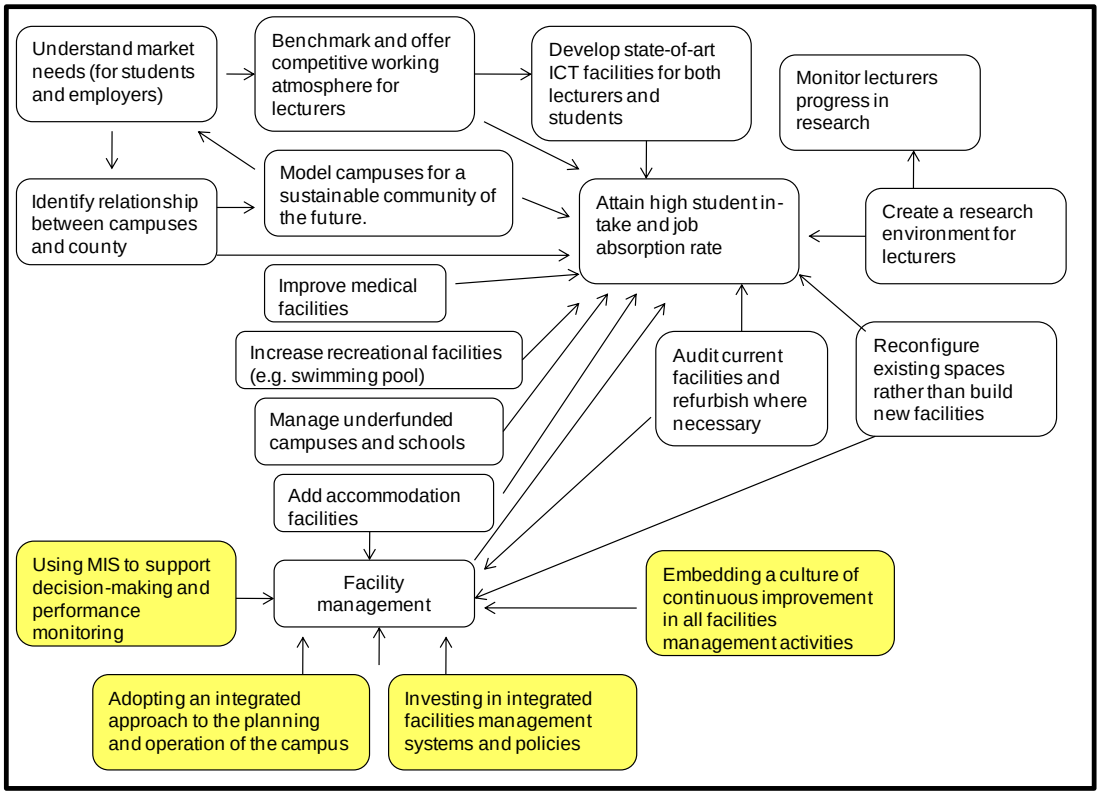

Figure 3: Conceptual model

3.5 Comparison of Model and Real World

Table 3: Comparison of conceptual model and real world

Conceptual Model Activities	*Real World*	*What TUM can do*
Attain high student in-take and job absorption rate	Self Sponsored students are revenue booster to the universities. However, in TUM, the number of KUCCPs students is relatively higher than Self Sponsored students.	**1.** Marketing university infrastructure and lecturer's competence
Develop state-of-the-art ICT facilities for both lecturers and students	Lecture sessions are mostly conducted on whiteboards and blackboards.	**2.** Invest in state-of-the-art facilities i.e. increase number of projectors (slide shows) and smart-boards.
Monitor lecturers progress in research	Low publication rate	**3.** Enforce the minimum number of publications one should have per annum as per the CUE regulation.
Create a research environment for lecturers	Excessive teaching at the expense of research activities	**4.** Create research environment (office space and high speed internet). Encourage lecturers to take maximum load within TUM as opposed to other universities
Benchmark and offer competitive working atmosphere for lecturers	A number of lecturers have no offices, PC facilities and furniture required for conducive research and working atmosphere. There is high lecturers turnover; especially for those who have attained PhDs.	**5.** Management should provide appropriate working facilities before recruitment.
Reconfigure existing spaces rather than build	Not only are the types of spaces needed changing but so too is the notion that all	**6.** Explore opportunities within university buildings for ways of using existing spaces.

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new facilities	spaces are designated for one set use. No attention is being paid to spaces that can accommodate a variety of activities, such as circulation areas.	
Sporting facilities	Incomplete and inadequate sporting facilities; lack of swimming pools.	**7.** Enhance sporting facilities, especially in Kwale campus. Construct a swimming pool
Medical facilities	TUM has only nurses and a Clinical officer	**8.** Employ a Medical Doctor and construct a health care centre in Kwale campus
Students Accommodation	TUM has acute accommodation; both in Main and Kwale campus	**9.** Construct hostels to accommodate all first year students; both in Main and the satellite campuses
Audit current facilities and refurbish where necessary	Old buildings (those constructed in 1960s) and new buildings are in deplorable state	**10.** Major repair and refurbishment of the old and new buildings should be undertaken
Manage under-funded campuses and schools	Poor planning on starting new campuses without sufficient resources	**11.** Strengthen facilities and resources on new campuses instead of starting new ventures or constructing new facilities
Identify relationship between campuses and the County Government	There is loose co-operation between the County Government and university authorities,	**12.** The university (especially campuses) should provide a range of environments, including education and social amenities, that will enable a tighter integration of the campus with the community
Model campuses for a sustainable community of the future.	A sustainable campus is one that balances economic, social and ecological dimensions.	**13.** TUM to support the efficient management of the campus and its facilities, through decentralization. Management need to incorporate the university's mission in campuses to be a place of learning and interaction with the community. Management to have a campus architectural master plan.
Understand market needs (for students and employers)	There is a mis-match between courses offered in TUM and the market requirement	**14.** Undertake market research on profitable courses to launch and employers requirements
Facility management	Poor facility management is evident in TUM	**15.** TUM competitiveness can be enhanced by: (1) Adopting an integrated approach to the planning and operation of the campus; (2) Using management information to support decision-making and performance monitoring; (3) Investing in integrated facilities management systems and policies; and (4) Embedding a culture of continuous improvement in all facilities management activities

3.6 Changes: systemically desirable, culturally feasible

Table 3 contains a number of recommendations that TUM could implement in an ideal world or as per the Conceptual Model. However, TUM has finite and limited resources in terms of manpower and finances and should pragmatically chose the order and timescales for implementation. But change management could bring conflicting views even if the logic of the Conceptual Model is undeniable. If change and culture clash, especially in respect with TUM's polytechnic mentality, culture wins. We approach this dilemma through an Ease Benefit Matrix, a Change Management tool. This is shown in Figure 4 where the size of the circles indicates the amount or resources required to complete the task. The larger the circle the more resources deemed necessary. The numbers relate back to the "what TUM can do" column (see Table 3). So for example the 10-circle is saying we have an idea for change (Major repair and refurbishment of the old and new buildings should be undertaken) that has a high benefit, is relatively easy to do but will require significant resources to complete.

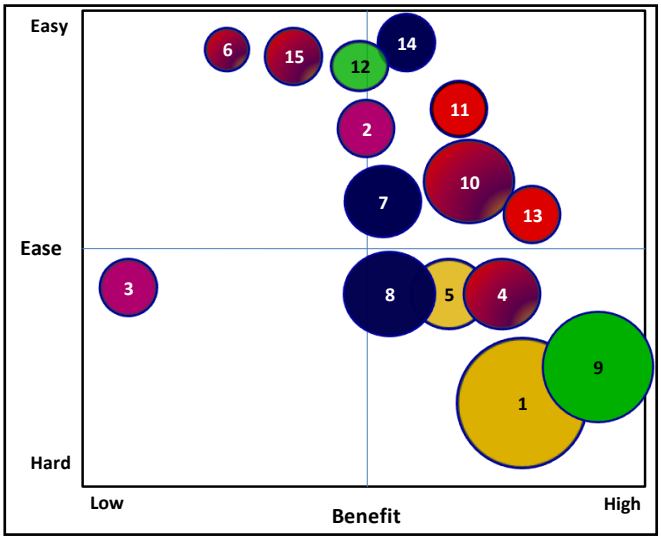

Figure 4: Ease Benefit Matrix

3.7 Take action to improve the Problem Situation

TUM management has initiated and taken a number of desirable positive steps towards the implementation efforts. These include procuring state-of-the-art facilities (e.g. smart-boards, N-Computing, Eduroam, among others), hostels construction in Kwale Campus, improving student services (e.g. building a student canteen, customer care center),

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among others. However, majority of these items do not fit in the competitive criteria identified. Management should encourage innovation and participation and try to fight the deep-rooted culture of fear and subsequent innovation assassination. In the past five years, TUM fraternity has been fighting their top management, by taking them to court, circulating defamatory letters, and sending accusations to higher offices. Consequently, out of fear and self protection, any minor decision has to be done by management consensus. TUM management should consider a corporate wide approach of team building and change management program, as an annual mandatory event to all the staff. For long, the culture and political scenario has been recruiting top leadership of TUM from the *mijikenda* community. As a government university, management should continue on the current path of reversing the imbalance through diverse and non-tribal recruitment. TUM also need to encompass some of its students and develop them among staff fraternity as a show of developing skills base for competence.

4. Conclusion

The SSM is fascinating because of its simplistic approach in understanding and modeling the research problem. The paper has demonstrated how SSM can be applied to evaluate competitiveness of university. Rather than using rating techniques (such as *Data Envelopment Analysis* or *Multi-criteria Decision Analysis*) or correlation and regression techniques (to establish root causes and relationships), the use of SSM framework does not call for analytics. In other words, whereas quantitative approaches limits readers with analytical comprehension, the SSM readers need not have analytical mind.

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