

Challenges and prospects for professional statistical training and statistical education in Africa – Tanzanian experience

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Abstract

The term statistics can have different meaning to the; academia and official statisticians (economists, politicians, governments and the general public). While most of the academia, from one end, view statistics as a very rich mathematical game, the official statistician on the other end view statistics as information. This diversity has brought problems on deciding what to teach to who, where, and for what purposes. On the part of the academia, no one is allowed to pursue a statistics course if he has a bad mathematical background. For the part of the official statistics, it is emphasised that statistical knowledge is important to all people irrespective of one's mathematical background.

This paper looks at the education system of the country to find out the type of statistics that is taught at different levels in relation to the expected learning outcomes at end. The levels that are looked at are; Primary Schools Education, Ordinary Secondary School Education, Advanced Secondary School Education and Tertiary (University) Level Education. One of the major challenges that are faced by statistical training in the country is the lack of qualified teachers, while the prospect is the increased demand for statistics (data - results based management). The ever increasing need for statistics may drive governments to find means of raising the nations' statistical literacy by training more statistical oriented teachers.

The importance of statistics to the development of any society is re-emphasised. It points out that most of the societies are languishing in all sorts of underdevelopment features, such as poverty in some parts versus richness in others, because of, among other things, the lack or absence of reliable statistics. "If you cannot describe it, you cannot measure it, you cannot manage it".

To turn the citizens to be statistical literate, the paper proposes type of statistics curricula that can be taught to different groups of people right from low levels of formal education to the end. The

distinction is made on the purpose of teaching statistics, whether the aim is to produce professional statisticians or just for statistical knowledge sake.

The paper then concludes that all people, irrespective of their backgrounds need to be taught some sort of statistics. Some selected Statistics Courses should be taught at all levels of the education system of the countries, while others should be left to the professionals.

1. Introduction

Statistics as a field is still new in the African continent since most countries either did not have it in their vocabulary or just inherited it from their colonial masters. It is a term that is familiar with mathematically oriented people from topics of mathematical statistics. Statistics is viewed by many as a mathematical study of probability theories. Statistics as a profession is even more blurred in the eyes of almost all Africans. Furthermore, there is difficulty in distinguishing between a “statistician” and a “professional statistician”. People are at least used to the term “statistician” but not “professional statistician”. Moser (2014) had asked himself the same question of what it meant to be a statistician. He saw a clear difference between those who develop statistical theory as opposed to the ones working in the application of the theories. He then proposed those in the academics to be called “academic statisticians” while those in the application to be called “applied statisticians”.

It is only when the distinction is made between a statistician and a professional statistician will lead to the appreciation, importance, and power of statistics in this continent’s development endeavour. It is believed that most statistical undertakings in many countries are handled by unprofessional personnel, their inability to handle these tasks have defamed the statistics profession.

The importance of official statistics in any country needs no more emphasis in managing the socio-economic aspects on a daily basis. As Tulya-muhika (1990) had pointed out, “How does one know that the economics of African economists will have anything to do with African economies unless their thinking is soaked in accurate, timely, and reliable statistical observations. In general, I believe that *statistical observations* have a better chance globally than *economic observations* in bringing about the right economic policies” He went on to propose the characteristics of the future statistician in working places in order to achieve the above goal, the statistician of the future will have to be a multi-faceted, knowledgeable, public relations officer. He (or she) will need the capacity to do *statistical work*; be knowledgeable in *data processing* and conversant with *development* issues; be able to *work with* policymakers, data processors, and other specified groups, e.g. demographers, health workers, agriculturalists, industrialists; form an effective bridge-head between statistical information and users of statistics, including the general public. In short, it can be said “you cannot define it, you cannot measure it, and you cannot manage it”

Most economists and policy makers in the continent, for decades, have tried to manage the socio-economic aspects of their countries without basing their decisions on sound statistical information. They are mostly driven by political ideologies and manage to get through because even the public is not better off. They are not tasked to account for any of their decisions since when things do not succeed as hoped, issues of superstitious beliefs come in and nobody asks anything, with even the one who made the decision failing to know what really happened.

2. Brief history of Training Statisticians in Africa

The phrases such as “Training Statistician in Africa” or “Statistical Capacity Building in Africa” or “Statistical Training”, have been used in many literatures in this continent since the early 1960s. See UNECA (1971, 1977, 2007), Tulya-Muhika (1990), Ntozi (1992) and Thabane (2008) just to mention a few. These terms meant, and the still mean, to a large extent, preparing a batch of people who are able to produce official statistics in their respective countries. The earlier focus, was to prepare people to be employed in the Central Statistical Offices (NSOs) of these countries.

With the decentralisation by devolution (D by D) practices creeping up in the continent and the extension of democratic practices in most countries, statistics production is no longer carried out by the CSOs alone but by all producers within the entire National Statistical Systems (NSS), (Msokwa, 2014). While NSOs are best place to produce aggregate national levels figures, Ministries, Departments and Agencies (MDAs), Non- Governmental Organisations, Local Governments, Research Organisations, Civil Societies, and the like, are responsible for the production of Meso and Micro data at their levels and sometimes for their own use. These data are the ones that can be collated by the CSOs to generate official statistics. The current thinking of statistical training in African Countries Context should now broaden the horizon to include all producers and even users within the NSSs.

Before and soon after independence, most statisticians in Africa were trained in Europe, especially Britain and France (Ntozi 1992). Soon after independence, the 1961 Second Conference of African Statisticians recommended an intensive programme to overcome staff shortages in African Statistical Offices. The initial emphasis was on middle level training. Most institutions were established to serve this purpose. An example of such institutions is the Eastern Africa Statistical Training Centre, in Tanzania. As Thabane, et al (2008) have indicated, although these institutions were established in Africa, they were to a great extent staffed by academicians from the former colonial countries. These academicians continued to use curricula based on their universities without considering specific needs in these countries. This has led to, among other things, statisticians working in African countries face the following challenges:

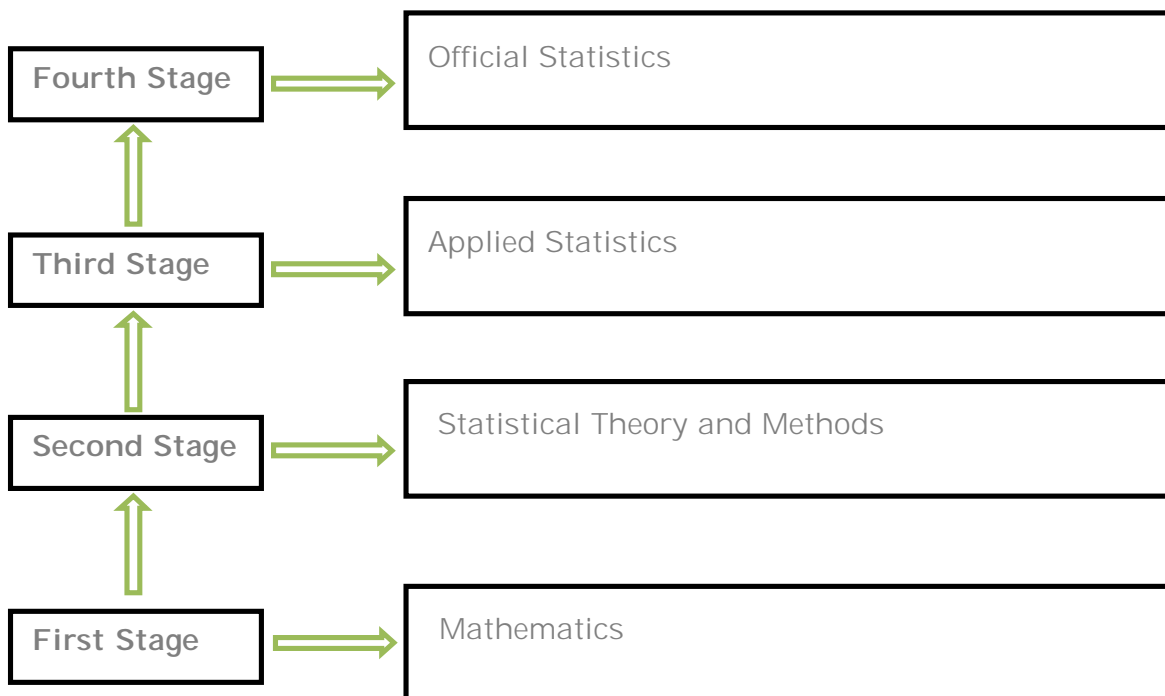
- (i) Absence of statistical career in their countries;
- (ii) Lack of the appreciation of the power of information by governments, leading to poor funding, incentives and motivation arrangements for statisticians;
- (iii) Lack of learning materials based on the specific African experience and practices;
- (iv) Limited opportunities for career development. In most African countries, statistics are perceived to be driven and required by governments, as a by-product;
- (v) Professional pressure, that is, the field is not lucrative enough compared to other professions;
- (vi) Adoption of foreign practices to local conditions, leading to poor plans and policy making
- (vii) Poorly informed society, that is, limited statistical literacy among the citizens (low statistical awareness);
- (viii) Absence of ICT policy for statisticians;
- (ix) Absence of in-service training programmes; and
- (x) Poor on-job training, including the lack of mentorship programmes.

3. Professional statistical training

The training of statisticians at professional level has four major stages. The first step is for a student to be good in mathematics, as this is a foundation to later stages. Stage two is statistical theory and methods. This stage uses mathematical knowledge to study different statistical theories and methods. It is impossible for a student to study in this stage without a good background in mathematics. Probably, that is why most people view statistics as synonymous to mathematics. The stage is a foundation for all statistical thinking that is met in a real world. The third stage is applied statistics. This stage uses theories and methods, and demonstrate how they are used in different socio-economic fields. The stage is a bit lighter in mathematics but still has some of it. It is at this stage where some non-mathematicians can be oriented to statistics and most of them seem to struggle with the course.

The fourth stage is the official statistics. This stage has minimal statistical theory and methods, and uses little mathematics as well, but needs a lot of wider knowledge of social-economic conditions of the societies. It is a stage that produces professional statisticians. Given their background in mathematics, statistical theories and methods, application of the theories and methods, and the understanding of the socio-economic conditions of the societies, enable them to produce statistics that are used in all walks of life. Produced statistics are mainly used in planning, decision making, monitoring and evaluation of various development programmes. These professional statisticians are supposed to educate statistical users as well on the type of statistics to use and best ways to use them in their relevant fields.

Figure 1.1 Stages in training professional statisticians



People can graduate with knowledge of any level, however, graduates from the stages outlines above can be categorised in four major groups. The first group consists of students majoring in

mathematics in their undergraduate studies. Upon their graduation they are called mathematicians, since many contents of their courses are mathematics. The second group are students who major in statistical theory and methods, but must take sufficient mathematics courses from the first stage. These are called theoretical statisticians upon their graduation. Their courses of study cover mainly the statistical theories and methods. Students graduating at stage three would study enough courses of stages one and two, and major in their applications. Graduates at this stage are able to apply different theories and methods of statistics in addressing scientific, social and economic issues of the societies. The graduates are called applied statisticians. Graduates of the fourth stage are called professional statisticians (have gone through all stages of the statistical training).

There are people who may not have studied sufficient courses in stages one to three in their formal education but study a good number of courses of stage four, thus they are called official statisticians. There are other people of different professions who study some statistical courses in their academic life. These form part of good users of statistics. They normally study statistics that are aligned to their fields off work, like education and agriculture. Such people can be called educational statisticians and agricultural statisticians respectively.

4. Statistical training in Tanzania

Tanzania, as many African countries, gained its political independence from the British in 1961. At independence time it inherited the education system of its colonial master. The education system was of eight years for primary (although this changed to seven years in the late 1960s), followed by six years of secondary school education that is split into two parts; four years for ordinary level and two years of advanced level. Thereafter a student proceeds to tertiary education ranging from two years (for a Diploma) and three years (for a Bachelor Degree).

Teaching of statistics at different levels of education is as follows; in primary and secondary education, statistics is taught as one of the topics in mathematics subject. All students in primary schools are taught mathematics, thus have a feel of theoretical (mathematical) statistics. In secondary education, all ordinary level secondary school students get some statistical knowledge (theoretically) through mathematics subject, where it is one of the topics. For the advanced level secondary education students who get some statistics topics are those studying science subjects, where mathematics subject is part of the combination or compulsory. Statistics that is taught at this level is just a topic in mathematics subject as well.

Students graduating from secondary schools understand statistics as part of mathematics subject that may not have any direct relation to normal (day-to-day) real life. Given that not all students fancy mathematics, most of them study it just to pass it since it is among the requisites, otherwise many would opt to other subjects that seem to have direct impact to future employment prospects, such as commerce and accountancy.

Students start studying statistics courses separately from mathematics at tertiary levels. It is at this level where a student decides to take statistics courses as minors or majors for their first degree. The pre-requisite for a student to take statistics courses is that he should have studied mathematics at the advanced secondary school level. This is why most people view this course as mathematics and

therefore limits many of them to study it. Given its nature, especially for the statistical theory and methods, they normally call it “that hard mathematics”. It is believed to be a course for a few mathematically gifted people. This has led to few students registering for statistical courses at higher learning institutions. Students registering for undergraduate degrees in the country to study statistics as one of their courses are less than one per-cent. The percentage is even less than 0.5 for most years for those majoring in statistics. The following table summarises student admissions to tertiary institutions in the country for the period 2008/09 to 2012/13

Table1 Percentage of students of statistics courses admissions to total admission in Tanzania for the 2008/09 - 2012/13 academic years

Admissions	2008/09		2009/10		2010/11		2011/12		2012/13	
	Admis	Percent	Admis	Percent	Admis	Percent	Admis	Percent	Admis	Percent
Statistics Major	45	0.13	224	0.55	174	0.32	180	0.40	113	0.25
Statistics Minor	107	0.32	105	0.26	103	0.20	85	0.19	223	0.50
Total statist	152	0.45	329	0.81	277	0.52	265	0.58	336	0.75
All Admis	33,834		40,479		53,303		45,598		44,715	

Source: Tanzania Commission of Universities

The data in Table 1 indicates that over 99 per cent of all admissions in tertiary academic institutions in Tanzania did not study statistics courses. This is an indication that almost all Tanzanians graduating from all levels of education are ignorant of official statistics. This is because such courses are not formally taught in many institutions in the country.

5. Training for professional statisticians in Tanzania

Since 1969 until 2011 the country had been training professional statisticians at the School of Statistics and Applied Economics (former Institute of Statistics and Applied Economics) at Makerere University in Uganda. The Institute of Statistics and Applied Economics (ISAE) was established in 1969 within the legal framework of Makerere University, Uganda, to provide facilities for increasing the number and the quality of high-level professional personnel in statistics and applied economics urgently needed for social and economic planning and development in East Africa and other English-speaking African countries (ISAE 2007). Given that this is an institution outside the country, few Tanzanians could access its facilities because of, among other things, exorbitant fee rates. As already has been stated above, Tanzanian universities continued to provide statistical education mainly covering courses up to second stage, (producing theoretical statisticians) with some touch in applied statistics. Graduates from these universities need an orientation to official statistics through on-job training sessions. This has hindered the improvement in the production and uses of official statistics in the country. This is because new employees learn the skills from senior staff in the office, who themselves went through the same process. Their limited statistical knowledge leads to monotonically using the same methods and formats over years.

The situation has made the National Bureau of Statistics (NBS), as the main employer of statisticians, to continue employing graduates from local universities as statisticians. This has made people to think that there is nothing like a professional statistician but titles or positions of statisticians in organisations which have nothing to do with formal statistical training. As long as one can be employed to fill the position of a statistician he shall be a statistician irrespective of his educational background. In essence the statistical profession seem not to exist since anybody can become one as long as he can do some stuff of statistical nature. In a course of advertising positions for statisticians, most prospective employers put therequired minimum qualifications as one having a degree in either statistics or mathematics or any qualification related to these areas (Government Circular 2002). This indicates that they equate statistics to mathematics and related qualifications. In other words, the government does not recognise statistics as a profession.

The country, however, had been having a Statistical Training Institution since 1965 which had been training statistics at certificate and diploma levels. The institution was established by the United Nations Development Programme (UNDP) in collaboration with the East African Common Services Organisation (EACSO),(the East African Statistical Training Centre in Dar es Salaam, Tanzania). It initially served the three partner countries of Kenya, Uganda and Tanzania. Some English speaking neighbouring countries had informal access to its services. In 1972 the UNDP ended its support and the East African Community (EAC) (successor to EACSO) took full control of the Centre until 1977.

When the East African Community collapsed in 1977, the Statistical Training Programme for Africa (STPA) requested the Tanzania Government to run the Centre and expand its user countries to be served to thirteen, namely; Botswana, Ethiopia, Kenya, Lesotho, Malawi, Seychelles, Somalia, Sudan, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe. It was at this moment when the name was changed to be the Eastern Africa Statistical Training Centre (EASTC). The Centre remained with this status for the next 17 years (without any legal status of its own) until 1994.

The Centre was legally established as a Tanzanian institution with a regional character in 1994 and allowed other countries to have access to its facilities. A law was passed by Tanzania Parliament to establishing the Eastern Africa Statistical Training Centre in November 1994, through Parliament Act No. 28 of 1994. Tanzania and user countries signed a protocol (memorandum of understanding) in which obligations and privileges of user countries were specified. It assured user

countries of participation in the activities of the Centre including membership in the Advisory Board and access to its facilities. On 17 May 2002, the Centre was launched as an Executive Agency under the Executive Agency Act, 1997 but still retained the regional character arrangements.

The initial objective of establishing the Centre was to provide statistical skills to in-service staff and educational qualifications for Certificate and Diploma levels to NSO staff. Minimum admissions requirements to the certificate level were ordinary secondary school leavers, and at least two years of work in a statistical office. Admissions requirements to a Diploma level were either a certificate from EASTC or Part One of the RSS Certificate and must have worked for at least two years after attaining the Certificate. Graduates from these levels are deployed in NSOs as data collectors and supervisors respectively.

6. Prospects for professional statistical training in the country from 2012

The EASTC has introduced a bachelor degree in statistics for professional statisticians. After training students up to diploma level for over 45 years and following the socio-economic dynamics in the user countries; where, first, there is an increase in the demand for statistics that did not match their production, secondly, the shift by NSO to employ graduates other than secondary school leavers, and the third, issue was a pressure from diploma graduates who wanted to continue with statistical career development but could not find comparable institutions except the School of Statistics and Applied Economics at Makerere University. These issues necessitate the Centre to review its programmes and status in the statistical development. The first step was to develop new curricula for the Bachelor Degree in Statistics and the second was to get accreditation by the National Council for Technical Education, as a tertiary academic institution. These two activities were finalised in 2012.

Starting October 2012, the Centre enrolled the first batch of students for the Bachelor Degree in Statistics to run for three years. The curriculum of this degree covers all the four stages mentioned above, thus upon completion of their studies graduates shall be professional statisticians. Additionally, in order to increase the statistical literacy and awareness to the nation, the Centre intends to do the following; first, intends to introduce an internship programme to all non-statistician graduates who aspire to get employed in the National Statistical System (NSS). Main topics that shall be covered in this programme shall be in official statistics. The second aspect is to collaborate with the NSS to make sure that all people who need to be engaged in any activities of statistics in the country, starting from data collection should acquire the relevant statistical training from professional institutions. Despite the introduction of the degree course, the Centre continues to enrol students for the certificate and diploma as the basis for their progression to degree level.

Other activities undertaken by the Centre is to run short course of different types, being client oriented or internally designed, undertaking consultancy assignments and researches in all socio-economic aspect related to statistics, and organising special training to users of statistics in the country.

All people need to know how to use statistics in their daily life irrespective of their profession or education background, as the Chinese proverb goes “without statistics/data you have no right to speak”. While professional statisticians would need to go systematically through all the four stages of training outlined above, users just need the type of knowledge to use statistics in their fields of operations. The kind of knowledge required by these people can be parts of any stage or some stages of a professional training. They do not need to cover everything like professional people. It is hoped that through these activities the statistical literacy in the country will be raised.

7. Challenges of professional statistical training and statistical education in Tanzania

There are a number of challenges that face professional training in the country:

1. The major and first one is that statistics as a profession is not recognised in the country. The government take a statistician as one who studies statistics or mathematics or any qualifications related to those from a recognised university. This means that a person with any qualification that the employer can think is equivalent to the above is employed as a statistician. There is no document that prescribes qualifications or requirements for one to be recognised as a statistician, leave alone a professional statistician. This has made many people working as statisticians in various organisations/institutions having either some statistical background or lacking them all together. The effect is that even the statistics that are produced by such organisations may have questionable reliability in the face of statistically knowledgeable users;
2. The lack of appreciation of the usefulness of statistics by the public, more so by the government. There are a number of ministries and government departments that have not even established statistical sections. As has been pointed earlier, they think that statistics are just end by-product of their processes and not pre-requisites. Some think that having the Monitoring and Evaluation (M&E) Sections or Information Management Systems (IMS) or Databases is synonymous to statistics. Others think that dealing with statistics is not part of their responsibility as this is dealt by the National Statistical Office;
3. The low position of statistics in the government echelon which makes statistical issues to be presented to the government, either by a third party (non-statistician) or if by a statistician (who may not also be a professional one) as an invitee on specific items who is not allowed to participate in the discussions and decisions on the matters presented. The best such a statistician can do is to present the matters, clarify some issues, and be allowed to leave the meeting. Discussions and decisions on statistical matters are made by non-statisticians;
4. As a result of a vicious cycle. Absence or little use of statistics in decision making. Given that most organisations and/or institutions, public and private have operated for a long time

have survived without using statistics or use those rudimentary produced, feel that they are not obliged to invest anything in training any of their staff in statistics;

5. The myth that statistics courses can only be pursued by mathematically gifted persons make, statistical awareness to be very low in the country. Most people understand the work of a statistician is to carry out a population census, after that he goes to sleep. Then why train so many of them to work just once in ten years or so?; and
6. Absence of a statistical career and common scheme of service in the country, and even within the government, makes it difficult for people employed in different government departments with the same qualifications to be compared. For example, a fresh graduate employed by the National Bureau of Statistics as a Statistician while if is employed as Statistician II by another government department. The former can be promoted to a Senior Statistician after serving at least three years while the latter is promoted to a Statistician I.
7. Statistical ignorance on the part of the general public.

8. Conclusions

The era of the need by the “Result Based Management” and the democratisation of the societies worldwide, which call for evidence based plans and decision making, the production of consistent and reliable statistics which have to be manned by professional statisticians, and proper use of statistics by statistically knowledgeable users, may be foundation stones for improving the statistical literacy in the country. It is hoped that these will trigger the need for training the public in statistics in all quarters.

9. Recommendation

To address the above challenges, the following are recommended;

1. Professional statisticians should form a national professional body in order to advise the government in statistical issues as has been done by other professions;
2. The government has to establish a statistical career at national level (after making consultations with professional statisticians), such that all statisticians employed in a public sector have the same career progression path;
3. Statistical training curricula in the country should be prepared for all levels of the education right from the beginning. There should be curriculum for primary pupils, secondary level, and tertiary levels. Within each level; the curricula should be split into two parts, one being compulsory to all students and the other special to professional ones. All students will need to be taught at least some elements of applied statistics, such as normal data handling and uses in their areas of specialisation. Professional ones need all the aspects of statistics as has been explained above in the four stages of training. A paradigm shift in the mid-sets of the educational set-up is a must in this aspect; and
4. There should be a formation of a National Statistical Board that is to be responsible for the professional aspects in a country in the production and use of statistics. This should be responsible to coordinate matters of both official (government) and non-official statistics in the country, that is, an overseer of all National Statistics matters.

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