Statistical collaborations in Tanzania; Making it a reality. Evidence from Sokoine University of Agriculture Laboratory for Interdisplinary Statistical Analysis (SUALISA)

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Abstract: *This manuscript intends to pinpoint the whole process of establishing a statistical laboratory at Sokoine University of Agriculture (SUA), Successes and challenges throughout its time of operations. Sokoine University of Agriculture Laboratory for Interdisplinary Statistical Analysis (SUALISA) was established under a university charter in 2014 and started its operations in December, 2014. The statistical collaboration laboratory at Sokoine University of Agriculture in Tanzania provides a venue for statisticians at SUA to collaborate with agricultural researchers by supporting and mentoring them in statistical thinking, analysis and education, which in turn will helps them turning their research into tangible results for Tanzania farmers.*
This empirical study touches corners of its operations since its establishment, services that are mainly offered, source of funding to the operational cost, success stories and challenges that we are facing during the whole time that we have been in operations, how we try to overcome the challenges and our way forward towards being a sustainable one stop research center.

Key Words:
Statistical Collaboration Laboratory, research collaboration, Sustainable, Research center

1. INTRODUCTION:

For a health growth in research advancement of any academic entity, a support in research planning, experimental design, statistical modeling and analysis, and statistical methods development is of crucial importance. There is a need to ensure that required information is correctly collected and processed, so as to provide reliable output to the intended audience. (Vance, 2015) has it that, nearly every statistician assumes, at times, the role of a statistical consultant. Academic statistical consulting centers formalize this process of answering statistics questions and helping clients answer their research or business questions. They are the primary interface between the field of statistics and non statisticians, and as such, they drive the perception of statistics by non statisticians. Until recently, few or almost no Universities in developing countries have had such kind of services (Awe and Oguntuase, 2013).

2. MOTIVATION:

Tanzania is making efforts towards industrial economy. The current regime is pushing buttons to ignite industrial thinking minds and practice to Tanzanians. For industries to operate, a number of factors must interchangeably work together. One among the notable factor is availability of raw materials. Tanzania economy relies much on agriculture; large part of the population labour is employed in agricultural sector. Despite this, productivity in this sector has shown a stagnant growth. According to NAP (2013) the rate of growth of the agriculture sector has averaged about 4.4% over the past decade, indicating a stagnant growth. Efforts to push towards industrial economy should go hand in hand with improving agricultural productivity, as this is a prominent source of raw materials. One major constraint to agricultural growth in the country is related to inadequate support services, that is, agricultural training, research, and extension services are lacking in Tanzania (NAP, 2013).The report stresses out that research and extension programs have not been able to fully include farmers' needs in their priorities, and linkages between research and farmers' productivity have been weak. Sokoine University of Agriculture remains the only agricultural University in Tanzania. Most agricultural researches are carried out by the University graduates through thesis progression and academic member of staff through projects and research advancement. Efforts to achieve increased agricultural productivity in the country necessitate proper collection and process of information for trustworthy communicated results to stakeholders, hence a need to incorporate collaborative statisticians in agricultural researches. The teaching and research functions of higher education have an important role to play in national development particularly in the development of higher level manpower (Awe and Oguntuase, 2013). Successfully advancement in transforming agriculture sector and empower the productivity relies on among other factors, a proper research carried out in well defined environment. (Sawyerr,2004), pinpoints that, though successful research is frequently attributed to individual researchers or research teams, we all know that such success is determined by more than individual

brilliance, hard work, and team competencies. It turns also on such factors as the nature and quality of the research environment generally, the facilities and other means at the disposal of the researchers, and prior or contemporaneous work by other researchers in related fields.

Traditionally, statistical consulting centers have provided core infrastructure for university research. Researchers need statistical consulting and collaboration to do their research, just as they need access to the library and the internet (Vance, 2015). In order to contribute beyond data analysis, the statistician must proactively collaborate in all project phases: problem formulation; study design; data collection; analysis; and communication of results. In this last phase, the good statistician anticipates how a policy-maker may interpret results, and aids in correct interpretation (Morton, 2005).

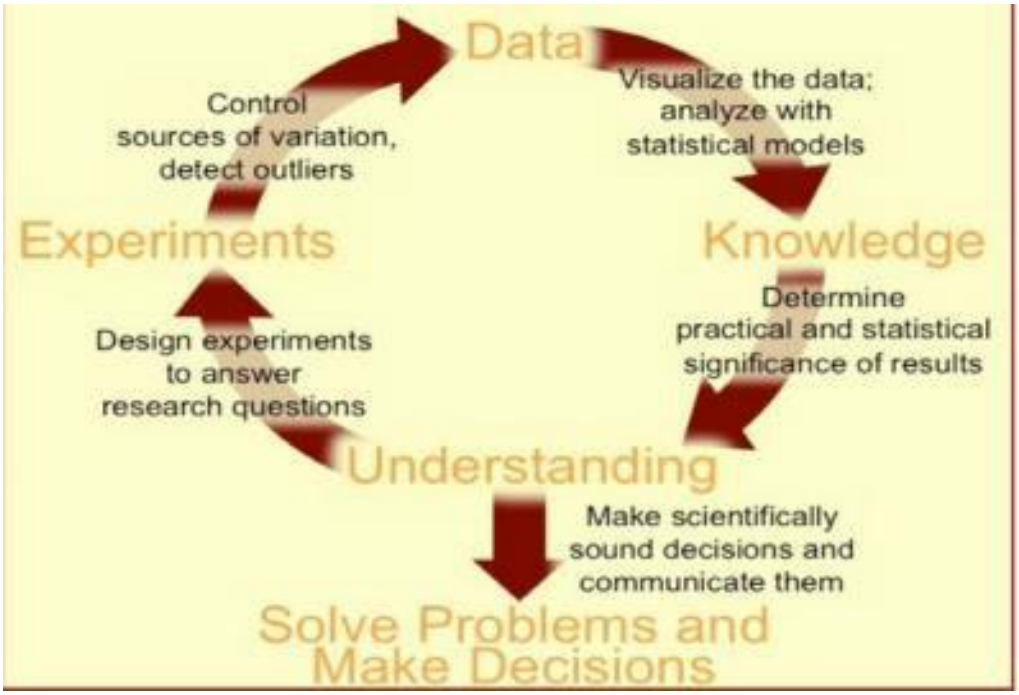

Figure 1: Statisticians' involvement in all phases of research

Source:LISA QQQ [pdf file] (n.d.). Retrieved from https://secure.hosting.vt.edu/www.lisa.stat.vt.edu/?q=other_resources

Another pulling factor towards establishing a statistical collaboration center is the fact that teaching of statistics in many Universities of the developing countries faces many challenges such that the quantity and quality of material offered faces many questions. The physical structure of many universities is substandard, books are either out of date or not available, the conduct of examinations does not meet the minimum requirements and the standard of learning—especially of statistics—is quite low (Awe and Vance, 2014). Despite that statistics as a discipline is taught to both formal statistics students and to students doing it as a course to help them in their main discipline of study, they rarely gets enough time to practice statistical methods. With substandard physical structure for offering education, the education provided to students is often not deep enough and also too theoretical for the students to comprehend what knowledge they need to apply in practical situations. We therefore believe that, a statistical collaboration center would be an ideal place to develop and improve the practical statistical knowledge of graduate students.

The statistical lab created in Tanzania at Sokoine University of Agriculture (SUALISA), is one of the very few statistical labs now existing in developing countries (Msemo and Vance 2015). The creation of SUALISA followed the initiative of LISA 2020 program, now at the University of Colorado Boulder which has a plan to establish 20 statistical collaboration laboratories in developing countries by the year 2020 (E. A. Vance,2015a). The establishment of SUALISA was further supported and funded by USAID funded project (initiative for Agricultural Research Innovations-iAGRI) (E. Vance and Magayane, 2014).

Statistical laboratories, including SUALISA, are intended to offer advice to researchers (postgraduate students, instructors, NGO's, Governments and Ministries) on how they can efficiently collect, analyze their research data and effectively communicate the results. The overall objective of SUALISA is to increase knowledge and application of statistics among SUA undergraduate, postgraduate and academic staff members as well the general public in Tanzania. Among other activities, SUALISA was established to:

(i) Train statisticians to the required level of competency for delivering training and consultancy services in statistics;
(ii) Implement collaborative mission between SUA and other universities dealing with statistical training and consultancies for researchers/research institutions;
(iii) Provide walk -in consulting to SUA students and staff;
(iv) Deliver short courses training in statistics and in statistical packages to graduate students and researchers at SUA and employees in the public and private sectors; and
(v) Offer commissioned collaborative services in statistics and statistical applications.

SUALISA puts up teams to work on collaboration, consultancy services, and short course training from the pool of university staff. By the virtue of the outlined activities the created statistical labs are in a way very unique projects in Africa that aim to be sustained indefinitely into the future. They are meant to continuously provide statistical services to the students and researchers in the universities as well as researchers from nearby ministries and research institutions. (Kazuzuru, B & Vance, E, 2016) stressed out the challenges and performances of the statistical laboratories in developing countries Universities. In their study, they pointed out how successfully SUALISA has worked from its commencement in 2014 to 2016 and the challenges that SUALISA was going through. Despite identifying the challenges, they did not discuss much the solutions to these challenges to make it even more successfully. This study despite cementing on the success stories of SUALISA, went further to explore more challenges that SUALISA still faces and ways to solve them towards making it a successfully and sustainable statistical laboratory that could be modeled for other academic entities in developing countries.

3. METHODOLOGY:

This empirical study made use of data available at SUALISA. SUALISA administration keeps the record of activities carried out at the center. We used these records to provide evidence for SUALISA performance and to make inferences. The analysis is based on descriptive statistics using bar graphs, box plots and line graphs.

4. SUCCESS STORIES:

SUALISA has proven to be an essential tool for researchers at SUA basing on the number of visit to the center on daily basis and varieties of clients in need.

4.1. Number of visits

SUALISA started its activities in December 2014 and between that igniting time and August 2017, the lab has served a total of 742 visits. It should be noted that the mentioned visits includes clients who had multiple visits. SUALISA collaborators have served a total of 32 weeks to August, 2017.

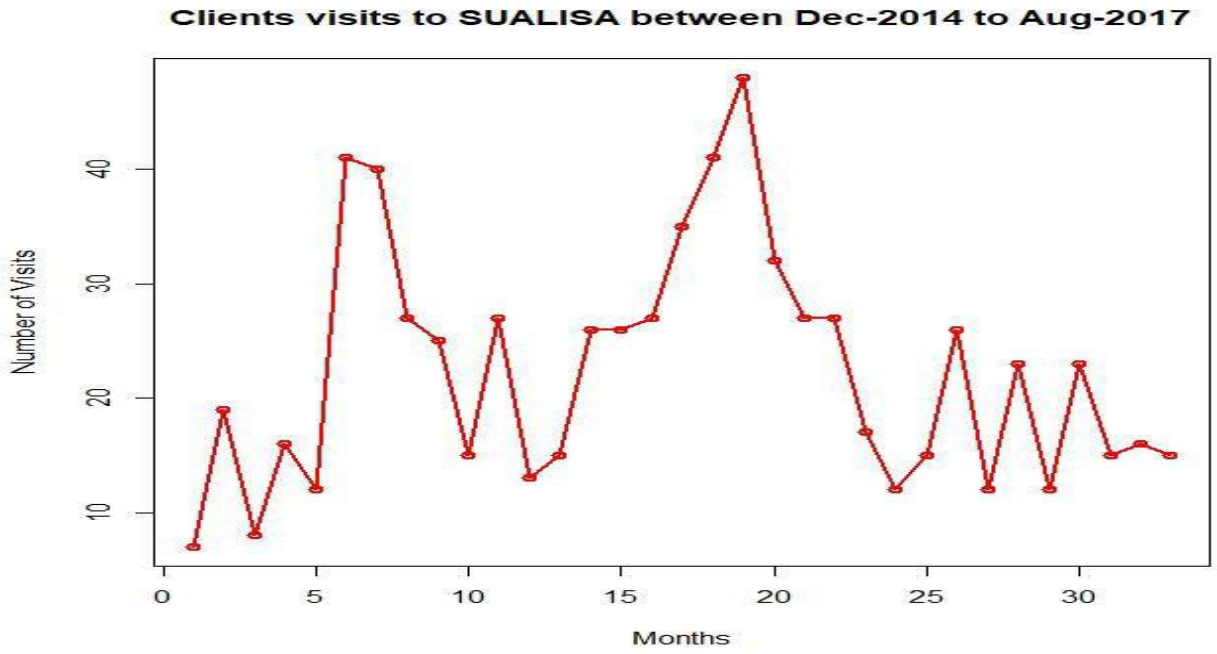

Figure 2: Number of visits to SUALISA.

Source (SUALISA, 2018)

In it is first month of operation (December, 2015) SUALISA had seven visits. The center had his first peak in May 2015 were only 41 visits were observed and the second peak was observed in June 2016 with 48 visits (Figure 1). Months of May and June had shown a large number of visits as compared to the rest of the months. This is partly due to the fact that at this time of the semester most graduate students are either trying to finalize their research proposals hence a need for help in coming up with a proper methodology or they are finalizing their thesis hence a need for support in data analysis and interpretations.

4.2. Visits per education level

In the beginning of its operations, SUALISA did not take records of the education level of the respondents who visited the center to receive its services. The interest was then centered at the mother department and collage of the client receiving the service. Internal meetings then realized that important information on the education level of the respondent was not taken into consideration, and with this concern, from April 2015 education levels of the clients was then recorded for further scrutinization. The plot below indicates the distribution of number of visits to the lab across education levels and collages.

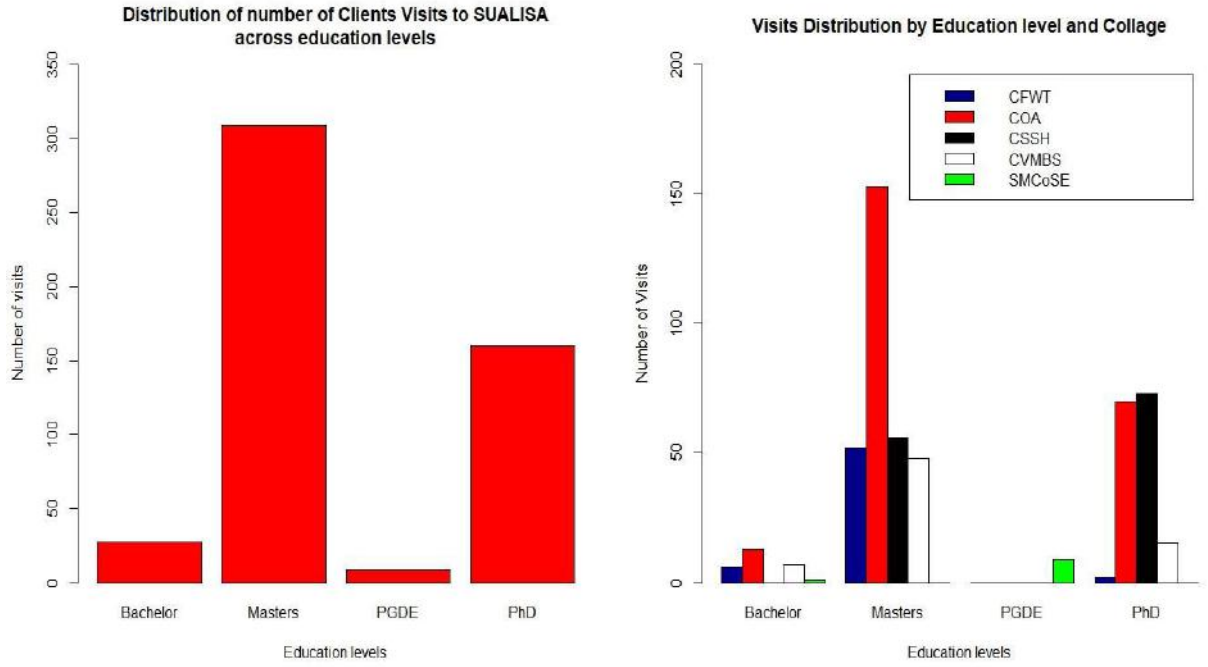

Figure 3: Number of visits distribution

Source (SUALISA, 2018)

During this time of operations, SUALISA has served a total of 505 visits with 310 being master's students, 160 being PhD students, 27 bachelor students and 8 postgraduate diploma in education students. Of the 310 master's students who were served during this time, 153 visits were recorded from Collage of Agriculture (COA), 52 were recorded from Collage of Forestry, Wildlife and Tourism (CFWT), 56 were recorded from Collage of Social Sciences and Humanities (CSSH) and 48 were recorded from Collage of Veterinary Medicine and Biomedical Sciences (CVMBS) (Figure 3). Of the PhD students that were recorded, 70 were from COA, 73 were from CFWT, 15 were from CVMBS and 2 were from CFWT. It is indicative that there are more master students who are in need of service from SUALISA collaborators. This could be contributed to the fact that, despite that these students gets a theoretical statistics class during a semester, the allocated time does not give them enough time to fully practice different statistical methods necessary to accomplish their researches.

4.3. Distribution of time spent by collaborators on client visits

SUALISA was meant to mainly serve three main services namely; walk-in consultation, Collaboration meetings and short courses. A walk-in service was meant to include meetings with clients that last for thirty minutes or less. Meetings that required more than thirty minutes necessitated the request for a collaboration meeting. SUALISA recorded time-in and time-out for visiting clients to obtain time spent by collaborators. Time spent was obtained in minutes by taking the difference between time-in and time-out for the visiting clients. Time-in was recorded as at the beginning of the consultation between SUALISA collaborator and a client.

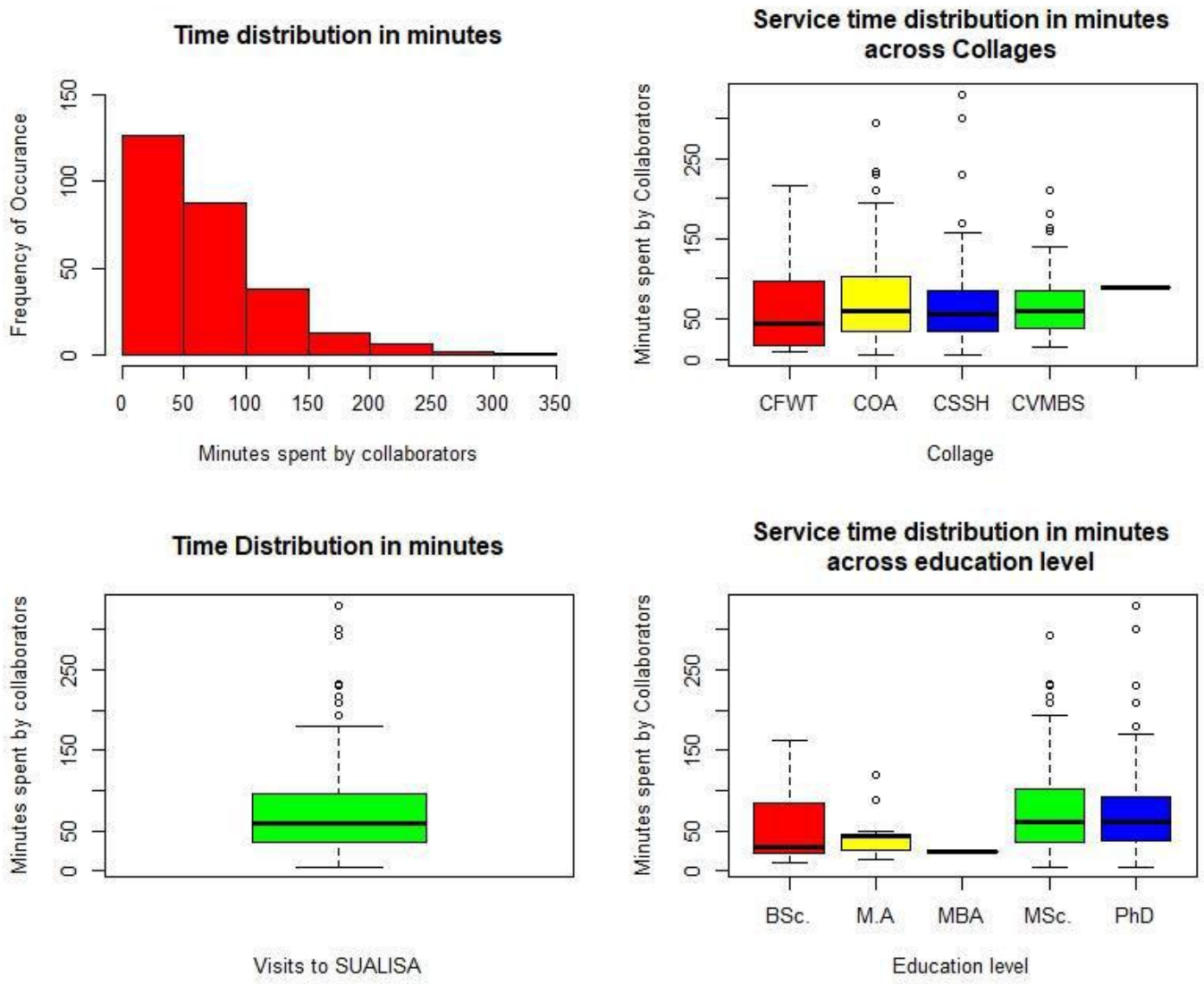

Figure 4: Service Time distribution of clients visiting SUALISA
Source (SUALISA, 2018)

Time spent by collaborators in assisting visiting clients ranged between 330 minutes to 5 minutes. The average number of minutes spent in assisting is 71.4 minutes with a standard deviation of 53.5 minutes. It is indicative that there was great variability among the recorded time spent by visiting clients. The time distribution is not normal (Figure 4), as the histogram has shown a longer tail to the right indicating positive skewness. Most of the clients spent between 0 to fifty minutes with few clients spending more than 100 minutes which has pulled the mean up towards 100 minutes. Time distribution across collages has shown that PhD students from CSSH and COA have recorded a maximum number of minutes spent with SUALISA collaborators. Despite that, Master students have recorded many visits as compared to the rest of clients receiving services (Figure 3), PhD students have shown to be in need of longer hours with SUALISA collaborators (Figure 4).

5. Challenges Facing SUALISA:

There are many issues that may affect the long term sustainability of SUALISA as an organization. First, we consider challenges that face the success of any statistical laboratory. SUALISA was funded by iAGRI, a USAID project which was centered at Sokoine University of Agriculture (SUA) which left the country in August, 2017. This being the corner stone support for the laboratory, it left SUALISA shaking financially. As the source of SUALISA's future funding is not secure, neither is its future.

Of greater concern to the administration of SUALISA is a unique problem that has not faced any of the other labs in the LISA 2020 network: all collaborators in SUALISA works as instructors for the Sokoine University of Agriculture. This manifests itself in a number of ways. The most obvious issue created by the larger problem is that collaborators in SUALISA still have to complete all of their university duties in addition to whatever work they do for

the lab. This includes, but is not limited to, teaching, giving exams, grading exams, and supervising students on field work. As a result, collaborators in SUALISA have very limited time they can give to the lab. Since the lab is viewed by the university as additional duties, none of the collaborators are given a lower workload than any of their peers who do not participate in the lab. This compounds the original issue, especially around exam time when the university does not consider duties that collaborators have in the lab when assigning exam invigilation times. Frequently instructors are unable to complete their regularly scheduled duties, and several times all of the instructors were preoccupied during the daily walk in time. The low level of university support to this point, has, in turn, created a low level of commitment by the collaborators in SUALISA. Specifically, they tend to view their duties as optional, and when they cannot complete the tasks assigned to them, do not contact other collaborators despite repeated prodding to that eff ect.

Perhaps the biggest problem facing SUALISA, and the one that is exciting to confront, is the very reason the lab was formed. There is a very low level of statistical understanding, and much misuse of statistics at SUA. The biggest concern is not the misunderstanding itself. Obviously if everyone already knew statistics perfectly we would not need a statistical lab at SUA. The concern is the research culture in which the misunderstanding exists. Researchers here, like researchers most places, must obtain the approval of their advisers before receiving their degrees. Here, however, the advisers will usually not accept advice that is contrary to their own. When they are the ones who have misunderstood the statistical tests which should be conducted, this makes it difficult for the collaborators at SUALISA to correct a mistake while maintaining an answer that will be acceptable to the client. This issue is directly related to the reputation of the lab. At labs like LISA, where the reputation is already firmly established, a student's adviser knows that the statisticians are giving the correct answer in the case of disagreement, but SUALISA does not have the same body of evidence that LISA has. Additionally, the level of statistical knowledge is lower among the instructors here, leading to bigger grievances in the practice of statistics. The problem for SUALISA then becomes the rapid establishment of a reputation or the increase of knowledge for the advisers themselves.

The other big issue is that SUALISA has not existed for long enough, nor provided enough of its services to establish a firm reputation with the students and researchers on campus at SUA.

6.Stepping stones towards overcoming challenges facing SUALISA.:

6.1. Generating funds for SUALISA

With departure of iAGRI, SUALISA is stumbling to maintain its activities, and to make it sustainable several attempts have been made, including designing different models to rise income that were documented in a funding proposal. The proposal suggests the followings:

6.1.1. Students pay direct for SUALISA

Another option is that postgraduate students pay cash directly to SUALISA as they use one of the three offered services. A charge for walk in consulting would be Tshs 10,000. Regarding collaboration project, MSc/postgraduate diploma students would pay Tshs 50,000, and PhD students would pay Tshs 70,000 for the first 10 hours of collaboration. If the project takes more than 10 hours, the client and the collaborators would discuss either co-author ship, at no extra cost to the client, or Tshs 7,000 for each extra hour of collaboration for both MSc and PhD students will be charged. As for the short courses which are normally offered in two hours' time, each attendee should pay a sum of Tshs3,000 per course irrespective of his/her status.

6.1.2. Part of postgraduate students' fees are given to SUALISA

Because the center is a valuable resource to all postgraduate students, part of their tuition fees could be paid to SUALISA. It is suggested that each MSc and postgraduate diploma student pay 68,000/= Tanzanian shillings per year for SUALISA services while each PhD student pay 88,000 /= Tanzanian shillings per year. With the current admission average rate of 44 PhD students and 290 MSc and PGD students, this charge would generate an average ofTshs23, 592,000 per year.

6.1.3. Outside clients pay cash directly to SUALISA

Students from other universities should pay the same amount for these types of services stated above (68,000 per MSc project and 88,000 per PhD project). Other outside clients (Ministries, NGOs, etc.) will negotiate a price with SUALISA leadership. All negotiated prices would be approved by SUA leadership prior to any collaboration.

6.1.4. Cash to be generated from training workshops

Training workshops will be mostly targeted to officers in various working places (Ministries, public parastatals, NGO, etc.) where we expect that the officials themselves or their employers would be able to pay a lump

sum of Tshs 300,000 or more (inclusive of breakfast and lunch) for a training workshop, which will be conducted at least for 3 consecutive days

6.1.5. SUALISA is subsidized with postgraduate research funds

Another alternative for funding SUALISA would be subsidizing it with postgraduate research funds. In exchange, SUALISA could examine the quality of students' PhD and Masters Works submitted for graduation or approving research methodologies proposed by applicants for donor funded projects.

6.2. Balancing the workload for SUALISA collaborators

There is a need to re-check the work load of collaborators. For the collaborators to efficiently devote their time in helping clients who seek for statistical help, teaching load has to be reduced. Depending on a university rank position of the collaborator, there are specific work load hours that have to be covered within a semester. Working in SUALISA adds more work to the collaborators and in turn this reduces efficiency. To make SUALISA sustainably stable, working hours needs to be re-adjusted.

7. CONCLUSIONS:

Statistical help is highly needed by researchers in developing countries. Many researchers have low understanding of statistical concepts and in turn misuse and abuse statistics. Having a center that assist researchers to have a smooth methodological conduct of research is crucial and LISA 2020 network is intended to have such collaboration centers in developing countries. Establishing a statistical collaboration center like SUALISA proves to be a cornerstone in research advancement in developing countries, despite challenges that are faced. It should be clear that challenges will vary from center to center and country to country, but it's anticipated that there are those that will cut across hence a need to develop no border solutions.

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