



## **Higher education in South Sudan: Past, Present, and Future (Differentiation, TVET, STI ecosystems, and gender-balance)**

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### **ABSTRACT**

The paper describes a gender-based analysis of data on the students and academic staff at 14 institutions of tertiary education in South Sudan (five public universities, two private universities, and seven TVET institutions). Aspects considered by the analysis include: gender-segregated distribution of academic staff, academic ranks, subject of specialization, institutional affiliation, educational attainment, student populations, their programmes of studies, field of specialization, and gender compositions of students, with focus on gender representation in Science, Technology, Engineering and Mathematics (STEM). Further, the paper has reviewed the status of Science, Technology, and Innovation (ST&I) ecosystems in the country in terms of how it is organised or governed. And in order to make recommendations on the needed reforms and adjustments, and align South Sudan's higher education with the rest of the world, the paper reviewed national development plans and South Sudan Vision 2040, in addition to regional and global trends that are forcing change in higher education systems. Furthermore, the paper reviewed the experience of BRICs with the expansion of their higher education systems in the past two decades with the aim of applying the lessons learned to transforming South Sudan tertiary education system. Other factors and trends that are driving change in higher education systems in Africa in medium to long term, and that will impact the development of higher education sector in South Sudan, have been highlighted in the paper. They include the call on the universities to enhance national economic competitiveness through training and capacity building in a globalized knowledge economy; and the needs for universities and TVET institutions in South Sudan to act as engines of national economic development, cultural renewal, and social progress; being able to catalyze innovation for national industrial development and value addition while responding to internationalization and globalization of higher education market; able to adapt to corporatization of university governance, and diversify their resource bases in the face of falling public financing of higher education operation; and to massify in order provide educational opportunities to broader sectors of population, including women and low-income groups in the society. Several key findings have been highlighted and recommendations have been made on how higher education sector in South Sudan can be transformed along the identified parameters.

**Key words:** Gender analysis, Higher Education, TVET education, South Sudan

### **RÉSUMÉ**

Le document décrit une analyse comparative entre les sexes des données sur les étudiants et le personnel académique de 14 établissements d'enseignement supérieur au Soudan du Sud (cinq universités publiques, deux universités privées et sept établissements d'EFTP). Les aspects pris en compte par l'analyse comprennent: la répartition par sexe du personnel académique, les rangs universitaires, le sujet de spécialisation, l'affiliation institutionnelle, le niveau d'instruction, les populations estudiantines, leurs programmes d'études, leur domaine

de spécialisation et la composition par sexe des étudiants, en mettant l'accent représentation sur le sexe en sciences, technologie, ingénierie et mathématiques (STIM). En outre, le document a passé en revue l'état des écosystèmes de la science, de la technologie et de l'innovation (ST&I) dans le pays en termes d'organisation ou de gouvernance. Et afin de faire des recommandations sur les réformes et les ajustements nécessaires, et d'aligner l'enseignement supérieur du Soudan du Sud sur le reste du monde, le document a passé en revue les plans de développement nationaux et la Vision 2040 du Soudan du Sud, en plus des tendances régionales et mondiales qui forcent le changement dans systèmes d'enseignement supérieur. En outre, le document a passé en revue l'expérience des BRIC avec l'expansion de leurs systèmes d'enseignement supérieur au cours des deux dernières décennies dans le but d'appliquer les leçons apprises à la transformation du système d'enseignement supérieur du Soudan du Sud. D'autres facteurs et tendances qui entraînent des changements dans les systèmes d'enseignement supérieur en Afrique à moyen et long terme, et qui auront un impact sur le développement du secteur de l'enseignement supérieur au Soudan du Sud, ont été mis en évidence dans le document. Ils incluent l'appel aux universités pour améliorer la compétitivité économique nationale par la formation et le renforcement des capacités dans une économie du savoir mondialisée ; et la nécessité pour les universités et les institutions d'EFTP au Soudan du Sud d'agir en tant que moteurs du développement économique national, du renouveau culturel et du progrès social ; être capable de catalyser l'innovation pour le développement industriel national et la valeur ajoutée tout en répondant à l'internationalisation et à la mondialisation du marché de l'enseignement supérieur ; capables de s'adapter à la corporisation de la gouvernance universitaire et de diversifier leurs bases de ressources face à la baisse du financement public du fonctionnement de l'enseignement supérieur ; et de se multiplier afin d'offrir des opportunités éducatives à des secteurs plus larges de la population, y compris les femmes et les groupes à faible revenu de la société. Plusieurs conclusions clés ont été mises en évidence et des recommandations ont été faites sur la façon dont le secteur de l'enseignement supérieur au Soudan du Sud peut être transformé selon les paramètres identifiés.

Mots-clés : analyse de genre, enseignement supérieur, enseignement de l'EFTP, Soudan du Sud

## **INTRODUCTION**

The current state of South Sudan's higher education system is a function of its political and socio-economic history. Since 1956, when Sudan gained its independence from Britain, to 9th July 2011 when South Sudan finally declared its independence, South Sudan was managed as part of Sudan. To date, the country is emerging from decades of political conflict. The declaration of the independence followed two destructive civil wars that pitted southern Sudan against the Sudanese central government. Both wars resulted in a combined 3.5 million deaths of South Sudanese, a great toll on human capital formation (see Dhal 2018; Akec, 2019).

Sudan ran a system of higher education which it inherited from the British colonial administration. And until early 1990s, there were mainly three public universities in Sudan (that is, Khartoum, Juba, and Gezira) admitting just about 3,000 out of 100,000 students that took university entrance examinations every year. Sudan's public higher education was underfunded, and relied heavily on an outdated elitist model that favored only the brightest and small section of the potential student population.

However, Sudan began to adopt a mass higher education strategy from 1989 and onwards. As

a consequence, the number of higher education institutions in the country began to multiply from three universities in 1990 to 26 public universities by 2011. Moreover, the total student enrolment at Sudanese universities soared from 8,000 in 1989, to 500,000 by 2011. Yet, South Sudan's share of enrollment was a mere 13,000 students (or 2.6% of the national student enrollment) in all public universities by that year. This was not surprising given the fact that South Sudan had always trailed behind other regions of Sudan in education and other areas of socio-economic and human indicators.

And as of July 2011, when South Sudan declared independence, it had nine public universities (of which only 5 were functioning) and 34 private universities, the majority of which were unaccredited by the Ministry of Higher Education and most of them eventually got closed.

Ten years into independence, it is of utmost importance to ask if higher education sector in South Sudan has progressed far enough, has diversified enough, is fair enough in term of gender balance, and whether or not it is fit for the purpose in terms of TVET provision, and how the country rates in terms of STI's ecosystems. And as of the time of writing, South Sudan still has five functioning public universities, two accredited private universities educating 36,000 students between them, or 94% of students enrolled in tertiary education are in university sector; and seven technical and vocational education (TVET) institutions educating 2,500 students; or mere 6% of students enrolled in tertiary education and technical education.

This paper is based on literature review and gender-based analysis of secondary and primary data obtained from key informants at 14 institutions of tertiary education and TVET in South Sudan. The paper analyzes the status of higher education in terms of gender-balance, TVET, and ST&I ecosystems, and proposes possible policy reforms and adjustments in order to transform South Sudan higher education

sector for it to close the identified gaps.

### **Organization of the Paper**

The paper is organised into five main parts. Section 1 provides the introduction and background. Section 2 gives a brief historical overview of the state of higher education in South Sudan between January 2005, when the Sudan Comprehensive Peace Agreement was signed, and July 9th, 2011, when the country's independence was declared. Section 3 covers the post independence period from July 2011 to December 2020, and examines the current status of higher education in the country with a focus on diversification of the sector, TVET, ST&I ecosystems, and gender presentation. Section 4 reviews country's development plans and long-term vision as well as regional and global trends in higher education systems that must be put into consideration when planning the future of South Sudan higher education and TVET. Finally, Section 5 presents conclusions and recommendations on the needed reforms and policy adjustment in order to transform South Sudan's higher education and TVET sector.

### **Historical Overview of Higher Education in South Sudan**

**The Status of Public Higher Education Sector (2005-2011).** South Sudan's higher education system is deeply rooted in the history of Sudan's higher education sector of which it was a marginal part until July 2011. Akec (2011a, 2011b, 2012a, 2012b, and 2012c) provides an overview as well as highlights of the issues pertaining to the state of higher education in South Sudan in the period between 2005, when the Comprehensive Agreement was signed, and 2011, when South Sudan became an independent sovereign State.

Sudan initially ran an elitist model of higher education system which it inherited from the British colonial administration (Akec, 2011b; Akec, 2012a; Akec, 2012b). Until early 1990s, Sudan had three public universities admitting just a few thousands out of the 100,000 students that took university entrance examinations

every year. Egypt, which by then was operating a mass higher education policy, provided more opportunities for the Sudanese youth to study at its universities. Sudan's public higher education was underfunded, and relied heavily on an outdated elitist model of capacity building that favored only the brightest and small section of the potential student population (Akec, 2012c). However, after decades of a stagnant higher education sector, Sudan began to adopt a mass higher education strategy in 1989. As a consequence, the number of higher education institutions in the country began to soar from three universities in 1990 to 26 public universities by 2011. Moreover, the total student enrolment at Sudanese universities increased from 8,000 in 1989, to 500,000 by 2011. Out of that number, South Sudan's share of enrollment was a mere 13,000 students in all public universities by 2011. This was not surprising given the fact that South Sudan had always trailed behind other regions of Sudan in education and other areas of socio-economic development that was further aggravated by the long North-South war (ibid).

For example, a study showing the distribution of newly admitted students to higher education institutions in Sudan in academic year 2005/2006, based on seven main regions of Sudan (Khartoum, Central, Northren, Darfur, Eastern, Kordofan, and Southern region), revealed the share of Southern Sudan to be 4%,

compared to that of Khartoum (34%), Central Sudan (30%), Northern Sudan (10%), Darfur (8%), Eastern Sudan (8%), and Kordofan (6%) (Table 1). It needs noting that, although South Sudan had 25% of the population, it only contributed 4% to overall university admission in that year in Sudan. This means that South Sudan was starting from a very low baseline with ample room to boost its total student enrolment at university by expanding its higher education institutions and admitting more students annually (Akec, 2012a, p. 38). As proceeding sections will demonstrate, that never happened.

By July 2011, when South Sudan declared independence, it had nine public universities and 34 private universities, the majority of which were unaccredited by the Ministry of Higher Education (Table 2). In contrast, Sudan had 26 public universities, and 7 private universities, in addition to 20 and 48 public and private colleges, respectively (Table 3). In short, South Sudan had 14% of public universities and colleges while other regions of Sudan had a combined 86% by July 2011. Furthermore, amongst the nine public universities in South Sudan, four were still setting up the necessary infrastructure and only five had students on their campuses. In 2011, there were 15,000 students applying for 3,000 places in South Sudan's five functioning public universities (Akec, 2012a, p. 39).

**Table 1. The distribution of students admitted to universities in Sudan in academic year 2005/2006 according to the region of origin**

Region	Percentage share of the newly admitted students
Khartoum	34
Central	30
North	10
Darfur	8
East	8
Kordofan	6
South	4
Total	100

Source: Akec (2012a, p. 39)

**Table 2. Public and Private Higher Education Institutions in South Sudan in 2011**

Institution	Public	Private or Philanthropic
Universities	9	34
Colleges	N/A	N/A

Source: Akec (2012a, p. 41)

**Table 3. Public and Private Higher Education Institution in Sudan by 2010**

Institutions	Public	Private or Philanthropic
Universities	26	7
Colleges	20	48

Source: Akec (2012a, p. 40)

It is worth noting that the South Sudan's higher education system that was inherited from Sudan, does send many secondary school students out to the world with no skills and no access to higher education. And demand continued to rise while the supply remained static. For example, by 2010, there were 1.4 million children enrolled in primary schools and over 44,000 students were enrolled in 158 secondary schools, according to the statistics by the Ministry of Education and General Instructions. What is more, a UNICEF report in 2011 reckoned that the rate of increase in school enrolment in South Sudan was the fastest in the region. This was worrying because the increase in enrolment at school level was not matched by expansion in the number of higher education institutions.

By May 2012, a Higher Education bill was passed by the National Legislative Assembly and immediately signed into law by the President of the South Sudan Republic. This was followed by the formation of a National Higher Education Council tasked with policy-making responsibility. The Council excluded the new four public universities and private universities and colleges, a decision by the Minister of Higher Education which invited some criticism (Akec, 2012b). Especially that

the majority of Council members were senior academics committed to elitist higher education tradition and therefore, favored erecting fewer but well maintained universities, while vehemently discouraging the establishment of private universities (Akec, 2012a, p. 40).

However, Akec (see Akec, 2011a, Akec, 2011b, and Akec, 2012c) contended that in order to be competitive in the knowledge economy, South Sudan needed to be able to turn out qualified graduates in increasingly larger numbers every year, and at a faster rate than would be produced by a narrower, elitist model of higher education of the time. He argued in favour of expanding higher education in South Sudan so that, at the very least, there is one public university in each of the South Sudan 10 States (Akec, 2011a).

#### **Status of Private Higher Education in South Sudan (2005-2012)**

South Sudan witnessed a mushrooming of private higher education institutions (PHEIs) since the Comprehensive Peace Agreement (CPA) was signed in 2005. By May 2012, there were 34 PHEIs, most which were operating without license in inadequate and poor quality infrastructure (see Table 2 above). The PHEIs attracted former Sudan People's Liberation

Army (SPLA) combatants and working adults whose education was interrupted by the North-South war. The advantage of PHEIs was that they could admit students who had no formal qualification such as Sudan School Certificate nor its equivalent, so long as students could demonstrate they were literate enough to follow lectures. Another advantage of the PHEIs in South Sudan was the flexibility of their time table (most operated in afternoons and evenings).

It was small wonder that the decision by the Ministry of Higher Education to close down 22 of these private universities and colleges in 2012 generated a heated debate. The reason, according to then South Sudan Minister of Higher Education, was to put more emphasis on quality as opposed to quantity. However, the Ministry of Higher Education was criticised for the lack of pragmatism, and for inability to learn from accumulated experiences of many African countries in the provision of private higher education (Akec, 2012b).

For example, many African countries have legislations that define the steps to be followed leading to registration and accreditation and recognition of PHEIs (Akec, 2012a; Akec, 2012b). And although many PHEIs are neither registered nor recognized by the accrediting bodies, yet still attract students. Cameroon is a good example where many private institutions operate outside the regulatory framework, and yet their graduates still find jobs. It means bad education where it might be found is still better than no education. Furthermore, 90 percent of undergraduate education in India is carried out by PHEIs that are funded by the Government (Akec, 2012b).

Akec (ibid.) argued that South Sudan could learn invaluable lessons from South Africa which suffered from Apartheid that marginalized its black majority in access to higher education. Since the ascendancy of black majority rule, the country has developed an elaborate system

of ascension for school drop-outs and adults seeking a second-chance to join a university. South Africa also has 71 PHEIs, the highest number of PHEIs on the continent. In contrast, by 2012, South Sudan was still without bridging courses, and yet decided to close down private higher education institutions while providing no alternative solutions for facilitating access to higher education.

### **Status of Higher Education in South Sudan (2011 to 2020)**

**Early challenges that Faced South Sudan Higher Education Sector after independence.** By June 2011, barely one month before the declaration of independence of South Sudan, there were 956 North Sudanese academics in five operating South Sudan's public universities, of which 451 were based at University of Juba alone where they formed 73 percent of the estimated 620 academic staff total head count (Akec 2012a, and Akec 2012b). Nearly 700 North Sudanese were employed in administrative, technical, and support roles.

Overall, before independence, the number of Northern Sudanese academics in the majority of colleges and schools in South Sudan's universities averaged 65 percent. In some colleges such as veterinary and medicine, the percentage of North Sudanese academics exceeded 90 percent or more. However, after independence, most South Sudan universities lost an average of 65 percent of their teaching staff. As such, some departments in South Sudanese universities were forced to close because of the lack of staff. Other subjects such as pharmacy, dentistry, and petroleum engineering are not offered at any of South Sudan's universities. There was no coherent or well-articulated strategy by the Ministry of Higher Education to meet the shortage of academic and technical staff. There was a grave shortage of lecture halls, laboratories, and equipment at South Sudan public universities. Because all of the functioning

universities relocated to Khartoum during the war, most of their accumulated assets and equipment were impounded by the Sudanese Government following the declaration of South Sudan independence. In March 2012, the University of Juba closed for several months due to student violence, while the University of Bahr El Ghazal was operating at half its capacity because its School of Medicine and School Veterinary Sciences were closed for the lack of the staff (Akec, 2012b).

Moreover, the then new South Sudan’s Ministry of Higher Education had not attained the capacity to admit new students to universities, and was obliged to rely on Sudan’s Ministry of Higher Education to do it for them for fees. A combination of poor planning and lack of vision by the Ministry of Higher Education, and lack of political will by the Government, also meant that no student could graduate from any South Sudan’s university for two successive academic years, beginning in 2010, and no new students were admitted to South Sudan universities in academic years 2011/2012 and 2012/2013 (Akec 2012a).

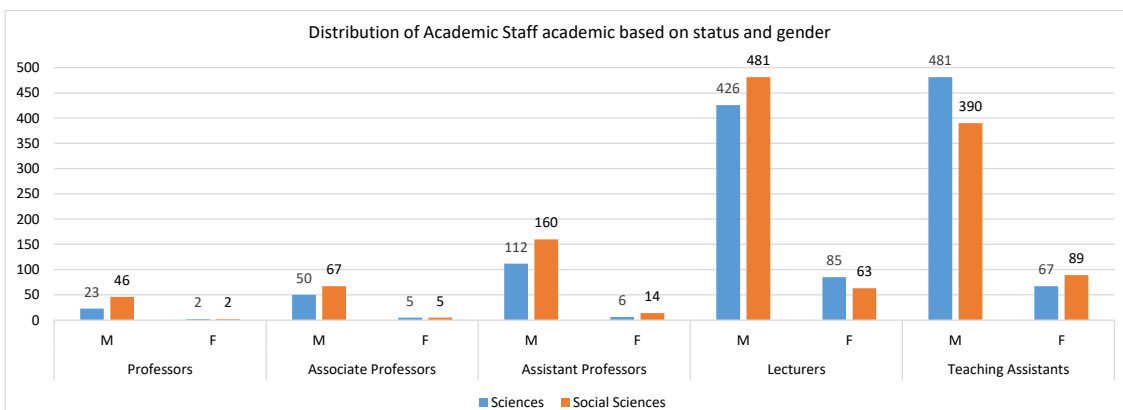
**Review of the statistics of Academic Staff**

Since the declaration of independence, slight improvements have occurred in higher education. And as statistics will show, the sector has a long way to go. This section presents the statistics on higher education as of August 2020. The statistics presents gender-segregated data

on the distribution of academic staff, students, and types of academic programs. The data were collected from each institution of learning, both public and private institutions.

As of 2020, there were about 2,574 full-time academic staff employed in the five public universities, two private universities, and seven technical and vocational education (TVET) colleges and institutes (See Fig. 1). About 48.8% of the academics were employed in STEM, whereas about 51.2% were in social sciences. Furthermore, overall academic staff were distributed according to academic ranks as follows: professors 73 (3%), associate professors 127 (5%), assistant professors 292 (11%), 1,058 lecturers (41%) and teaching assistants 1,027 (40%) (See Fig. 2). This means only 19% of the academic staff have PhDs or are qualified enough to carry out high level research. The bulk (that is, 81%) of the staff employed in tertiary education do not hold PhDs, and half of non-PhD holders have only the first degree.

Public universities employed 72 % (1,845) of the academics, private universities 7% (190), and 21% (539) were distributed across seven TVET institutions. This indicates that about 79% of the academics were employed in university sector, while only 21% were employed in TVET sector. Public learning institutions took a lion share of the staffing (90.6 percent), of which 34 percent are at the University of Juba (Fig. 3 and Fig. 4).



**Figure 1. Distribution of Academic Staff based on status, specialization, and gender**

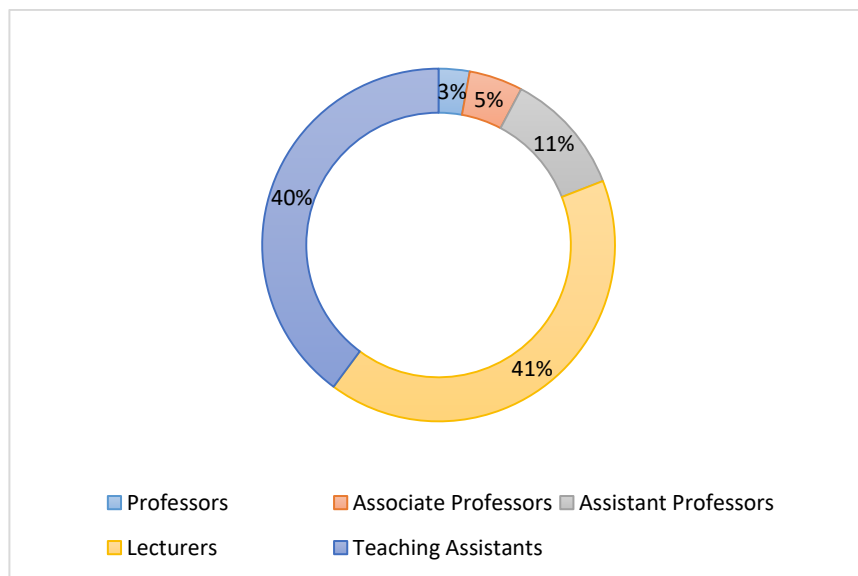


Figure 2. Distribution of Academic Staff based on ranks

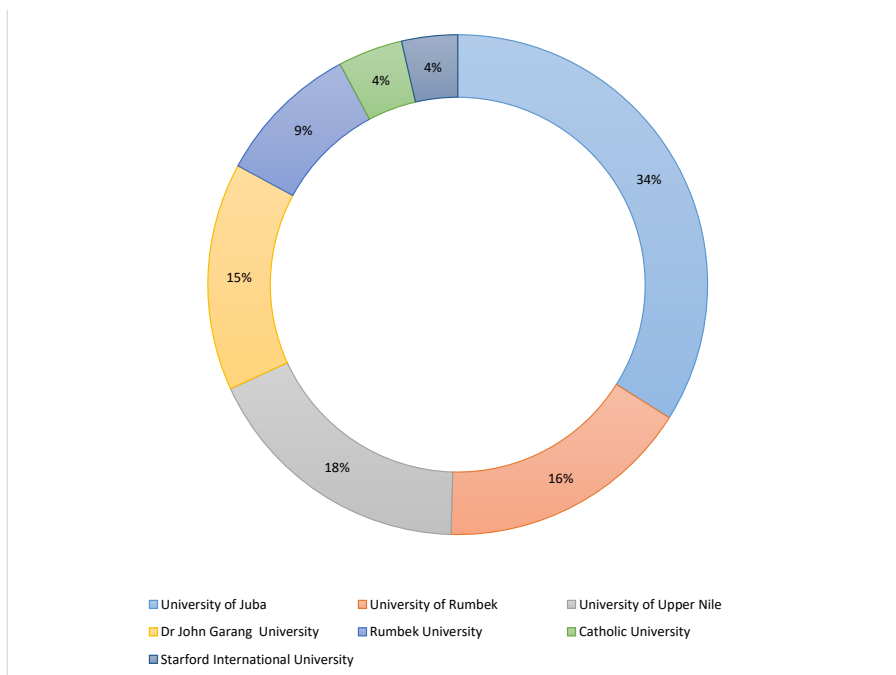
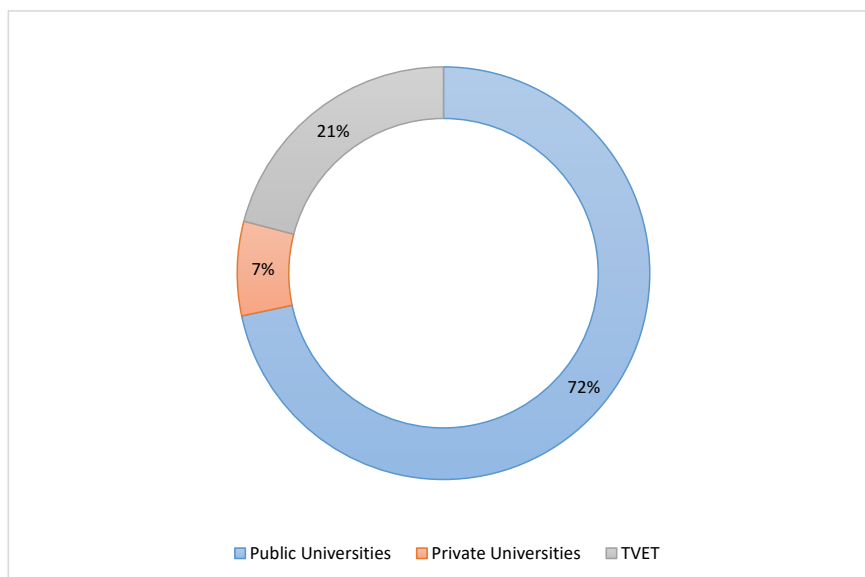


Figure 3. Distribution of Academic Staff in five public and two private universities





**Figure 4. Distribution of Academic Staff between public and private universities, and TVET institutions**

### **Gender-based Statistical Analysis of Academic Staff of Tertiary Institutions**

**Academic Ranks Distribution.** Regarding gender representation in different academic ranks, 87% of the academics are males, and only 13% are females. There are 73 professors at the seven public and private universities in South Sudan, only 4 (5.4%) female academics are professors, compared to 69 (94.5%) males. Out of the 127 associate professors recorded, only 10 (8%) are females and the rest, 117 (92%) are males. Also while there are 292 assistant professors, there are only 20 (7%) female academics in that rank, while 272 (93%) are males. The total number of lecturers is 1,050 of whom only 148 (14.1%) are female academics, and the other 902 lectures are males. Finally, there are 1,027 teaching assistants, of whom 156 (15%) are females, compared to 871 (85%) males (see Fig. 5).

### **Analysis of Teaching Staff distribution based on fields of Specialization**

When gender-based analysis is examined in terms of field of specialization, only 165 (13%)

of female academics are employed in STEM sector compared to 1,097 (87%) of males. Overall, 173 or 13% of academics working in the STEM sciences are females, compared to 1,144 (83%) male academics (see Fig. 6).

### **Gender-based distribution of Students in Higher Education and TVET Institutions**

In 2020, some 38,746 students were enrolled in 14 institutions of tertiary education and TVET. About 28,909 (75%) were male students, and the other 10,137 (26%) were female students (see Fig. 7). The great majority of students, or about 36,248 (94%), were enrolled in the university sector, while only 2,498 (6%) were enrolled in TVET. Furthermore, about 32,467 (84%) were enrolled in public universities; 3,781 (10%) in private universities; and 2,498 (6%) in TVET institutions (see Fig. 8). It is also worth noting that the University of Juba alone had 23,383 (62%) of the students enrolled in tertiary education institutions; which amounted to 72% of students enrolled in the whole university sector (both public and private) in South Sudan. Further, 26,150 students were enrolled in STEM and 25,528 students in social sciences.

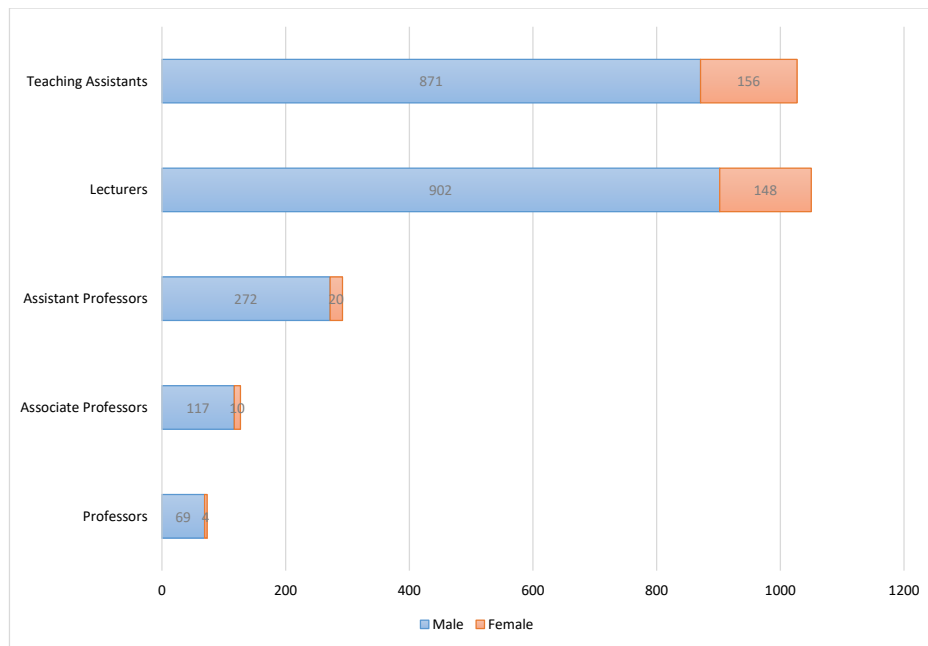


Figure 5. Academic representation of Women in South Sudan's Higher Education institutions

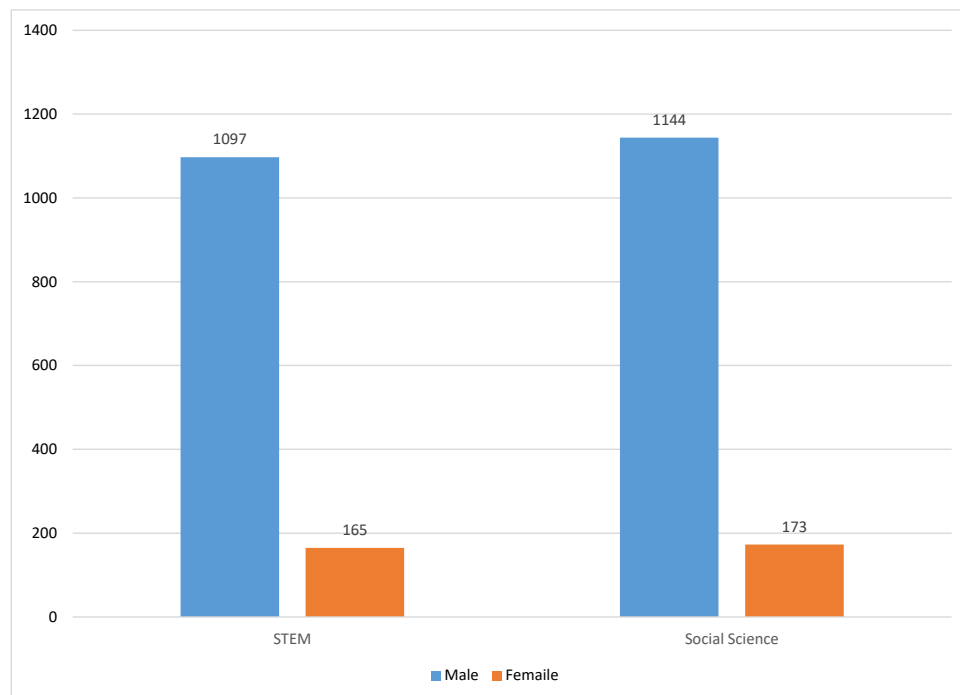
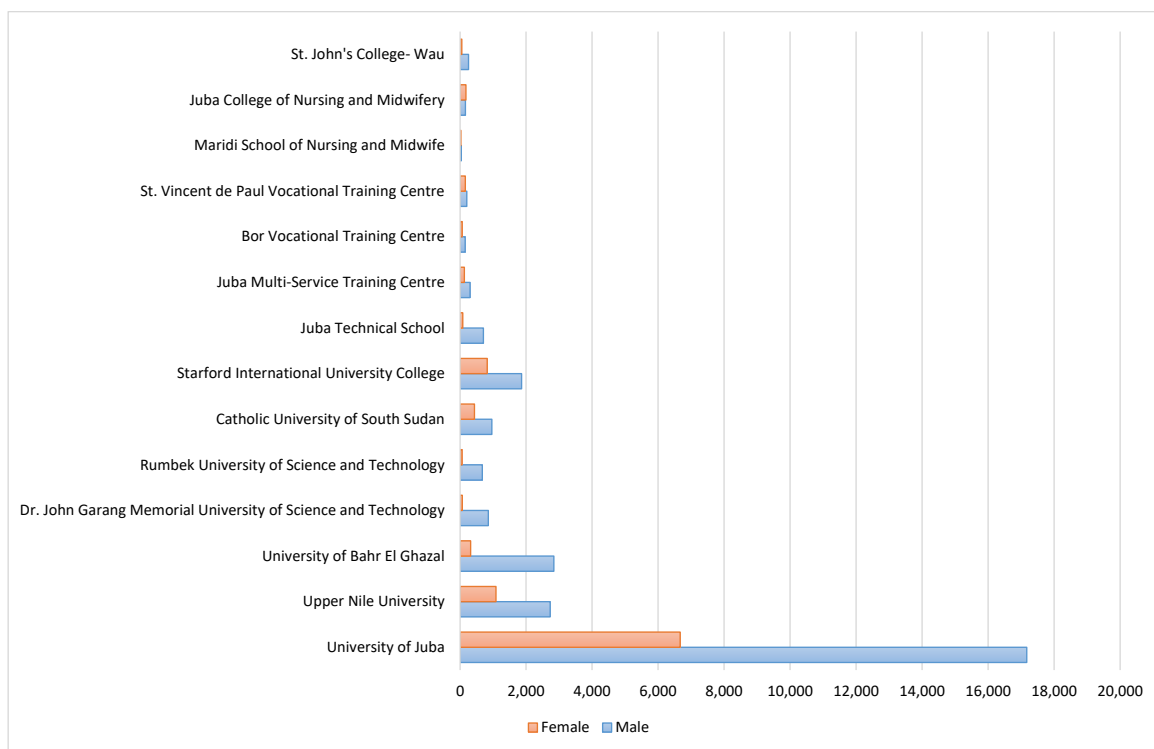
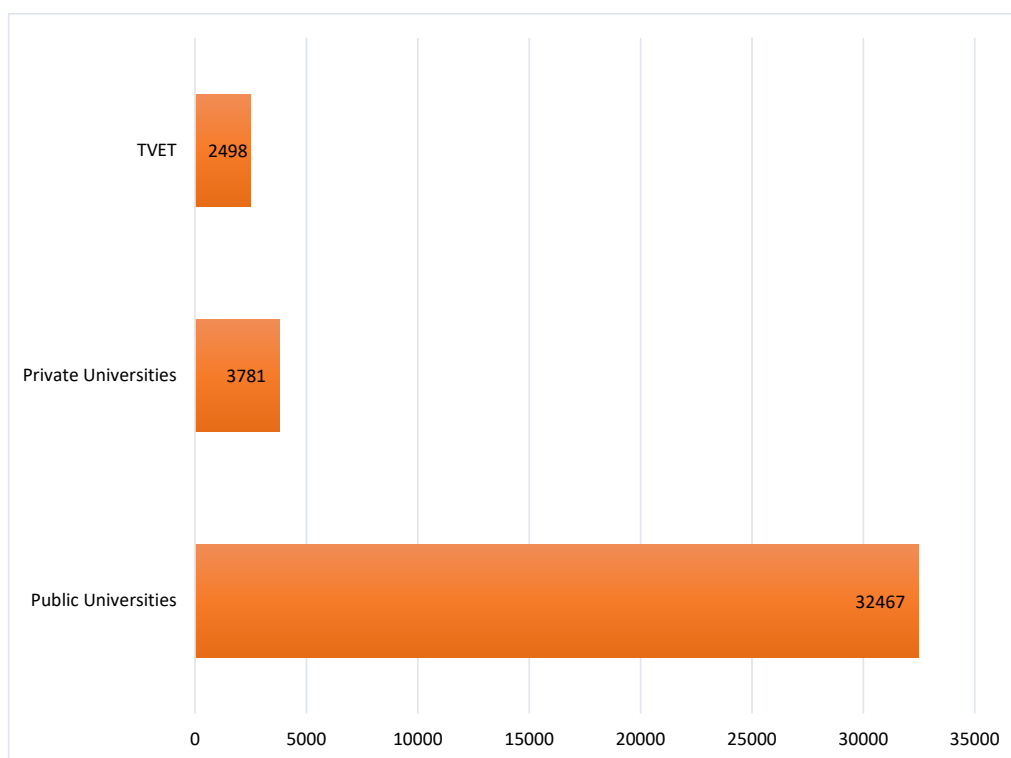


Figure 6. Representation of women in employment in STEM and social sciences in Higher Education in South Sudan



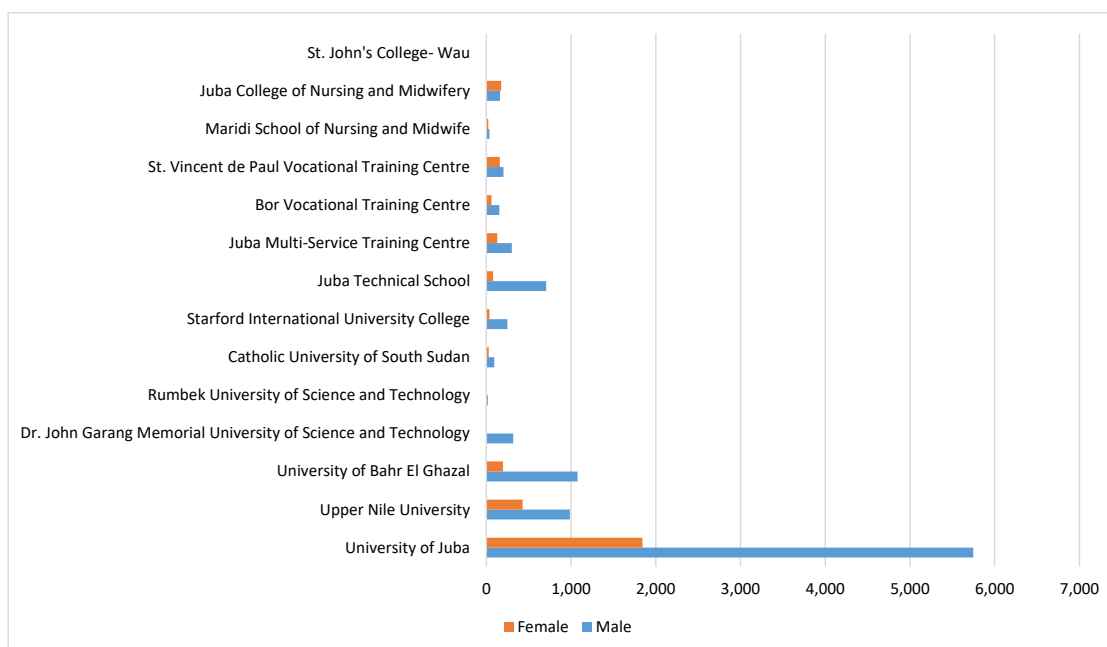
**Figure 7. Distribution of students by gender in 14 tertiary learning institutions and TVET in South Sudan in 2020**



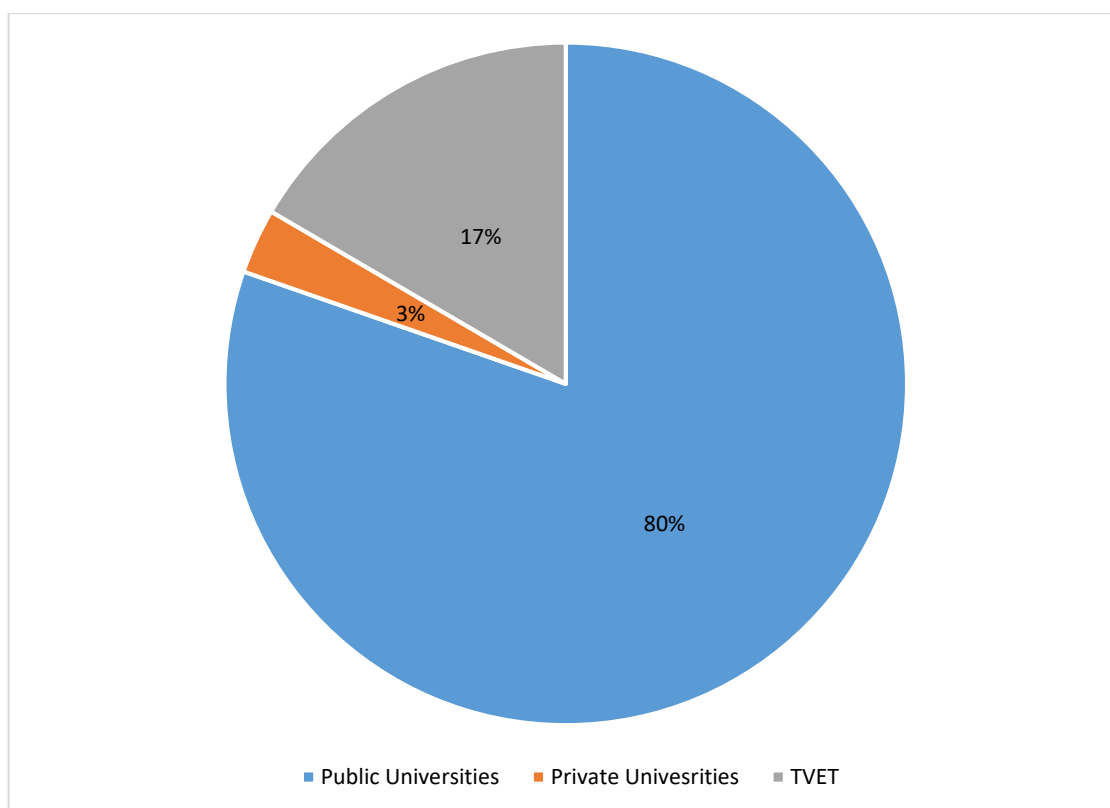
**Figure 8. Distribution of student population by the type of institutions in South Sudan in 2020**

**Gender-based distribution of students in STEM.** The distribution of students enrolled in STEM subjects by gender in 14 institutions of tertiary education and TVET covered by the study is shown in Fig. 9. Out of the 38,746 students enrolled in 14 institutions of tertiary education and TVET institutions, there were 13,218 (34%) enrolled in STEM, of whom 10,046 (76%) were male students, and 3,172 (24%) were females. All 14 institutions covered by this study, except St. John's College-Wau, had some STEM programs. The distribution of STEM students by type of the institutions is shown in Fig. 10. It is noted that 10,619 (80%) of STEM students were enrolled in public universities, 408 (3%) in private universities, and 2,191 (17%) in the TVET sector. The bulk of STEM students were distributed as follows: 7,589 (57%) enrolled at the University of Juba; 1,416 (11%) at the University of Upper Nile; 1,273 (10%) at University of Bahr El Ghazal; 787 (6%) at Juba Technical School; and 430 (3%) at Juba Multi-Service Training Centre.

**Distribution of students according to field of STEM specialization.** In the STEM-based undergraduate programmes, 624 students were enrolled in physical and biological sciences; 1,911 in computer science and information technology; 2,492 in health sciences; 1,189 in agricultural sciences; 1,069 in education (mathematics and physical sciences); 1,128 in engineering and architecture; and 990 in natural resources (see Table 4). Only agricultural sciences had students enrolled in masters (19) and PhD levels (1). Vocational training was confined to diploma and certificate levels. Nearly half of all students (50%) were enrolled in business, economics, and other social sciences; followed by students enrolled in arts and humanities at undergraduate level (14%). The third largest number of students were enrolled in health sciences (8.4%), followed by computer science and information technology (8.0%). In contrast, those taking engineering at undergraduate level trail at 2.8%, while those doing TVET take a meagre share of 3.6% of the total students enrolled in tertiary education and TVET institutions.



**Figure 9. Distribution of STEM students by gender in 14 institutions of tertiary education and TVET in 2020**



**Figure 10. Distribution of STEM students by the type of institutions**

**Table 4. Distribution of STEM Students according to field of specialization**

Field of Specialization	Diploma/ Certificate	Bachelor	Postgraduate Diploma	Master	PhD
Physical and Biological Sciences	-	624	-	-	-
Computer Science and Information Technology	1,312	1,911	-	-	-
Human Health Sciences	761	2,492	-	-	-
Agricultural Sciences	-	1,189	-	19	1
Education	91	1,069	12	8	2
Engineering and Architecture	-	1,128	-	-	-
Natural Resources	348	990	-	-	-
Arts and Humanities	1,863	3,807	56	154	2
Business, Economic and Social Studies	6,650	12,099	103	683	10
Vocational/Technical Training	1,378	-	-	-	-
<b>Total</b>	<b>12,403</b>	<b>25,309</b>	<b>171</b>	<b>864</b>	<b>15</b>

### **Science Technology and Innovation Ecosystem**

Currently, South Sudan has no established working system for the coordination and support of science, technology, and innovation (ST&I) policy, including the absence of budgetary allocation in support of ST&I for industry, research, or education (Akec, 2021). This state of the affairs was confirmed by a report prepared by Economic Commission for Africa (UNECA), entitled: *Towards a Framework for Governing Science, Technology, and Innovation in the Republic of South Sudan* (2019). The report was prepared at the request of the Government of South Sudan. The key findings of the report indicate that the whole ST&I policy has been entrusted to a directorate at the Ministry of Higher Education, Science, and Technology, and noted that: “South Sudan does not have a national policy that guides the science, technology and innovation development process. The priority sectors for STI intervention have not been identified, and there are no coordinating mechanisms for inter-institutional efforts in developing STI programmes and activities in various sectors of the economy.” (UNECA, 2019, pp. ix).

The report also acknowledged that some initiatives have been carried out to establish agricultural research system and expand support to higher education and technical vocational education. The report used China and South Korea STI governance systems as benchmark to make several recommendations for grounding South Sudan’s STI systems and policy. The key recommendations include:

- a) Creation of a Parliamentary Committee for STI to champion legislation pertaining to STI and be a voice for STI when drafting or passing annual budgetary allocation to STI
- b) Establishment of Science and Technology and Innovation Council chaired by the President of the Republic with the Minister

responsible of science, technology, and innovation as Vice Chair. The role of STI Council is to set priorities, and encourage policy makers in various ministries to commit resources to science and technology and innovation.

- c) Making choice between i) retaining and strengthening the science, technology, and innovation mandate of the current STI governance system, ii) creation of a standalone Ministry of Science, Technology, and Innovation, iii) decentralization of science, technology, and innovation functions to all sectorial ministries or to subnational jurisdiction (states).

### **Realignment of Higher Education Sector with Country’s Plans, Long-Term Vision, Regional Agenda, and Global Trends South Sudan Vision 2040**

In 2011, South Sudan developed a long-term strategic plan - “South Sudan Vision 2040: Towards Freedom, Equality, Justice, Peace and Prosperity for All.” The vision had seven pillars as follows: (a) Educated and Informed Nation; (b) Prosperous, Productive and Innovative Nation; (c) Free, Just and Peaceful Nation; (d) Democratic and Accountable Nation; (e) Safe and Secure Nation; (f) United and Proud Nation; and (g) Compassionate and Tolerant Nation.

According to this vision, by 2040, South Sudan will have a quality education system that is able to prepare its youth to cope effectively with the global dynamic environment. That the education system will be relevant, of high quality, and accessible. That South Sudan will have obtained the latest information technology available, which is capable of placing it firmly on the path of becoming “an educated and informed nation.” And in order to “build an educated an informed nation,” South Sudan would aim to achieve the following key strategic objectives:

1. Increasing access to general and higher

- education opportunities
2. Providing educational infrastructure to meet the need of the nation
  3. Building institutional capacity
  4. Designing curricula that meet the needs of the people of South Sudan and enhances their international outlook
  5. Improving quality of and widening participation in teacher education programmes
  6. Improving quality of education
  7. Promotion of the use of English as medium of instruction
  8. Promotion of equity and social change
  9. Promotion of application of science and technology
  10. Promotion of access and use of Information and Communication Technology

### **South Sudan National Development Strategy 2018-2021**

The South Sudan National Development Strategy (SSNDS 2018/2021) was launched in November 2018 under the theme: “Consolidate Peace, and Stabilize the Economy”, as overall theme. It followed the signing of Revitalized Agreement on the Resolution of the Conflict in the Republic of South Sudan (R-ARCSS) between the Government and opposition groups in August 2018. Its socioeconomic guiding principles include (SSNDS 2018):

- a) Inclusive and equitable economic growth,
- b) Economic diversification;
- c) Empowerment of women and youth;
- d) Improving the quality of education and expanding training opportunities;
- e) Support to scientific and socio-economic research;
- f) Provision of vocational technical training;
- g) Adoption of communication and information technologies;
- h) Industrialization of the economy;

### **Realignment with Regional and Global Agendas**

To align the future of higher education in South Sudan with continental agendas and global trends, a note must be taken of the challenges facing African higher education sector. These include the need for higher education sector to realise its potential as development partner of national governments, and as service provider to communities around, as the experience has shown elsewhere (see Akec, 2020). To be credible, South Sudan higher education sector must respond to regional agendas and global trends in higher education that include but not limited to: African Union Commission Agenda 2063: the Africa We Want; Comprehensive African Agricultural Development Plan (CAADP); UN Agenda for Sustainable Development Goals 2030; assimilation of digital technologies in its economic infrastructure; responding to Fourth Industrial Revolution (Schwab 2016); and transitioning to Education 4.0 (Bunting *et al.*, 2015; Cloete and Maasen, 2015; Juma, 2016; Ernst and Young 2017; Akec, 2018b; Tikly, 2020).

Furthermore, higher education sector must provide universal access to quality higher education and vocational training to an increasing number of student population (Akec, 2020). And in order to compete in the global higher education market, South Sudan higher education sector must accelerate the integration of digital technologies into learning in order to transition to Education 4.0 which will fit the changing needs of today’s student (as life-long learner who demands flexible curricula and flexible academic programmes) (Ernst and Young, 2017).

### **Avoiding the Pitfalls and Learning from BRICs Experience**

The expansion of African higher education sector, especially in the sub Sahara region in the first three decades of gaining independence, was hampered by a World Bank’s new policy push for higher education in Africa and developing

countries following the publication of its influential report in 1986 (Psacharopoulos *et al.*, 1986). The report claimed that the returns to a dollar spent on primary education were twice the returns to a dollar spent on higher education (ibid:8). As a result, the World Bank came to describe higher education as a 'luxury' (Cloete Maassen, 2015:8), and began to push for educational policies in the Sub Sahara African region that shifted public funding from tertiary education sector to general education sector, resulting in the decline of public expenditure per tertiary student (World Bank, 2009:xxvii). The World Bank's policy is regarded as a major contributor to the underdevelopment of higher education sector in Sub Sahara Africa (Monbiot, 2003; Cloete and Maasen 2015:6). Furthermore, the World Bank advocated for alternative financing policy options that included the students' contribution towards the cost of higher education through tuition fees payment, student loan schemes, and award of selective scholarships to poorer students who may not afford to pay for university education (Psacharopoulos *et al.*, 1986:17). These alternative financing options were largely ignored by governments in the Sub Sahara Africa in favour of under investing in higher education (Akec, 2020:20).

In contrast, starting from early 1990s and for the next two decades that followed, the governments in Asia, Eastern Europe, and Latin America, especially the BRIC countries-- Brazil, Russia, India, and China—succeeded in expanding their higher education systems considerably by making more resources available to tertiary education through a mix of subsidies and charging of tuition fees (Carnoy *et al.*, 2013). This was because the governments in BRIC countries recognized higher education as a source of economic competitiveness that, in addition, yields higher private returns to individuals (ibid.:6). Based on that clear understanding of the challenges of expanding higher education

systems, BRICs responded robustly to the increased demand for tertiary education in their societies by soliciting contributions from the families towards the cost of higher education of their children. They also encouraged the expansion of private higher education for those who could not get into public universities but can afford to pay their own tuition fees.

Thus, BRIC countries were able to apply the strategies and financing options that were proposed in the World Bank's report -- implementing cost sharing policies, while finding ways to support the students from the under privileged backgrounds. The result was the massive expansion and growth of the sector over the same period in which African higher education systems had stagnated (Carnoy *et al.*, 2013). In Brazil, for example, enrollment per 100,000 of population rose from 1,074 students in 1990 to 3,421 students per 100,000 of the population by 2010; in Russia enrollment increased from 1,900 students to 6,599 students per 100,000 of population; in India from 585 students to 1,173 students per 100,000 of population over the same period (ibid:37). The expansion of higher education in the three BRIC countries: China, Brazil, and India is shown in Fig. 11 in term of enrollment per 100,000 of population from 1920 to 2010.

Furthermore, the graduate enrollment rates for three BRICS countries (Brazil, India, and China), and that of Sub Sahara Africa between 1970 and 2009, are shown in Fig. 12. It is noted that while graduate enrollment for Brazil, India, China, rose from 10, 5, and 1 percent respectively in 1975 to 36, 14, and 24 percent in 2009; the gross enrollment ratio in higher education in Sub Sahara Africa rose on average from 1.6 in 1975 to 7.4 by 2009.

Another feature of expansion of higher education in BRICs countries is differentiation, vocationalization, and inclusion/rationalization

(Carnoy *et al.*, 2013:42).



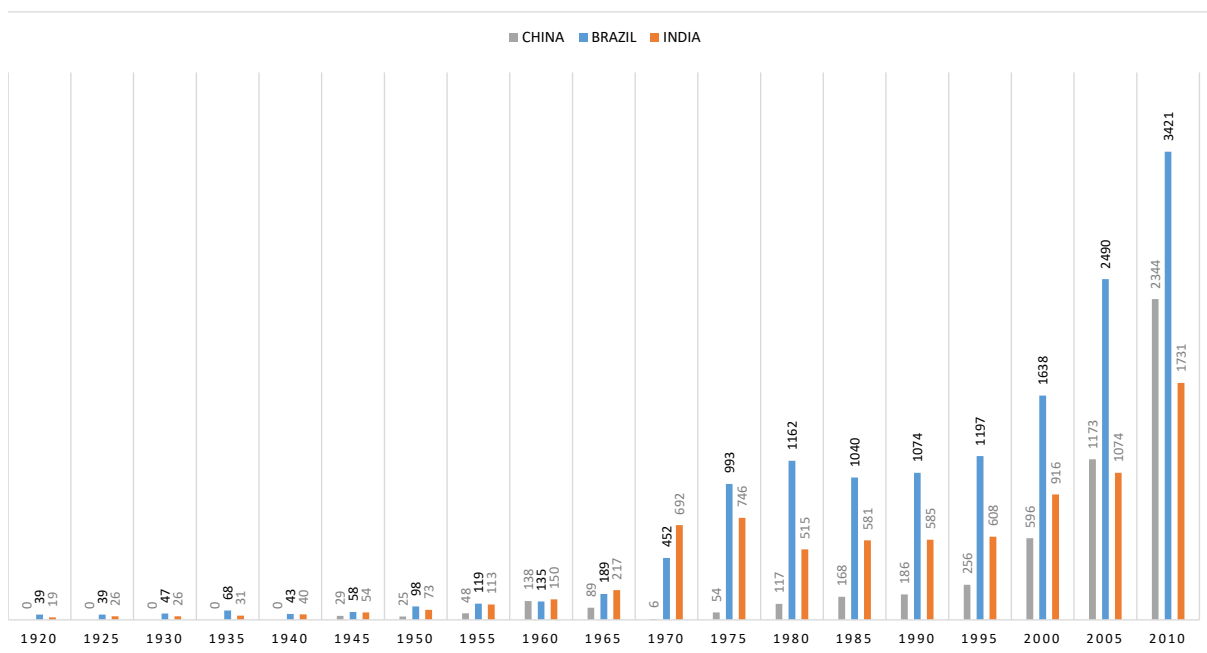


Figure 11. Enrolment in higher education per 100,000 of population in BRICS between 1920 and 2010 (Source Extracted from Carnoy *et al.*, 2013)

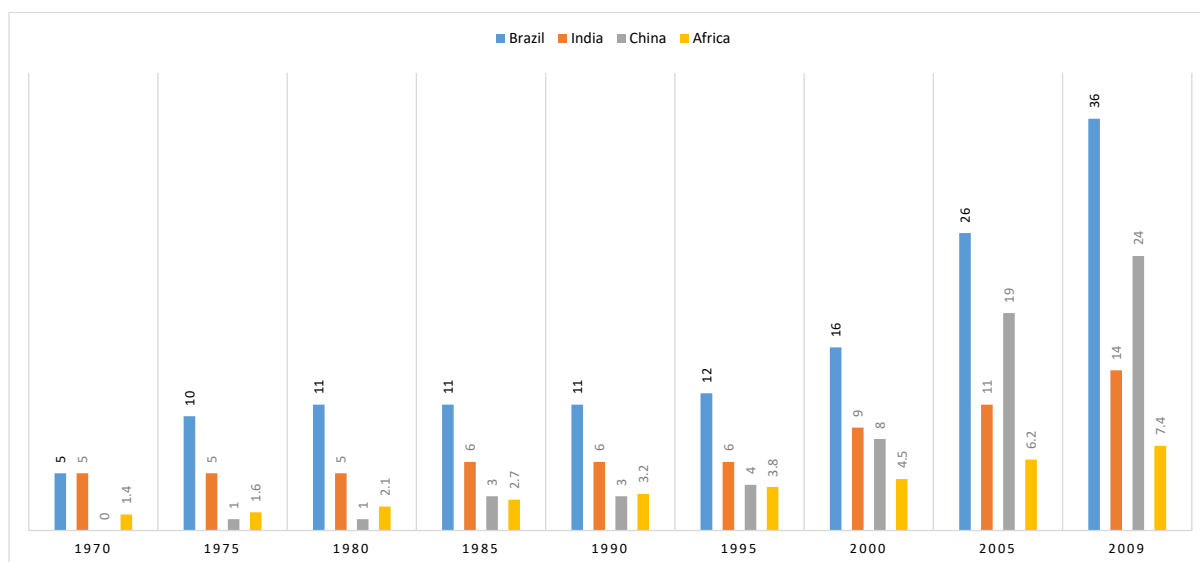


Figure 12. Gross Enrollment rates in higher education in three BRICs countries and Africa between 1970 and 2009 (Source: Akec 2012, p. 21).

**Differentiation.** Differentiation allowed more high school graduates to enter universities by expanding both the second and third tier institutions to absorb en masse the new entrants. This allows the quality of former elitist institutions to be preserved by continuing to educate fewer and most talented students. In India, for example, institutions of tertiary education are grouped into 3 tiers (Ernst and Young LLP 2017:54):

*Tier 1 Institutions*– Research focused, providing high quality research and innovation with critical national role in addressing intellectual imperative. They are selective and educate fewer number of students.

*Tier 2 Institutions* – Offering professional courses with prime aim of producing industry-ready graduates, with an important responsibility of addressing economic concerns. It is of lower cost and absorbs the mass of new entrants.

*Tier 3 Institutions* – Foundation institutions offering diverse courses with purpose of producing well rounded graduates with skills needed by local industries, with responsibility of addressing social imperatives. It is open, wide spread, and non-selective non-university tertiary education.

Mass higher education is facilitated by differentiation. A typically differentiated higher education system is provided by the state of California in the US comprising a number of private universities, and public universities with three tier system of 10 campuses of University of California with 220,000 students; State universities on 23 campuses with student population of 430,000; and an undefined number of open 2-year community colleges that enrolled 1.5 million students by 2009 (Clark 1998:6).

**Vocationalisation.** Involves teaching of professional technical subjects in engineering

and computer sciences (Carnoy *et al.*, 2013). The returns to technical professional education have been rising with globalization and demand for manufacture of high-value added goods.

**Inclusion/Rationalization.** Many countries including India, Brazil, and China strives to reduce inequality and bring on board socially and economically excluded groups through affirmative actions, use of aptitude/ability tests, quotas, and other schemes.

### **Global trends affecting the transformation of Governance of Higher Education Institutions**

The factors and trends driving change in higher education systems in Africa, include the call on the universities to enhance national economic competitiveness through training and capability improvement in a globalized knowledge economy (Weigratz, 2009:xvi; Cloete *et al.*, 2015:5; Akec, 2018a; Akec, 2020); to act as engines of national economic development, cultural renewal, military power, and social progress (Bok, 1982; Bowen, 1982:2; Kerr, 2001; Castells, 2009:1; Akec, 2017); to catalyze innovation for national industrial development and value addition (Clark, 1998:3-8; Weigratz, 2009:xvi; Akec, 2018b:77); to respond to internationalization and globalization of higher education market (Martinez and Kitaev, 2009:124; Carnoy *et al.*, 2013:6; Raina, 2015:105); to adapt to corporatization of university governance (Keeling 2006; Mamdani, 2007:108; Fazackerley and Chant, 2009; Shattock, 2014:1-13; Cloete *et al.*, 2015:5, Raina, 2015:108); to diversify their resource bases in the face of falling public financing of higher education operation (Clark, 1998:3-8; Mamdani, 2007:108; Rinne and Koivula, 2009; Shattock, 2009:1-8; Williams, 2009:9-32; Carnoy *et al.*, 2013:8); to provide educational opportunities to broader sectors of population, including the low-income groups in the society through massification (Bowen, 1982:2; Carnoy *et al.*, 2013:8); and to

weather the impact of health pandemics by use of communication technologies (The Economist 2020, 15th August).

As a latecomer, South Sudan higher education needs to catch up fast with an already ‘moving target’ (Weigratz, 2009, p. xvii). This makes it necessary for South Sudan higher education to strive to leapfrog into 21st century education 4.0 (Abramovitz, 1986; Ohno 2006:6; Akec 2018b:79). Most prominent of all, South Sudan higher education institutions, like others in the twenty first century, need to be governed effectively, and must be entrepreneurial in order to thrive. These two cardinal factors are reviewed below.

### **Governance**

Akec (2020) provided a comprehensive literature review of the trends affecting university systems globally. The literature includes the review of the Anglo-Saxon (Shattock, 2014), Humboldtian (Kehm, 2014; Salmela-Mattila, 2014; Stensaker, 2014), Napoleonic (Chatelain-Ponroy *et al.*, 2014; Moscati, 2014), and Japanese university systems (Christensen, 2010; Oba, 2014; Shattock, 2014). The trends include change in governance of university systems in these countries, diversification of funding through innovation and entrepreneurship, integration of digital technologies into teaching to meet the changing student needs, and globalization of higher education market.

In regards the governance, Shattok (2014) describes the international trends driving the modernisation of higher education. It includes the changing role of the State in university governance and its impacts on university’s internal governance structure and distribution of authority in the collegiate. It is also noted that the driving force behind international modernisation push is the recognition by governments and regional blocks (such as the EU) of the critical roles of universities in knowledge economy, the need for adjustment in the structures of funding of higher

education, and review of how authority is shared within the university, and between university and external actors, including the State. It is observed that reforms in European and Japanese universities were driven by State legislation, and to a lesser extent in UK and Australia; while in United States the State plays no role at all in regulating universities. Furthermore, the US and Anglo-Saxon reforms have tended to embrace ‘enterprise university’ model and marketisation of higher education system in line with new funding arrangements that give universities more autonomy. What is more, the US higher education system comes out as providing the most diversified, individualized, and autonomous range of universities compared to any existing higher education system (*ibid.*). And similarly, in the European university system, there is a push to give universities more autonomy, while encouraging universities administrators to borrow business practices in order to improve decision-making processes in a university (Akec 2020:8).

### **The role of innovation and Entrepreneurialism at University: The Third Mission**

Increasingly, universities are viewed as key contributors to national economic competitiveness, especially in the knowledge intensive sectors of the economy (Shattock, 2009a:1). Besides education and research, universities are charged with a ‘third mission’ of service to society (Williams, 2009:24). And in order to fulfil this ‘third mission,’ universities are under pressure to change the way they are organised and led; with a need for them to be more autonomous in their decision-making processes and capable of acting entrepreneurially in order to exploit opportunities in their economic environments (Shattock, 2009a:2).

The literature on university entrepreneurialism and innovation is very extensive (Clark, 1998; Kwiek, 2009; Lambert, 2009; Marinez and Kitaev, 2009; Mora and Vieira, 2009; Rinne and Koivula 2009; Shattock, 2009a; Shattock, 2009b; Shattock, 2009c; Shattock, 2009d;

Shattock, 2009e; Temple, 2009; Williams, 2009; Mazzucato, 2011; Fagerberg, 2016; Juma, 2016; Akec, 2018a; Akec, 2018b). To be entrepreneurial or innovative, Burton Clark (1998:3) argued that a university must be willing to put in place institutional structures capable of expending energy and taking risk on activities in anticipation of positive outcomes which cannot be guaranteed at the outset. Furthermore, finance is a key driver and indicator of entrepreneurial activity; and that a university which has enough resources to fund all its activities will see no incentive in being more innovative (Williams, 2009:9). And that the structure of financing of higher education in terms of the incentive arrangements, may stimulate entrepreneurialism or may impede it (ibid.:14).

Shattock (2009c:64) also highlights the importance of aligning human resource management practices such as level of pay, academic promotion procedures, and system for motivation and recognition of staff performance with the institution's strategic mission in order to stimulate entrepreneurial behaviour among staff. And that flexibility in the face of changing environments and contexts, as opposed to following rigid traditions and organisational cultures, is seen as more conducive to creating more entrepreneurial behaviours. Moreover, Mora and Viera (2009:75) highlight the role of governance in enhancing or inhibiting entrepreneurial behaviour in the university. They argue that following components of governance influence entrepreneurship to varying degrees. These are: State regulation, stakeholder guidance, academic self-governance, managerial self-governance, and competition for resources.

Likewise, the European Commission university modernisation program has identified the following areas of change: less regulation, more autonomy to universities, increased funding for innovation, and better university leadership. The Commission recommended that universities (Akec, 2020:15):

- Take more responsibility for their financial sustainability in the long term by diversifying their funding sources
- Establish stronger, sustainable, and collaborative linkages with the business community, and society in general on commercialisation of research output
- Share knowledge with business community for the purpose of exploiting intellectual property generated by research.

## **CONCLUSIONS AND RECOMMENDATIONS**

The paper has described a gender-based analysis of the current statistical data on students and academic staff at 14 institutions of tertiary education in South Sudan (five public universities, two private universities, and seven TVET institutions). Aspects considered included: gender-segregated distribution of academic staff, academic ranks, subject of specialization, institutional affiliation, educational attainment, student populations, their programmes of studies, field of specialization, and gender compositions of students, with focus on gender representation in Science, Technology, Engineering and Mathematics (STEM).

Moreover, the paper reviewed the status of Science, Technology, and Innovation (ST&I) ecosystem in the country in terms of how it is organised or governed. And in order to make recommendations of the needed reforms and adjustments, and align South Sudan's higher education with the rest of the world, the paper reviewed national development plans and South Sudan Vision 2040, in addition to regional and global trends that are forcing change in higher systems everywhere. Furthermore, the paper reviewed the experience of BRICs with the expansion of their higher education systems in the past two decades with the aim of applying the lessons learned to transforming South Sudan's higher education system and ST&I ecosystems. As a latecomer, South Sudan higher education needs to catch up fast with an already 'moving target'. This makes it necessary for South

Sudan higher education to strive to leapfrog and transition to education 4.0 that will serve the Fourth Industrial Revolution.

The factors and trends driving change in higher education systems in Africa in medium to long term, and that will impact the development of higher education sector in South Sudan, include the call on the universities to enhance national economic competitiveness through training and capability improvement in a globalized knowledge economy. Secondly, to act as engines of national economic development, cultural renewal, military power, and social progress. Thirdly, to catalyze innovation for national industrial development and value addition. Fourthly, to respond to internationalization and globalization of higher education market. Fifthly, to adapt to corporatization of university governance. Sixthly, to diversify their resource bases in the face of falling public financing of higher education operation. Seventhly, to provide educational opportunities to broader sectors of population, including the low-income groups in the society through massification. And to weather the impact of health pandemics by use of communication technologies.

### Key Findings

- Historically, South Sudan has started from a very low base as gleaned from its meagre 4% representation in admission to Sudanese universities in 2005, the year the Comprehensive Peace Agreement (CPA) was signed.
- By 2011, South Sudan had nine public universities (but in practice, only five of them were functioning).
- The breakup of Sudan into two separate States put South Sudanese universities, which were dependent on North Sudan staff, under difficult circumstances, from which it is still emerging.
- South Sudan inherited an elitist system of higher education from Sudan which targeted only very talented but few able students.
- The country higher education sector is not differentiated and is top-heavy, with 94% of students being enrolled in university sector, while only 6% are studying at TVET institutions or community colleges. This is contrary to experience elsewhere where there is differentiation and ability to absorb the mass entrants to universities using a three-tiered system, with largest population of students enrolling in the open and widely-spread community colleges.
- Although South Sudan Vision 2040 has promised “an educated and informed nation” by 2040, much work still needs to be done in order to make progress towards the attainment of the aspirational goal.
- Of 2,574 academic staff employed in tertiary education institutions, only 49% are employed in STEM-related specializations.
- 79% of academics are employed by public universities and only 21% in TVET sector
- While 87% of total academic staff are males, only 13% are females.
- While 95% of academics with the rank of professor in the universities are males, only 5% are females
- Only 13% (of all the academic staff who are specialised in STEM are females, showing under representation of women in STEM.
- There are 38,746 students enrolled in 14 institutions of higher education covered by this study, of whom females constitute only 26%.
- Only 19% of academics surveyed have PhDs, while 81% of academics have no PhDs and half of them (or 40% of the total academic workforce) only have the first degree as their highest qualification
- 13,000 students are enrolled in STEM of which female students are only 24%
- Overall, women are underrepresented in all aspects of higher education (from staff numbers, academic ranks, student population, STEM specialization, and post graduate studies)
- Science, Technology and Innovation

- ecosystems are underdeveloped as well as TVET sector
- South Sudan is entering into a dynamic Africa and global higher education scene and will need to leapfrog into twenty-first century education 4.0 that will serve the Fourth Industrial Revolution.
- Higher education to adopt new governance models in which tertiary education and TVET institutions act like businesses that are able to use resources efficiently
- Universities and higher education colleges in South Sudan to become more entrepreneurial in order to advance their 'Third Mission' of serving society

### **Key Recommendations**

- South Sudan higher education system needs to expand and transform through differentiating vertically into a 3-tiered system with fewer well-funded research universities educating fewer but most able students, more comprehensive universities for professional training absorbing a mass of new entrants, and open-widespread community colleges catering for TVET and needs of local industries including agricultural training institutes.
- Development of admission policies with affirmative action that will assist in increasing women participation in all sectors and levels of higher education and STEM.
- Availing resources for postgraduate training to PhD levels, including increasing the pool of women scientists
- Devise innovative schemes to resolve funding challenges facing higher education sector including soliciting higher tuition fees payment from students and their families, provision of student loan schemes, and scholarships for the under privileged students.
- Consider affirmative action, building of capacities through postgraduate and post doctoral training, and incentive to attract more women to STEM.
- Improve the ST&I ecosystem by setting up a special Ministry for Science, Technology, and Innovation;
- Establish ST&I Council under the Presidency;
- Establish a Specialized Committee on ST&I in the National Legislative Assembly to support STI sector in the country

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