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Higher Education and Scientific Research in Sudan: Current status and future direction

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ABSTRACT

Higher Education (HE) is an essential resource for Sudanese who hope to escape the painful transition to independence, its violent attempts to forge a common national identity, and its decades of war and military rule. The year 1990 witnessed the birth of HE revolution which is considered as a revolving point for HE in Sudan. Since then, however, considerable discrepancy between the output of graduates in different specializations and the absorptive capacity of the labour market has been noticed leading, in turn, to unemployment, underemployment and to scarcity of graduates. The purpose of this study was to examine the status and future direction of higher education and scientific research in Sudan. Study methodologies combined use of qualitative and quantitative data. The findings indicate that the regulation of HE institutions and oversight of scientific research in the country are managed by Ministry of Higher Education and Scientific Research (MOHE), but formulating policies, plans, objectives, funding, and scientific research priorities are handled by the National Council for Higher Education and Scientific Research since 1972. Today, there are 128 Higher Education Institutions (HEIs), of which 36 are public and 20 private universities, 53 private colleges and 19 technical university colleges. Disciplines in HE include education, humanitarian, social, administration and law, agriculture, health, science, information technology, engineering and others as services. In 2018, the number of enrolled students was 300,000, with 54% female and 46% male students. The highest total numbers of students' enrolment were in education and social studies, which accounted for 20% and 19%, respectively, of the total enrolment, followed by health and Administration and law studies with 14% and 13%, respectively. Agricultural studies, science and information technology had the lowest numbers of students, representing only a total of 3%, 5% and 5%, respectively. The Government of Sudan needs to expand HEIs to promote growth and take advantages of new technologies for agriculture, science and information technology education. This would spur economic growth and development in Sudan which in turn would enhance food security and livelihoods improvements in the country. In 2018, the number of affiliated staff was 21,584 professors, associated and assistant professors, lecturers and assistant lecturers and 51% were PhD holders consisting of 27% female and 73% male. The highest total numbers of employed staff were in health studies followed by social and

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education studies. Also data show that employed male staff (64%) were significantly more than female staff (36%) especially in disciplines like information technology and engineering studies. The highest numbers of employed staff were the assistant professors followed by lecturers and the teaching assistants while the lowest numbers of employed staff were professors and associate professors. However, the rapid expansion of higher education was not accompanied by increase in staff quantity and quality. There is accordingly urgent need to help young staff to pursue postgraduate studies in order to upgrade the proportion of doctoral trained faculty. The consistent low number of females staff compared to males is explained by the history of education in Sudan, which focused on training male students. It is time to narrow the academic gender gap in HEIs and give females equal opportunities for training and promotion. During the academic year 2017/18, there were 32 students for every staff member which is almost double the averaged world ratio of 16.5 students for one staff member. To achieve the Government's desired goals of 2030, the teacher-student ratio should be similar or near to the averaged world ratio. Like many HE systems in Africa, the higher education sector in Sudan is currently experiencing substantial challenges. This paper raises issues and challenges that need to be addressed at policy level. For example, the Council in 1997 gave permission to each public university to admit additional 25% of the qualified fee-paying students, as determined by each university, and such students may be admitted with as low as with 12% less than the minimum corresponding score for the general admission determined by general competition. In this regard it seems that the Government is supporting rich families at the expense of the poor ones. This will create research and knowledge divide within the country between those who have access and benefit from HE and those who lack it. Overall, there is need for Sudan Government policy makers to take advantage of the role HEIs could play in development of the country, not only for capacity building and research, but also for preparing leaders in development and policy analysis. Accordingly 1) There is need for strategic investment in infrastructure and human resource capacity development to support higher education and research in Sudan. As part of this effort, the Government of Sudan should invest in strengthening postgraduate training so as to build capacity for HEs, research and various sectors of the economy. In this regard efforts need to be made to strengthen integration of Sudan Higher Education and research into Africa Higher education space. Accordingly, Sudan Government needs to put in place mechanisms for training her Postgraduate students in different African universities, while at the same time bringing in students from other African countries to train in Sudan; 2) It is also recommended that Sudan Government through well-structured independent review processes establishes 5-7 HE Centres of Excellence in the country that respond to strategic areas of the country such as strengthening Agri-food systems, building climate change resilience, management of dryland ecosystems and water resources, strengthening health services, and developing capacity in data sciences and digital technologies; 3) There is also need to create and expand opportunities and facilities for Technical and Vocational Education and Training for skilling Sudan youth in both existing and emerging economic sectors. These TVET institutes should offer various technical programmes to provide human resource training to meet the needs of the country and self-employability. Likewise there is need to set up programmes to build entrepreneurial skills of Sudan youth, so as to enhance their employability; 4) While there is gender balance at undergraduate level, deliberate steps need to be made to increase the pool of female students undertaking postgraduate training

so as to increase female staffing in HEs, research institution, and leaderships at various levels; and 5) Finally, to promote research excellence and innovativeness in the country, there is need to establish a Research and Innovation Fund for generating research outputs and innovations, and for supporting linkage with industry.

Key words: Gender participation, higher education institutions, public and private education, students enrolment, students staff ratio, Sudan, TVET

RÉSUMÉ

L'enseignement supérieur (ES) est une ressource essentielle pour les Soudanais qui espèrent échapper à la douloureuse transition vers l'indépendance, ses tentatives violentes de forger une identité nationale commune et ses décennies de guerre et de régime militaire. L'année 1990 a vu la naissance de la révolution de l'ES qui est considérée comme un point tournant pour l'ES au Soudan. Depuis lors, cependant, un écart considérable entre la production de diplômés dans différentes spécialisations et la capacité d'absorption du marché du travail a été observé, entraînant à son tour le chômage, le sous-emploi et la rareté des diplômés. Le but de cette étude était d'examiner le statut et l'orientation future de l'enseignement supérieur et de la recherche scientifique au Soudan. Les méthodologies d'étude combinaient l'utilisation de données qualitatives et quantitatives. Les résultats indiquent que la réglementation des établissements d'enseignement supérieur et la surveillance de la recherche scientifique dans le pays sont gérées par le Ministère de l'Enseignement supérieur et de la Recherche scientifique, mais la formulation des politiques, des plans, des objectifs, du financement et des priorités de recherche scientifique est gérée par le National Conseil de l'enseignement supérieur et de la recherche scientifique depuis 1972. Il existe aujourd'hui 128 établissements d'enseignement supérieur (EES), dont 36 universités publiques et 20 privées, 53 collèges privés et 19 collèges universitaires techniques. Les disciplines de l'enseignement supérieur comprennent l'éducation, l'humanitaire, le social, l'administration et le droit, l'agriculture, la santé, la science, les technologies de l'information, l'ingénierie et autres en tant que services. En 2018, le nombre d'étudiants inscrits était de 300000, dont 54% de femmes et 46% d'hommes. Les effectifs totaux les plus élevés étaient inscrits dans les domaines de l'éducation et des sciences sociales, qui représentaient respectivement 20% et 19% de l'effectif total, suivis des études en santé et administration et en droit avec 14% et 13%, respectivement. Les études agronomiques, les sciences et les technologies de l'information comptaient les effectifs les plus faibles, représentant seulement un total de 3%, 5% et 5% respectivement. Le gouvernement du Soudan doit élargir les établissements d'enseignement supérieur pour promouvoir la croissance et tirer parti des nouvelles technologies pour l'enseignement de l'agriculture, des sciences et des technologies de l'information. Cela stimulerait l'économie la croissance et le développement au Soudan qui, à leur tour, amélioreraient la sécurité alimentaire et l'amélioration des moyens de subsistance dans le pays. En 2018, le personnel affilié était de 21 584 professeurs, professeurs associés et assistants, chargés de cours et assistants et 51% étaient titulaires d'un doctorat, dont 27% de femmes et 73% d'hommes. Les effectifs totaux les plus élevés se trouvaient dans les études de santé suivies des études sociales et éducatives. De plus, les données montrent que le personnel masculin employé (64%) était beaucoup plus que le personnel féminin (36%), en particulier dans des disciplines comme les technologies de l'information et les études d'ingénierie. Les effectifs les plus élevés étaient les professeurs assistants suivis des chargés de cours et des assistants pédagogiques, tandis que les effectifs

les plus faibles étaient les professeurs et les professeurs associés. Cependant, l'expansion rapide de l'enseignement supérieur ne s'est pas accompagnée d'une augmentation de la quantité et de la qualité du personnel. Il est donc urgent d'aider les jeunes à poursuivre des études de troisième cycle afin d'augmenter la proportion de professeurs formés au doctorat. Le faible nombre constant d'employés féminins par rapport aux hommes s'explique par l'histoire de l'éducation au Soudan, axée sur la formation d'étudiants de sexe masculin. Il est temps de réduire l'écart entre les sexes dans les établissements d'enseignement supérieur et de donner aux femmes des chances égales de formation et de promotion. Au cours de l'année académique 2017/18, il y avait 32 étudiants pour chaque membre du personnel, soit presque le double du ratio mondial moyen de 16,5 étudiants pour un membre du personnel. Pour atteindre les objectifs souhaités par le gouvernement à l'horizon 2030, le ratio enseignant-élèves doit être similaire ou proche du ratio mondial moyen. Comme de nombreux systèmes d'enseignement supérieur en Afrique, le secteur de l'enseignement supérieur au Soudan connaît actuellement des défis importants. Ce document soulève des problèmes et des défis qui doivent être traités au niveau politique. Par exemple, le Conseil en 1997 a autorisé chaque université publique à admettre 25% supplémentaires des étudiants payants qualifiés, selon la détermination de chaque université, et ces étudiants peuvent être admis avec aussi peu que 12% de moins que le minimum correspondant. score pour l'admission générale déterminé par le concours général. À cet égard, il semble que le gouvernement soutienne les familles riches aux dépens des pauvres. Cela créera un partage de la recherche et des connaissances au sein du pays entre ceux qui ont accès et bénéficient de l'enseignement supérieur et ceux qui n'en ont pas. Dans l'ensemble, les décideurs politiques du gouvernement soudanais doivent tirer parti du rôle que les EES pourraient jouer dans le développement du pays, non seulement pour le renforcement des capacités et la recherche, mais aussi pour préparer les chefs de file en matière de développement et d'analyse des politiques. En conséquence 1) Il est nécessaire d'investir stratégiquement dans les infrastructures et le développement des capacités des ressources humaines pour soutenir l'enseignement supérieur et la recherche au Soudan. Dans le cadre de cet effort, le gouvernement du Soudan devrait investir dans le renforcement de la formation postuniversitaire afin de renforcer les capacités des établissements d'enseignement supérieur, de la recherche et de divers secteurs de l'économie. À cet égard, des efforts doivent être faits pour renforcer l'intégration de l'enseignement supérieur au Soudan et la recherche dans l'espace de l'enseignement supérieur en Afrique. En conséquence, le gouvernement du Soudan doit mettre en place des mécanismes pour former ses étudiants de troisième cycle dans différentes universités africaines, tout en faisant venir des étudiants d'autres pays africains pour qu'ils se forment au Soudan; 2) Il est également recommandé que le gouvernement du Soudan, par le biais de processus d'examen indépendants bien structurés, établisse 5-7 centres d'excellence dans le pays qui répondent aux domaines stratégiques du pays tels que le renforcement des systèmes agroalimentaires, le renforcement de la résilience au changement climatique, la gestion des écosystèmes des terres arides et les ressources en eau, le renforcement des services de santé et le développement des capacités en sciences des données et technologies numériques; 3) Il est également nécessaire de créer et d'étendre les opportunités et les installations d'enseignement et de formation techniques et professionnels (EFTP) pour la qualification des jeunes Soudanais dans les secteurs économiques existants et émergents. Ces instituts d'EFTP devraient proposer

divers programmes techniques pour dispenser une formation en ressources humaines répondant aux besoins du pays et à l'auto-employabilité. De même, il est nécessaire de mettre en place des programmes pour développer les compétences entrepreneuriales des jeunes Soudanais, afin d'améliorer leur employabilité; 4) Bien qu'il y ait un équilibre entre les sexes au niveau du premier cycle, des mesures délibérées doivent être prises pour augmenter le bassin d'étudiantes entreprenant une formation de troisième cycle afin d'augmenter le personnel féminin dans les établissements d'enseignement supérieur, les instituts de recherche et les dirigeants à divers niveaux; et 5) Enfin, pour promouvoir l'excellence de la recherche et l'innovation dans le pays, il est nécessaire de créer un fonds de recherche et d'innovation pour générer des résultats de recherche et des innovations, et pour soutenir les liens avec l'industrie.

Mots clés: participation des femmes et des hommes, établissements d'enseignement supérieur, enseignement public et privé, inscriptions d'étudiants, ratio personnel étudiant, Soudan, EFTP

INTRODUCTION

Higher Education (HE) is an important trend that has gained considerable attention from different stakeholders and customers of education systems, including policy makers, management of HE institutions, accrediting organizations, governments, funding agencies, affiliated staff members, employers, students, and their families (Abdalla, 2016). This is largely due to a global awareness of the significant impact HE quality can play in the development processes (Siegfried *et al*., 2007). African HE service provision has been diversified and the number of Universities increased and also enrolments have soared amidst funding and quality challenges (Nakayiwa *et al*., 2016). In this context higher education encompasses all post-secondary education including both public and private universities, institutes, colleges, diploma and research centres in a country (Africa Union, 2015). From 2000 students in 1970 enrolment had expanded to more than 4.5 million by 2008 and to 9.54 million by 2012 of which 66% are in Sub Saharan Africa (Nakayiwa *et al*., 2016). Where most countries had a single public institution in 1970, the number of institutions has grown to more than 600 by 2012; and the private sector's role has developed considerably (UNESCO, 2010). In Sudan, there are tenths of public and private universities, private colleges, and technical university colleges that have been established thereby doubling the number of graduates by many folds than their numbers 30 years ago. This is attributed to the HE policy implemented in 1990 by the regime of the former Governments as part of Sudan's Cultural Revolution (MOHE, 2020).

Sudan, the third largest country in Africa with an area of about 1.88 million km^2, has a special geopolitical location bonding the Arab world in Northern Africa to Africa south of the Sahara (FAO, 2018). The current population of Sudan is more than 43 million which is equivalent to 0.56% of the total world population and 50.2% are male and 49.8% are female based on Worldometer elaboration of the latest United Nations data (www.worldometers.info/world-population/sudan-population/). More than 40% of Sudan's population is below 15 years of age representing a typical feature of a developing country. Sudan is characterized by geographical diversity, reflected in its multicultural, multiethnic, and multilingual population (Ahmad, 2010). High population growth in the country (2.6%) implies challenges in terms of provision of services, acceleration of economic growth as well as environment sustainability, resource management and social equity. Sudan is lagging behind on the overarching Sustainable Development Goals (SDGs) for poverty reduction with 46.5% of the

Sudanese living below the poverty line and on access to safe water and improved sanitation. Also disparities are significant in the incidence of poverty between urban and rural areas, with the hardest hit being in rural areas.

Since the Independence in 1956, Sudan has been burdened with many conflicts which have hindered its economic, social and cultural development (UNEP, 2007). While some of these problems can be attributed to colonial polices within the country, many have been created by the post-independence governing elite. Two rounds of north-south civil war has led to loss of lives of 1.5 million people, and the continuing conflict in the western region of Darfur has driven two million people from their homes and killed more than 200,000 (FAO, 2018). These ongoing conflicts in marginal States, lack of basic infrastructure in large areas, and reliance by much of the population on subsistence agriculture, have resulted in almost half of the population living at or below the poverty line (UNEP, 2011). In 1999, the economy boomed on the back of rising oil production, high oil prices, and significant inflows of foreign direct investment. Since the economic shock of South Sudan's secession in 2011 and the consequent loss of two thirds of oil reserves, Sudan has struggled to stabilize its economy and make up for the loss of foreign exchange earnings. In addition, the interruption of oil production in South Sudan in 2012 for over a year and the consequent loss of oil transit fees further exacerbated the fragile state of Sudan's economy. Since then, Sudan has attempted to develop non-oil sources of revenues, such as gold mining and agriculture, while carrying out an austerity programme to reduce expenditures (Mahgoub, 2014; Beshir *et al*., 2017).

Mostly, due to armed conflicts and civil wars, Sudanese women have been suffering from the lack of basic services, especially healthcare. Maternal mortality, for example, stands at 509 per 100,000 live births. In addition, social and cultural norms, beliefs and traditional practices continue to hinder women from engaging actively in all walks of life. However, female enrolment in primary education increased from 64.4% during 2006-2007 to 69.9% in 2009, while female enrolment in secondary education increased from 30% in 2005 to 35.5% in 2009. In addition, Sudanese women have made progress in terms of representation and political participation. For example, in the 2010 elections women won 28% of parliamentary seats.

In spite of the rapid pace of urbanization (from 8.3% in 1956 to approximately 40% in 2008) Sudan remains rural in its social, economic and cultural outlooks with the majority of the country's total population living in rural areas (African Development Bank Group, 2010). The gross domestic product (GDP) in Sudan was worth 55 billion US dollars in 2019, according to official data from the World Bank and projections from Trading Economics. The GDP value of Sudan represents 0.05% of the world economy (www.tradingeconomics.com/sudan/gdp). Since independence in 1956, Sudan has been keen to promote agricultural education and qualifying managerial agricultural scientists, as the country is primarily an agricultural country (Mahgoub, 2014). About 90% of Sudan's exports are agricultural products such as Cotton, Gum Arabic, Cattle, Meat, Oil seeds, Sorghum, Vegetables and Fruits (ARC, 2007; World Bank, 2012). Also, more than 60% of Sudanese graduates of HEIs who are employed in government are males (MOHE, 2020).

It has been documented that within the twenty first century, eradication of extreme poverty as elucidated in the Sustainable Development Goals (SDGs) is a function of knowledge generation and exploitation (Nakayiwa *et al*., 2016). As such, available evidence suggests that education, health, gender equity, social protection and standards of living have expanded

significantly in spite of the numerous challenges facing Sudan internally and externally (Sudan National Voluntary Report, 2018). Worthy to explore in Sudan therefore, is the role of Higher Educaon (HE) and its contribution to the knowledge economy and how it impacts on appreciation, adoption and implementation of initiatives that will actualize sustainable development as articulated in the SDGs.

This paper highlights the status and future direction for Higher Education and Scientific Research in Sudan. It provides information on scientifically based understanding of the status of HE in Sudan, its achievements and challenges; an assessment of the contributions of the national, regional and international organizations to Higher Education in Sudan context; and identification of the Higher Education prospects in Sudan including strategic investments for the future such as establishment of Centres of Excellence for Higher education and research in the country. Study methodologies include field work through interviews and observations; and review of existing literature and extensive internet searches. The study covers the history, practices, and status as well as link between higher education and agricultural development. It ends with recommendations for guiding future direction of higher education and research in Sudan.

RESEARCH AND DEVEOPMENT

History of Higher Education in Sudan. Education remains a basic human right. Its function is to develop the talents of individuals to the fullest extent possible so as to enable them participate freely in a society. On the other hand, higher education, also called third-level, post-secondary or tertiary education leads to an academic degree or qualification. Higher Education is an optional final stage of formal learning that occurs after completion of secondary education. The right of access to Higher Education is mentioned in a number of international human rights instruments. The UN Economic Social and Cultural Rights of 1966 declares, in Article 13, that "Higher Education shall be made equally accessible to all, on the basis of capacity, by every appropriate means, and in particular by the progressive introduction of free education" (www.en.wikipedia.org/wiki/). Higher Education is important to national economies, both as an industry and as a source of trained and educated personnel for the rest of the economy. College educated workers have commanded a measurable wage premium and are much less likely to become unemployed than less educated workers.

Formal education in Sudan was started by the British Colonial Administration after their re-occupation of the country in 1898. Previously education was limited to Quranic and other religious schools and the few Sudanese who enrolled in any activity which could be classified as modern or HE were those who enrolled in Al-Azhar University in Egypt. Gordon Memorial College, which later became the University of Khartoum (UofK), was established in 1902 by the British in order to provide the administration with its needs of indigenous manpower in the fields of education and administration. The College had experienced different phases of change which mirrored the economic and social development in Sudan. Through all these phases, the changes were gradual and adequate resources were normally provided. This small scale but balanced pattern continued after independence with the creation of new departments and widening of the range of disciplines offered until 1969. The establishment of the medical, agricultural and engineering schools was in response to the changing realities and needs as well as the aspirations of the population. In 1951, the establishment of technical colleges was closely related to necessity where colleges such as Shambat Agricultural College and Khartoum Technical College helped provide the much needed technical skills on which development projects and municipalities depended.

Inspired youths travelled abroad to gain higher qualifications especially in disciplines where local institutions were not able to train such as medicine and engineering in Egypt and Eastern Europe. The ambitious development plans of the early 1970s were catalyst for HE proliferation, albeit at small scale. A number of technical colleges and new universities were established to provide skilled personnel for the different projects undertaken as well as to fill the gaps created by migration to rich Gulf States in the wake of the oil boom.

Higher Education in Sudan has a long history of interaction with politics. Institutions were affected by the political climate as well as being instigators of political changes. Gordon Memorial College graduates were the force which established the Graduates' Congress in 1902 that led to the creation of the main political parties in Sudan either directly or as a reaction. The Graduates' Congress was the focus of the independence movement and its leaders formed the new administration when self-rule became a reality. The involvement of the graduates in politics continued unabated after independence and the influence of University of Khartoum was remarkable in the popular uprising of October 1964 and the demise of the first military regime of General Ibrahim Aboud.

The University of Gezira and University of Juba were established in 1975 at Wad Medani City in Central Sudan and Juba City in South Sudan, respectively, as the first universities in the country to be built outside the capital Khartoum. The University of Gezira is close to the Gezira scheme, one of the biggest agricultural projects in Africa, with main objective being to supply the project with high caliber graduates (Ahmed, 2011). In 1990, other universities were established to serve agricultural development among other needs in specific regions of Sudan. For example University of Kordofan, one of the biggest universities in Sudan, is located in El-Obeid City in North Kordofan State; the university has a Centre for Intermediate Technology in Agriculture. Currently, mandates of Sudanese universities as is the case for other African universities have considerably changed from their traditional teaching and research roles, to greater active involvement in the development agenda of their countries (Beshir *et al*., 2017).
The Khartoum Branch of Cairo University was the eventuality of Egyptian quest for influence among the emerging classes of modern forces and it became the fore-runner for mass HE in Sudan. The range of disciplines offered was crucial in reducing the gap in office skills which University of Khartoum with its elitist nature and budgetary constraints that curtailed expansion failed to deliver. The graduates of this university were disadvantaged because of prevailing prejudices which saw the Cairo University Branch as a quantity institution, in contrast to the University of Khartoum which safeguarded the quality of its courses and graduates.

Later on Omdurman Islamic University helped provide the education system with teachers and later, after expansion and modernization, became another source for manpower in different fields. The conservative nature of the university helped to shelter it from HE upheavals except for a short period of its history.

Role of Ministry of Higher Education and Scientific Research (MOHE). In Sudan, the Ministry of Higher Education and Scientific Research focuses on the provision or regulation of institutions of HE and the oversight of scientific research (MOHE, 2020). The MOHE was initiated in 1971 to carry out the task of setting policies, plans and programmes for HE and scientific research and providing coordination between its institutions. Higher Education and scientific research institutions consist of universities, government and private institutions, research centres and institutes that are established under their own laws and founding orders. These

institutions have scientific, administrative, and financial independence and are supervised by their boards and administrative bodies.

The period of 1970s witnessed the issuance of laws and regulatory bodies of HE in Sudan and therefore is considered a major transformation stage for HE in Sudan. Some of these issuance of laws and regulatory bodies were: establishment of a National Council and a Ministry of Higher Education and the promulgation of the National Council for Higher Education in 1972 (MOHE, 2020); establishment of the University of Gezira in Gezira and University of Juba in Juba as the first two universities to be established outside the Capital in 1975 with the aim of linking university studies with the environment and community needs and meeting the needs of those societies (Beshir *et al*., 2017); inclusion of all institutes and colleges that were affiliated with departments of MOHE were encompassed after issuance of founding orders for them; and establishment of technical colleges and university colleges, with the assistance of the World Bank. Abu Haraz Agricultural Institute, Abu Naamah Agricultural Institute and Atbara Faculty of Mechanical Engineering were founded in the academic year 1977-1978 to partially meet the country needs for technicians in agriculture and engineering.

The Engaz regime declared that the situation of HE in Sudan had severely deteriorated in all aspects and there was an urgent need for revolutionary reforms (Elhadary, 2016). The year 1990 is considered as a turning point for the HE situation in Sudan. This year witnessed birth of HE revolution and expansion in the establishment of State universities which was adopted by the National Salvation Revolution that came to power in June 1989. The major objectives of this revolution in HE were: to increase student intake at all institutions and reform admission policy; geographical distribution of universities in different States of Sudan; encourage formation of private Higher Education institutions and relate educational programmes with the local environment and the needs of society; abolish student boarding and subsistence schemes; encourage all students studying abroad to come back and continue their studies at Sudanese institutions; and use Arabic language as the only language of instruction at the undergraduate level.

National Council for Higher Education and Scientific Research. The Council is the responsible body for formulating policies, plans, objectives, funding, scientific research priorities and all matters regarding Higher Education within the framework of national policy. It grants licenses for establishment of HEIs besides determining the educational and research plans. The Council also helps in universities planning and supervision, defining institutional relations, setting educational plans, defining curricula, and policies implementation. The Council holds its meetings periodically, twice a year at most. It consists of 86 members including the Minister, heads of boards and directors of public universities, heads of boards of trustees and directors of private universities, three private colleges, six deputy ministers of relevant ministries, five members interested in HE scientific research, with the Secretary General of the Ministry of Higher Education and Scientific Research as a Rapporteur. The National Council for Higher Education and Scientific Research has established ten scientific advisory committees specialized in Agricultural and Veterinary Studies, Natural Resources and Environment, Engineering Studies, Educational Studies, Medical Sciences, Economic and Social Studies, Basic Sciences, Legal and Sharia Studies, Computer Studies, Humanitarian Studies, and Scientific Research. These committees advise the council to conduct studies and research, hold seminars, conferences and workshops, study curricula and programmes, establish colleges in governmental and private universities, and submit recommendations to

the Council to authorize them (MOHE, 2020).

General levels of education in Sudan. The Anglo-Egyptian condominium in 1898 insisted that education policy should concentrate on a basic elementary education for the masses. With this in mind, in 1900 the colonial authorities started to create a school system, geared to provide Sudanese officials for the lower grades of the administration, and decided to appoint as many Sudanese as possible to posts not requiring education. They made efforts to reopen as many kuttabs (primary schools) as possible, by giving subsidies to teachers. Instructional workshops were set up at Kassala, Omdurman, and at the Gordon College. Later, four government primary schools were created. By 1914 the policy was working, and the students from these schools were filling the lower ranks of the administration. However, this all concerned education for boys. It was in 1907 that education for girls began on the initiative of Babiker Badri. In the 1930s and 1940s there was an expansion in secondary schools in northern Sudan. In 1938 the decision was taken to provide post-secondary schooling, leading towards the establishment of a university. In 1944 these schools were amalgamated to form a university, offering degrees equivalent to a United Kingdom degree. Between 1898 and 1930, the government policy in the South of the country was simply to maintain a basic military control of the area, which otherwise remained undeveloped. Education was in local languages at primary level, and in English at higher level.

The school system was in good shape at independence in 1956, and the new government continued to create new schools and universities. In 1989 there were five public universities and two private universities in Sudan. In September 1990, the Engaz regime islamicized the schools and HEIs were backed by the leaders of the Muslim Brotherhood and Islamic teachers and administrators, who were the strongest supporters of the regime. Within a year the government ordered that Arabic should be used as the language of instruction, replacing English. This decision has made the Sudanese students and graduates less competitive to work outside Sudan.

Scientific writing in Sudanese HEIs. Writing is an essential means of communication and the act of creating written work or putting something in written form (Zakaria and Mugaddam, 2013). It may well be considered as one of the most difficult and productive skills. Academic writing is commonly known as scientific writing which is portrayed as organized research practiced and utilized by researchers at HE level. Dynamic and quality research has been the keystone of HE. Research is primarily integrated with academic writing as genre based pedagogies that acknowledge the writing procedure as a necessity arranged with social and cultural response to specific contexts and communities (Al-Mubarak, 2017). Considerable amount of research has recommended that writing in a second language learning context is a difficult and demanding task. Alsamadani (2010) mentioned that the difficulty and complexity of academic writing arise from the fact that it includes discovering a thesis, developing support, organizing, revising, and finally editing it to ensure an effective, error free piece of writing.

The introduction of learning outcomes represents a broader set of expectations about what students should acquire from their studies. This will affect not only teaching in HE, but also the assessment of students' learning. Assessment methods and assessment criteria must be related to the aims of students' learning, and crucial for assessment is to decide what is to be assessed. The MOHE helps the HEIs to advance understanding of assessment and evaluation practices and processes, particularly in the contribution they make to student learning, and of course, staff

and institutional development. Generally, this could be done, irrespective of discipline, with setting out to provide readily accessible, up to date information about significant developments within the field, with a view to the sharing and extension of evaluated and innovative practice.

Education and gender equality in Sudan. Female gross enrolment rate (GER) at the pre-school and Higher Education levels has always been and is still higher than for the male GER (UNESCO, 2018). Once enrolled, girls have a good survival rate, of 79.10% at primary level and 97.51% at secondary level according to the 2012 data (UIS, 2017). The high retention rate for girls in the education system may be explained by strong incentives for them to stay in school to delay marriage and entrance into an uncertain labour market. Boys may have better opportunities in the labour market and therefore fewer incentives to stay in school. Additionally, the World Bank (2017) suggests that girls are at a greater disadvantage among marginalized or vulnerable population groups in the population as a whole.

Although some attempts have been made to enhance women's education, women continue to be generally less represented than men in the labour market. This could result largely from an interaction between social structure, traditional beliefs, family economic conditions, and State policies. According to UNICEF (2020), 49% of girls are missing out on primary education in Sudan. As a consequence of unequal views towards women, educators can easily implement their views on who they allow to enroll in schools, and the large numbers of families who struggle with the cost of education generally choose to give boys educational opportunities.

Indeed, women and girls account for 76% of enrolments in literacy classes and adult education (World Bank, 2012). In addition, the capacity of teachers is low in the country and the severe lack of female teachers often creates a learning environment that is hostile to girls. This can be attributed to the lower rates of schooling for girls in past generations, resulting in lower literacy rates for women and a greater need for catch-up education. To improve education in targeted areas, GPE is investing in initiatives like the Basic Education Recovery Project, to the tune of US$76 million, which significantly helps girls' education in Sudan (UNESCO, 2018). Despite this discrepancy in number of elementary and high schools for girls, they manage to occupy 54% of the university enrolment in the last ten years (MOHE, 2020).

Status of Higher Education in Sudan, its achievements and challenges

Overview of students enrolment in the HEIs. Higher Education institutions statistics in Sudan from 1975 to 2018 based on MOHE (2020) are presented in Figure 1. The HE system is characterized by a range of HEIs including public, private universities, private colleges and technical university colleges. Statistics from 1975 to 2018 indicate a total of 128 HEIs from which 36 are public and 20 are private universities, 53 private colleges and 19 technical university colleges (MOHE, 2020).

Names of the universities, their locations and dates of establishment for the Sudanese public and private universities across the country are presented in Tables 1 and 2, respectively. There are 36 public universities distributed in 26 cities across Sudan, and 20 private universities distributed in six cities, namely, Barbar, Khartoum, Omdurman, Wad Medani and Kosti.

Student enrollment in HEIs from 1980 to 2018 is presented in Table 3. The number of students in HEIs increased from around 26,000 in the early eighties to more than 300, 000 in 2018. The rate of student gross enrolment in the Sudanese universities has been increasing for the last 38

years from 1980 to 2018.

Comparison between male and female registered students in Sudanese HEIs from 1980 to 2018 is presented in Table 2. On average, the data show higher number of female students than male students. Before 1990, the number of male students was higher than females and after 1990 the number of female students increased drastically and consistently.

Summary of students enrolled in HEIs by fields in academic year 2017-2018 is presented in Figure 2. The HEIs offered various disciplines including education, humanitarian, social, administration and law, agriculture, health, science, information technology, engineering and others as services studies. The highest total numbers of students' enrolments were in social studies followed by education and health.

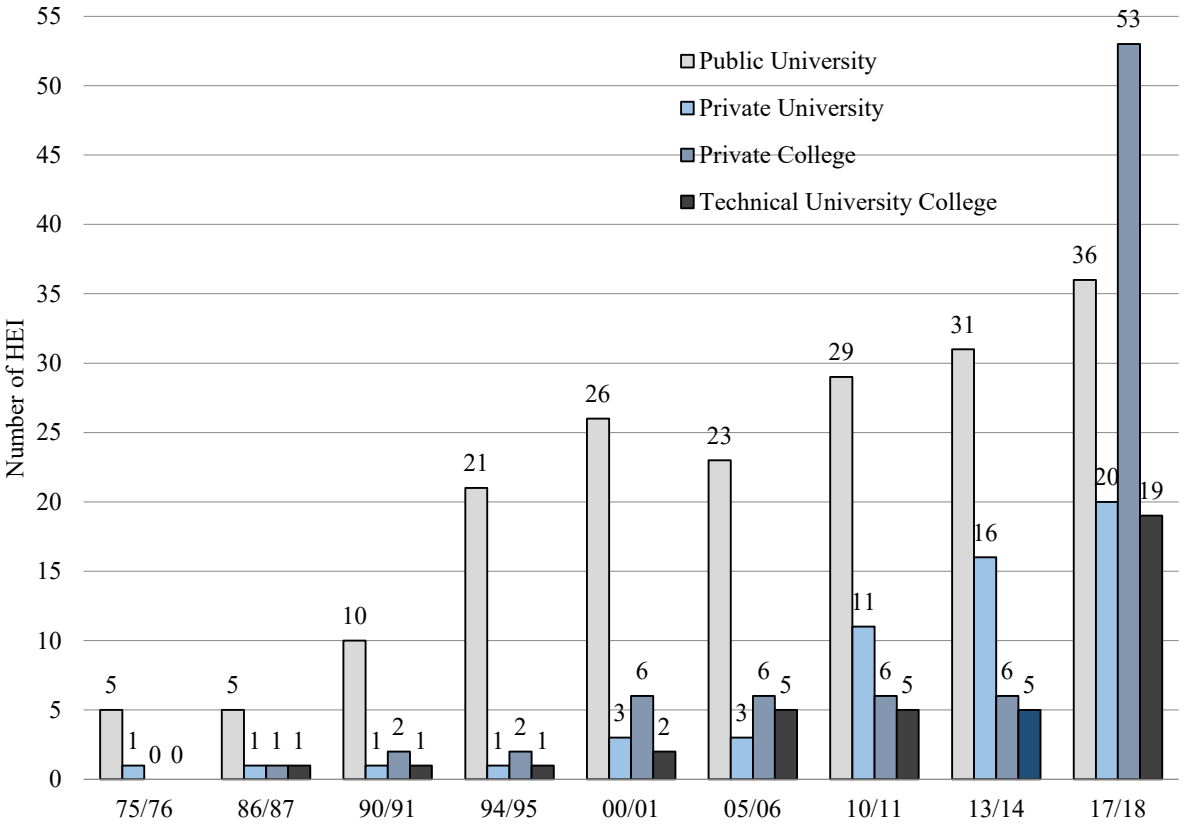

Figure 1. Higher Education institutions statistics in Sudan from 1975 to 2018
Source: MOHE (2020)

Table 1. Public universities, location and year of establishment in Sudan ranked by the year of establishment

Public University	Location	Year
University of Khartoum	Khartoum, Khartoum State	1902
Omdurman Islamic University	Omdurman, Khartoum State	1912
Neelain University	Khartoum, Khartoum State	1956
University of Gezira	Wad Medani, Gezira State	1975
Sudan University of Science and Technology	Khartoum, Khartoum State	1975
Kordofan University	El-Obeid, North Kordofan State	1990
The University of Holy Qur'an and Islamic Sciences	Omdurman, Khartoum State	1990
Nile Valley University	Atbara, Nile State	1990
The University of Holy Qur'an and the foundation of science - Gezira State	Wad Medani, Gezira state	1991
Alfashir University	Elfashir, Darfur State	1990
Al-Zaiem Alahari University	Khartoum North, Khartoum State	1993
Dalanj University	El-Dalanj, South Kordofan State	1993
Sinnar University	Sinnar, Sinnar State	1993
Imam Mahdi University	Kosti, White Nile State	1993
Zalingei University	Zalingei, Central Darfur State	1994
Nyala University	Nyala, Darfur State	1994
Gadarif University	Gadarif, Gadarif State	1994
Kassala University	Kassala, Kassala State	1994
Shendi University	Shendi, Nile State	1994
Dongola University	Dongola, Northern State	1994
Red Sea University	Port Sudan, Red Sea State	1994
Blue Nile University	Damazin, Blue Nile State	1995
West Kordofan University	El-Nuhood, West Kordofan State	1997
BakhtElrida University	El-Dowaym, White Nile State	1997
Albutana University	Rofaa, Gezira State	2001
Peace University	El-Foola, West Kordofan State	2003
Sudan Opened University	Khartoum, Khartoum State	2004
Abdul Latif Al-Hamad University of Technology	Merowe, Northern State	2009
Bahry University	Khartoum North, Khartoum State	2011
Islamic Institute for Translation	Khartoum, Khartoum State	2013
Giniena University	Elginiena, West Darfur State	2014
University of Managil for Science and Technology	Managil, Gezira State	2016
Sudan Technical University	Khartoum, Khartoum State	2016
Technology University	Khartoum, Khartoum State	2016
East Kordofan University	Kadogly, South Kordofan State	2016
Eldaein University	Eldaein, East Kordofan State	2016

Source: MOHE (2020).

Table 2. Private universities name, location and year of establishment in Sudan ranked by the year of establishment

Private University	Location	Year
Ahfad University for Women	Omdurman, Khartoum State	1966
International University of Africa	Khartoum, Khartoum State	1977
Omdurman Ahlia University	Omdurman, Khartoum State	1986
Sudan International University	Khartoum, Khartoum State	1990
Future University	Khartoum, Khartoum State	1991
Wad Medani Ahlia University	Wad Medani, Gezira State	1992
Karary University	Omdurman, Khartoum State	1994
University of Science and Technology	Omdurman, Khartoum State	1995
University of Medical Science and Technology	Khartoum, Khartoum State	1996
IbnSina University	Khartoum, Khartoum State	1999
White Nile University	Kosti, White Nile State	1999
Ribat National University	Khartoum, Khartoum State	2000
Elrazi University	Khartoum, Khartoum State	2001
Arab Open University	Khartoum, Khartoum State	2002
Elsheikh Abdallah Elbadri University	Barbar, Nile State	2002
Mashreg University	Khartoum North, Khartoum State	2003
Garden City University	Khartoum, Khartoum State	2003
National University	Khartoum, Khartoum State	2005
Al-Mughtaribeen University	Khartoum, Khartoum State	2010

Source: MOHE (2020).

Table 3. Students enrollment in HEIs from 1980 to 2018

Year	Bachelor			Diploma		
	Male	Female	Total	Male	Female	Total
1980*	17753	10357	28110	-	-	-
1990*	13954	12174	26128	-	-	-
2000	106046	121236	227282	6871	7243	14114
2010	167718	204627	388582	47255	44508	92675
2018	266005	308748	574753	44563	50170	94733

Source: MOHE (2020)
***: Data not available for the Diploma students and graduates**

Table 4. Comparison between male and female registered students in Sudanese HEIs (Bachelor and Diploma) from 1980 to 2018

Year	Total number of male students*	Total number of female students*	Total number of students*	Percentage of male students* (%)	Percentage of female students* (%)
1980	17753	10357	28110	63	37
1990	13954	12174	26128	53	47
2000	112917	128479	241396	47	53
2010	214973	249135	464108	46	54
2018	310568	358918	669486	46	54
Average	134033	151813	285846	51	49

Source: MOHE (2020)
***: The total was calculated by adding Bachelor and Diploma students**

It is now argued that Sudan needs high numbers of graduates since there must be enough to assist in community transformation and to face challenges and opportunities of the twenty-first century. Taking into account the number of graduates annually produced by Sudanese HEIs and the disconnect between the industry and the knowledge and skill base of these graduates, the relevance of establishing these universities has been brought to question. Also, the high number of graduates with no jobs shed doubt on the relevance and significance of the established HEIs and industrial and societal needs.

Overview of affiliated staff enrolment in the HEIs. Summary of number of affiliated staff employed in HEIs by discipline in 2017-2018 is presented in Figure 3. The highest total numbers of employed staff were in health studies followed by social and education studies, while the lowest total numbers of employed staff enrolment were in information technology followed by administration and law and other disciplines like service studies. Agricultural studies discipline has also moderate number of employed staff. Generally, lecturers and the teaching assistants are more than the rest of affiliates like assistant and associate professors.

Summary of total number of employed affiliated staff by disciplines and gender in HEIs is presented in Table 5 This data clearly show that employed male staff being more than female staff especially in disciplines like information technology and engineering studies. Generally, both disciplines have the least number of employed affiliates across all disciplines. Agricultural studies has few employed staff even though, more than 80% of the population are working in agriculture. Qualified staff often terminate their jobs at the HEIs and join private companies that often offer better opportunities. On the other hand, the number of employed professors and associate professors in the HEIs is fewer compared to the rest of the affiliates. This could be attributed to the fact that many experts and high caliber professors and associate professors left the HEIs to join private jobs or departed the country to other countries for better earning and lifestyle.

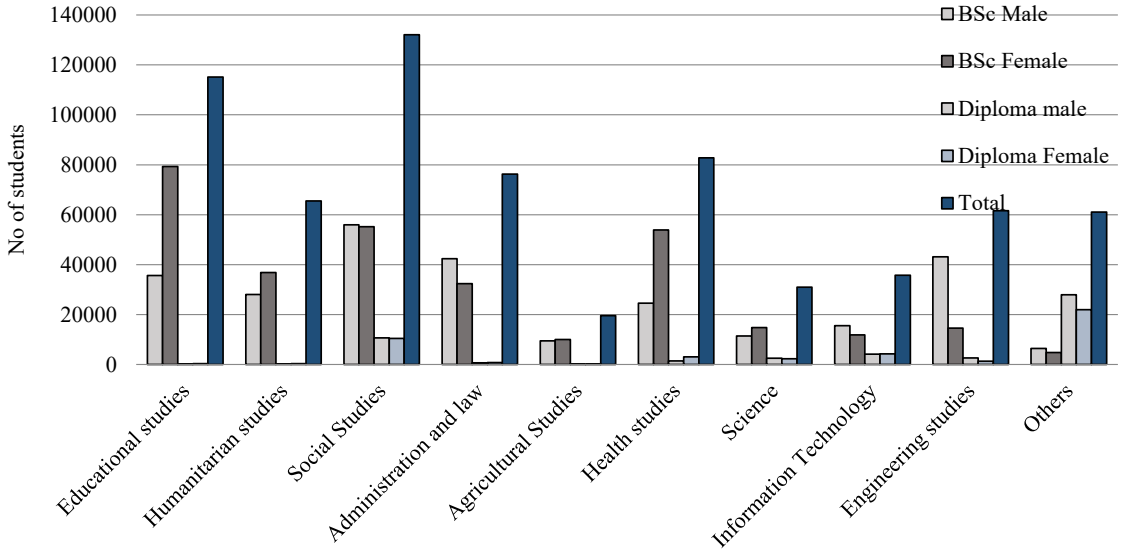

Figure 2. Summary of students enrolment in HEIs by fields during the academic year 2017-2018
Source: MOHE (2020

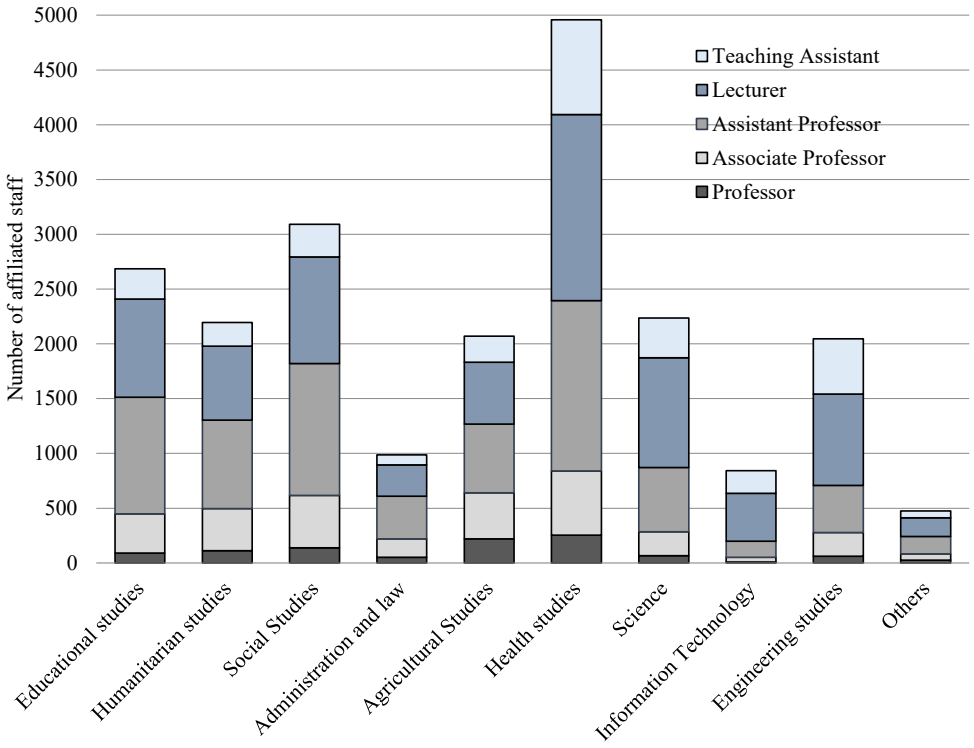

Figure 3. Gross affiliated staff employment by discipline in 2019
Source: MOHE (2020)

Table 5. Total number of employed staff affiliated by disciplines and gender in Sudan Higher Education Institutions

Field	Professor		Associate Professor		Assistant Professor		Lecturer		Teaching Assistant		Total No by discipline
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Educational studies	67	23	284	75	691	373	533	363	129	148	2686
Humanitarian studies	101	10	329	56	539	269	398	277	135	80	2194
Social studies	129	10	391	86	843	362	593	380	160	136	3090
Administration and law	47	6	141	26	283	107	164	121	53	39	987
Agricultural Studies	203	17	334	86	393	234	340	224	125	114	2070
Health studies	202	53	428	156	958	598	728	969	349	516	4957
Science	59	7	186	33	414	172	549	452	189	175	2236
Information Technology	10	0	37	4	118	29	260	177	120	87	842
Engineering studies	59	3	205	10	351	80	552	282	307	197	2046
Others	26	0	49	8	126	33	112	59	39	24	476
Total by Gender	903	129	2384	540	4716	2257	4229	3304	1606	1516	21,584

Source: MOHE (2020).

The number of male and female affiliated staff employed by HEIs in academic year 2017/18 is presented in Figure 4. The highest numbers of employed staff were the assistant professors followed by lecturers and the teaching assistants while the lowest numbers of employed staff were professors and associate professors. From the gender perspective, the number of male staff is higher than female in all affiliates catgorises. This is despite the fact that there have been more women than men students enrolled in universities since 2000. There is need to help the young staff to pursue their postgraduate studies so as to be promoted to associate professors and professors. The consistent low number of females staff compared to males is explained by the history of education in Sudan which did not promote female education. It is time to narrow the academic gender gap in HEIs and give females equal opportunities for promotion.

The shortage of employed staff is challenging to the capacity of the national institutions particularly the research and educational public institutions. This situation has led to a significant deterioration of academic and research infrastructures, a reduction in the capacity of students' supervision, lack of learning materials and in the final analysis a decline in the quality of teaching and research. There is thus an urgent need for stregthening the quality of HE and scientific writing in the country. In addition, the quality of teachers is low and the lack of female teachers often creates a learning environment that is hostile to women.

The Ministry of Higher Education and Scientific Research has paid great attention to the shortage of teaching staff in Sudanese universities. The Ministry formed a specialized technical committee that prepares direct online classes chaired by a number of specialists and technicians. The Ministry is focusing attention on developing a hybrid conception that provides services for direct electronic classes (lectures)

which includes teaching components (exercises, lectures and quizzes), and set a schedule for examinations, in cooperation and coordination with the professors' initiatives abroad. The Ministry indicates that there are programmes and plans the Ministry is striving to prepare in order to bridge the shortfall and facilitate the teaching process for university students.

In 1997 the National Council for Higher Education and Scientific Research introduced a new admission policy to public universities. Each public university was given permission to admit additional 25% of the competing, fees paying students. These students share the same facilities with students entering through normal admission. However, other private HEIs students are given incentives of up to 12% less points than the minimum corresponding score for the general admission determined by general competition. These fees paid by private students are determined by the respective universities, are compulsory and not subject to any negotiation. The annual private fees range from USD1,000 for social studies, to USD6,500 for engineering electricity and up to USD8,500 for medicine. Public universities use this money to pay their lecturers and help public students who are not able to pay their tuition fees. It is now seen that these paid fees are not enough for these public universities to retain their staff and advance their education facilities and learning environment.

Comparison between affiliated staff and enrolled students in the HEIs. The percentage number of affiliated staff compared to enrolled students per discipline in Sudan HEIs is presented in Table 6. In general the average number of registered students in HEIs is 68,0696 while the number of affiliated staff is 21,584 during the academic year 2017/18. The highest number of students (19% of total students) was in social studies while the lowest number of students (3% of total students) was in agricultural studies. However, social studies and agricultural studies had 14% and 10%, of the total affiliated staff in HEIs. The highest number of affiliated staff was in health studies and the lowest was in services and other studies.

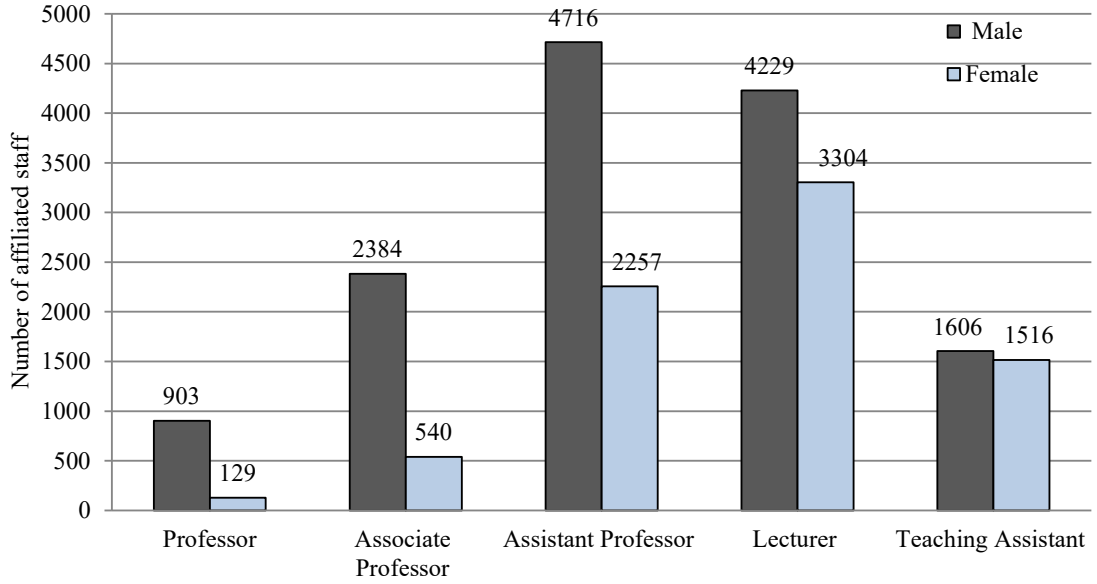

Figure 4. Total number of male and female affiliated staff employed by HEIs during the 2017-2018 period Source: MOHE (2020)

Table 6. Registered students and affiliated staff, their percentages by discipline and students affiliated staff ratio in Sudan Higher Education Institutions during 2017-2018

Discipline	Registered students	Percentage of registered students per discipline (%)	All Staff	Percentage of all staff per discipline (%)	Students-affiliated staff ratio
Educational studies	115193	17	2686	12	43
Humanitarian studies	65486	10	2194	10	30
Social Studies	132117	19	3090	14	43
Administration and law	76207	11	987	5	77
Agricultural Studies	19507	3	2070	10	9
Health studies	82797	12	4957	23	17
Science	30910	5	2236	10	14
Information Technology	35770	5	842	4	42
Engineering studies	61638	9	2046	9	30
Others	61071	9	476	2	128
Average	68070	10	2158	10	32
Total	680696	100	21584	100	32

The students - affiliated staff ratio was calculated based on OECD (2020) (Table 4). It is evident that the staff number compared unfavorably to enrolled students in all disciplines. The availability of one affiliated staff ranged from 9 to 128 registered students. One affiliated staff teaches 9 registered students in agriculture, 14 registered students in science, and 17 in health studies. This ratio deteriorates to 1:77, 1:43 and 1:43 in administration and law, education and social studies, respectively. The MOHE (2020) reported that the averaged ratio of affiliated staff to enrolled students was 1:32 based on academic year 2017/18 registered students and affiliated staff. It is apparent from the data that the staff number has not kept pace with students number and there is the need therefore to employ more trained staff. In addition, more rewarding recruitment salaries will undoubtedly stop migration of high caliber staff.

Higher Education contribution to development in Sudan

Distribution of HEIs. Distribution of the total number of HEIs (public and private universities, private colleges and technical university colleges) during the academic year 2019/20 is presented in Table 5 and Figure 5. The Central region had the highest number of HEIs (83) with most of them being private colleges (46), followed by the Eastern region (10) with four private colleges, Darfur region (8) with six of them being public universities and the White Nile region (8) with three technical university colleges. The Blue Nile and Sinnar Regions had the lowest number of HEIs (3) followed by the Northern (7) and Kordofan regions (6).

Higher Education contribution to national and regional development. Distribution of HEIs in all regions has highlighted the productive role of education in economic growth and development in the country. The positive side of the revolution of 1990 was the increase in the number of students, especially females, enrolled in HEIs. The distribution of HEIs in the States has helped to reduce cost of travelling and accommodation in towns especially in the Central region where 66.4% of the total HEIs are located. In conflict regions like Darfur and Blue Nile and Sinnar regions there are few HEIs, however these HEIs have focused on

solving political, social and cultural issues for development and political stability. Universities in Sudan have peace building centres running research and activities that help Sudanese authorities and general people to experience tolerance and reconciliation (Mohamed *et al*., 2008). However, these centres like the universities themselves are poorly funded by the federal government and hardly get external funding as they are official government bodies and hence deprived of benefits.

Higher Education Institutions cannot be leaders in the drive for sustainable development and still expect to carry on business as usual. Therefore, there is need to create more links between HEIs and industry, with more internships, placements and collaboration. Disruption is coming (as evidenced by the COVID-19 pandemic) and HEIs must face the choice of whether to take the initiative and lead the change in areas such as on-line and distant learning, climate justice, fighting poverty and conflict in marginal areas and ensuring gender equality.

Table 7. Distribution of Higher Education Institutions in Sudan

Region	State	Public University	Private University	Private College	Technical University College	Total
Northern Region	Northern State	2	0	0	1	3
	The Nile State	2	1	0	1	4
	Total					7
Central Region	Khartoum State	12	16	39	1	68
	Gezira State	3	1	7	4	15
	Total					83
Blue Nile and Sinnar Region	Blue Nile State	1	0	0	1	2
	Sinnar State	1	0	0	0	1
	Total					3
White Nile Region	White Nile State	2	1	2	3	8
	Total			8		
Eastern Region	Red Sea State	1	0	3	1	5
	Kassala State	1	0	1	1	3
	Gadarif State	1	0	0	1	2
	Total			10		
Kordofan Region	North Kordofan State	1	0	0	1	2
	East Kordofan State	1	0	0	0	1
	West Darfur State	1	0	0	0	s1
	South Darfur State	1	0	0	1	2
	Total					6
Darfur Region	North Darfur State	1	0	0	0	1
	Central Darfur State	1	0	0	0	1
	West Kordofan State	2	0	0	0	2
	South Kordofan State	2	0	0	2	4
	Total			8		
Total		36	19	52	18	125

Source: MOHE (2020).

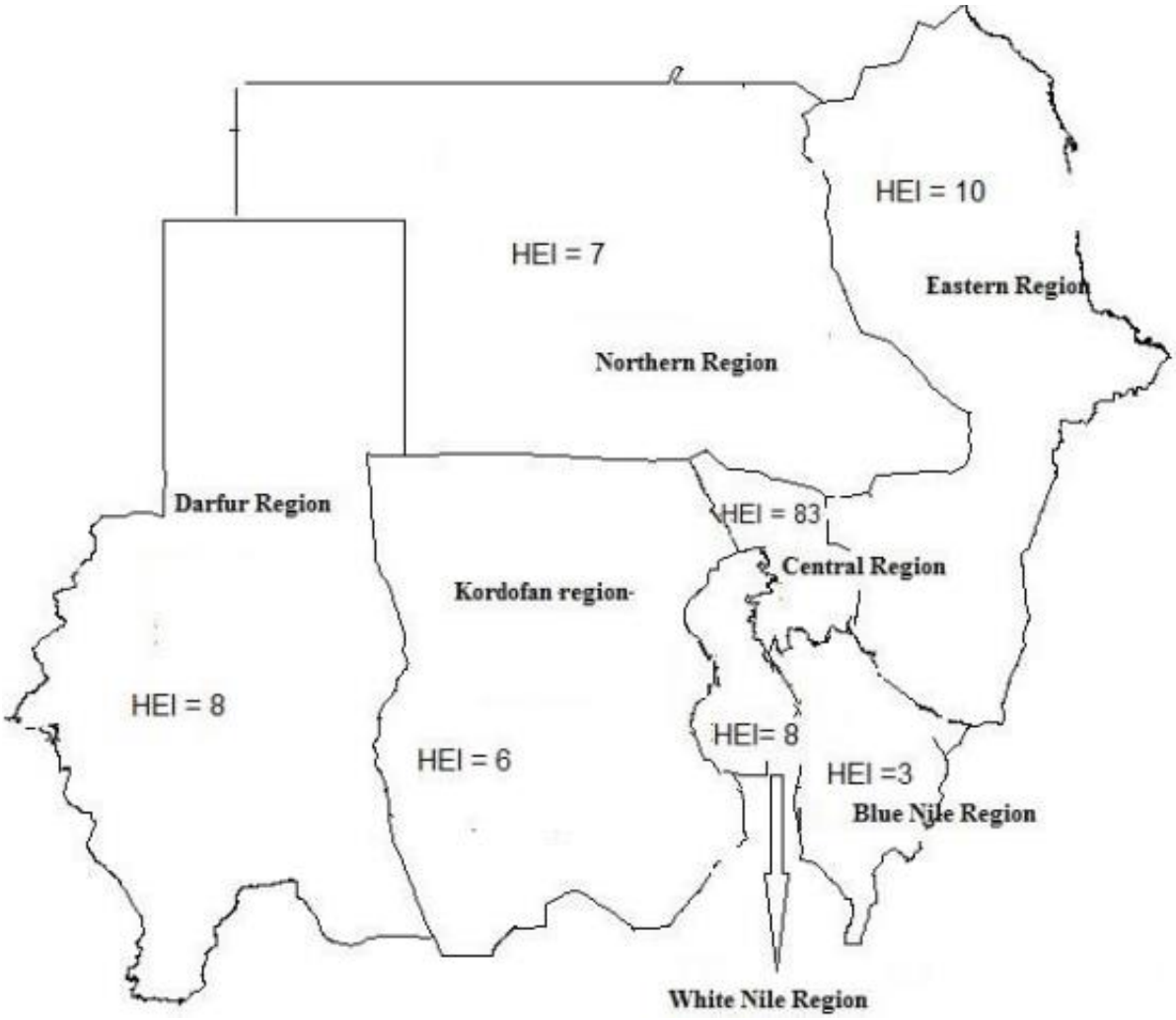

Figure 5. Distribution of Higher Education Institutions in Sudanese regions
HEI: is Higher Education Institutions
Source: MOHE (2020)

Policy environment for Higher Education in Sudan

Policy for higher education. The policy process in HE operates at four levels and also in different modes (Shattock, 2012). The first is at the international level, although less attention has been focused on this level. International agencies such as the World Bank and the Organisation for Economic Cooperation and Development (OECD), are fertile sources of policy. The second is the national level. The most familiar forms of national policy are: (1) legislation, which determine the legal framework in which HE institutions operate; (2) regulatory regimes, which not only enforce these legal frameworks but play an important role in terms of assessment, evaluation and improvement; and (3) funding agencies and regimes, which determine how resources are allocated. Coordination, and certainly coherence, of policies at national level is usually difficult to achieve. The scope of these policies is very wide – policies that determine access to HE and the institutional taxonomy of national systems; policies that focus on research and innovation; and policies that determine the conditions on which foreign students can be admitted. Typically these policies are the responsibility of different Ministries. Outside

the policy process there are numerous interest groups, including the HEIs themselves, students' organisations and trade unions.

The third is the intermediate level between States and HEIs. The most obvious forms of this level are public agencies responsible for distributing funding to individual institutions and for ensuring, and improving, the quality of HE. The fourth is the institutional level. The policy process within institutions has traditionally taken two main forms namely; (1) academic policy, focused on teaching programmes, the student experience and research priorities; and (2) administrative policy, focused on supporting resources and infrastructure (financial, human and physical). These two forms of policy have tended to be more strongly coordinated, or combined within overarching policy. Institutions have now been obliged to focus more on policy and to develop more robust management systems.

Policy environment contribution to the development and promoting investment. Education in Sudan is free and compulsory for children aged 6 to 13 years. Primary education up to the 2019/2020 academic year consists of eight years, followed by three years of Secondary education. The primary/secondary educational ladder of 6+3+3 years was switched in 1965 and during the Engaz regime to 8+3 with Arabic as primary language replacing English. Then during the 2019 Sudanese transition to democracy, the educational ladder was returned to 6+3+3 with English as primary language in the 2020/2021 academic year. Schools are concentrated in urban areas; many in the South and West were unfortunately damaged or destroyed by years of civil war. There are several HEIs in Sudan such as the University of Khartoum, where even foreigners attend HEIs because the reputation of the universities are very good and the living expenses are low compared to in other countries.

Noteworthy is that the education system in Sudan went through many changes in 1990s. The educational policies in Sudan changed in 1990, when Engaz regime led the country. The HE policy aimed at creating the largest number of universities and public institutes while cutting down on the government spending on government educational institutions. This led to creation of unfair competition among universities. Under these policies the curriculum and the educational system changed, which led to another big gap between educational achievements and employment. Graduates from schools or universities possess a lot of information about the nature of their field of study, but are hundreds of miles away from labour market skill demands. Currently, the graduate also suffers from not having regularly updated and developed curricula. There is also widespread technical illiteracy among most students in Sudanese universities, in addition to the limitations that were imposed by US sanctions that affected science students and innovators in Sudan. The rapid expansion in student intake without corresponding increase in the quality of academic environment has had negative impacts on research performance at HE institutions. Up to the present there is no direct funding for research at Sudanese universities.

Engaz government only provided 3% of its 2015 budget to education and creating educational environment (Radio Dabanga, 2018). This percentage for a country like Sudan, which suffers from both illiteracy and poverty, was intended to tighten control over the people who had to take their children off school as a result of high government fees or even so that children could work and have an income to help their families. As well, it was justified for teachers to leave public schools and work at private institutions as a result of low salaries, and lack of improvement in the public school environment. Additionally, the lack of improvement in educational infrastructure and development was

made worse with the loss of oil revenues.

Funding of HE in Sudan historically came from the government and this trend continued till the birth of HE revolution in 1990. Since then private bodies became major partners in sponsoring HE. The rapid expansion of the HEIs has resulted in remarkable funding decline. The public universities responded to this financial cut by amending their admission requirements so as to increase student intake, and raise student fees. This rapid expansion in student intake without corresponding increase in the quality of academic environment has had negative impact on research performance at HEIs, with very limited research outputs over the last 20 or so years.

After the Sudanese Revolution in 2019, percentage of the national budget spent on education is planned to increase to 20% (Radio Dabanga, 2019). However, there are a number of local Non Governmental Organizations (NGO) that work in education in Sudan. The most prominent is the Sudanese Organization for Education Development, which focuses on basic education (www.soed-sd.org). Among international NGOs, the most active in Sudan are Save the Children Fund, Refuge Care Netherlands (ZOA), Plan International Sudan, Education Above All, Association of Religious Data Archives (ADRA), the Jesuit Refugee Service, The Sudanese Organization for Combating Violence Against Women and Children (SAO), World Vision, Islamic Relief Worldwide (IRW), amongst others.

The extraction of petroleum in 1999, the signing of the CPA in 2005 and discovery of Gold mining in the North, among others, have led to considerable increases in the volume of foreign investment. Currently, HEIs have sufficient institutional arrangements and practices that can bring HEIs closer and form a common research and innovation agenda. Sudanese HEIs and government public research institutions, as important sources of information for innovation, should raise their profile as sources of innovation and work on linkages with local, regional and international bodies to explore possibilities for the commercialisation of innovations.

The secession of South Sudan has deprived the country of 24% of population, 25% of its total area, 30% of potential arable land, 25% of its water resources and over 80% of its oil income. The economic situation became more precarious with the Darfur and Blue Nile region conflict. Economic crisis no longer looms over the country, but has created pressures from the international society and deprivations of loans and financing. The only viable economic sector is agriculture, with industry demise due to heavy taxations, expensive inputs prices, devaluation of the Sudanese currency and increases in levels of foreign currencies exchange rates. The agricultural sector created 39% of the GDP, employed about 80% of population, and contributed 80% of the country's exports (FAO, 2018). Additionally, Sudan is endowed with arable land, animal resources, fresh water sources and a variation in climate that makes the country ideal to contribute significantly to the world food security. The Government could expand agricultural educational assistance by building the capacity of the HEIs with the goal of promoting greater food and nutrition security. Assistance should also be given to HEIs, civil societies, and private sector groups and there is need to provide technical assistance to HEIs and other bodies to prepare project proposals for grants.

Higher Education prospects and strategic investments in Sudan

Presence of public and private education. Distribution of public and private universities, private colleges and technical university colleges in Sudanese States in 2019-2020 is presented in Figure 6. Khartoum State had the highest number of public universities (12) followed by Darfur (6), Kordofan (4) and the Northern and the Nile States (4). In 1966 the first private university Ahfad University for

Women was initiated in Omdurman, Khartoum State. It was founded as a familial tradition of educating girls in Sudan. In 1907, Babiker Badri opened up his secular school for girls in a mud hut with nine of his own daughters along with eight neighbourhood girls. Badri family carried on this tradition of private education for three generations in Sudan until Babiker's son, Yusuf established Ahfad in 1966. The college was then granted full university status in 1995 by the Sudan National Council for Higher Education due to its expansion of curriculum and students' body. It remains the oldest and largest private university in Sudan to date.

Sudan University of Science and Technology (SUST) began as the Khartoum Technical School and School of Commerce in 1902. The School of Radiology (1932) and School of Arts (1946) were then merged to Khartoum Technical School and School of Commerce to form Khartoum Technical Institute in 1950. The Shambat Institute of Agriculture (1954), Khartoum Senior Trade School (1962), Institute of Music and Drama and the Higher Institute of Physical Education (1969) were merged with Khartoum Technical Institute and renamed as Khartoum Polytechnic Institute (KP) in 1975 and later it was accredited in 1990 as Sudan University of Science and Technology (SUST). Today SUST is one of the biggest public universities and ranked first in Sudan.

In 1977, the International University of Africa was established as a private institute with the major role of educating young African Muslims and training preachers. The institute thrived on financial help and donations from Saudi Arabia and other Arab States in the Persian Gulf. In 1992 the institute was upgraded to a private university which since then has kept active in Islamic HE, training students mostly from sub-Saharan Africa.

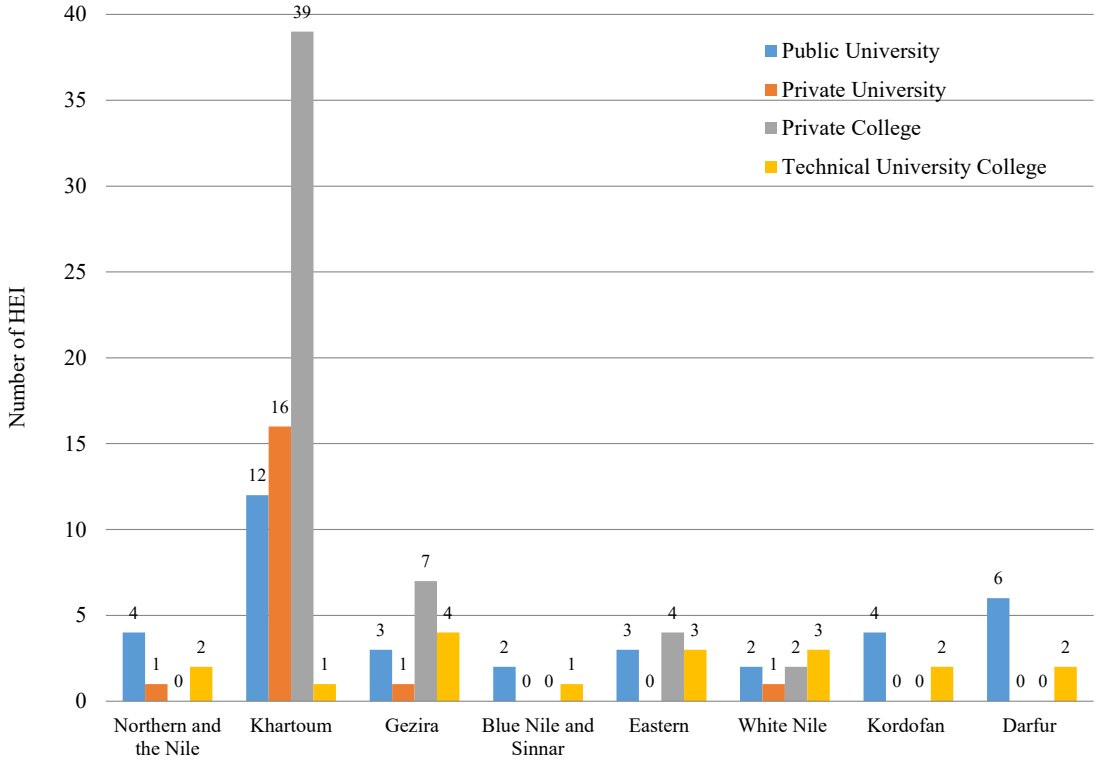

Figure 6. Types of Higher Education Institutions and their distribution in Sudan
Source: MOHE (2020)

In Early 2000s there was great need for providing HE for those with social, economic or age conditions and as an extension of the revolution of HE, it was necessary to provide open education in various regions in Sudan. The Open University of Sudan (OUS), established in 2002, is a public university that provides bachelor and postgraduate courses through distance learning with no age limits. The OUS has 12 departments, centres and E-learning projects that provide services to thousands of students in finance, public relations, education, libraries, human resources management and linguistics.

In 1990s after the boom of HE revolution, several private universities and colleges were initiated in Khartoum (16 universities, 39 colleges), Northern and The Nile (1 university), Gezira (1 university, 7 colleges), the White Nile State (1 university, 2 colleges) and The Eastern States (4 colleges). The MOHE is required to open windows and give some incentives for private sectors to establish private colleges and university colleges in marginal areas.

Strategic investments for the future and centres of excellence in Sudan. Sudan, a country with a rich cultural heritage and enormous potential for development, is the point where Africa meets the Middle East. As a country aspiring toward peace and prosperity, Sudan must invest in its human resources, first of all in its children and youth education. This is one track to see Sudan prosper and move forward. Today, MOHE and HEIs leaders, however, need to re-think again: what would be the right way to ensure sustainability through long-term behavioral change in HE in Sudan?. They should put strong emphasis on empowering communities and private sector to take a more active role in the education process. This should include identifying their own needs through inclusive community base associations to taking charge of resource mobilization and HEIs construction with primary government support but also attracting privaate sector participation. The private sector may also avail grants and funds that may alleviate some basic needs, such as administrative fees and infrastructure, for the most vulnerable communities of students, often hosted by the communities. This should assist making education affordable for a wider range of students and provide some basic needs for empowered youth thus ensuring their enrollment in HE to develop skills necessary to contribute to the nation's economic transition.

The MOHE has strong relationship with other institutions from other line ministries and stakeholders in and outside Sudan. Currently, there are private companies that support HE in Sudan by sponsoring students by paying tuition fees, paying for accommodation and availing scholarships for staff to pursue their postgraduate studies in and outside Sudan. However, there is need for more collaboration and partnerships in research and advocacy to ensure that Sudan can tackle the challenges of food and nutrition insecurity, water resource use, climate change, disease outbreaks like transboundary animal diseases, Corona Virus Disease 2019 (COVID-19) and the push for industrialization. The country will also need to invest in data science and digital technology to enable it move towards the Fourth Industrial revolution, an aspiration for countries all over the world. Establishment of training and research centres of excellence in some of these areas will help the country meet the SDGs and contribute more effectively to Africa Union aspirations enshrined in Agenda 2063. This important step requires strategic partnerships with especially African and Arabic governments, private sector as well as global knowledge centres.

Quality and relevance of HEIs in Sudan. Considerable efforts have been made over the past few years to develop an effective national framework for quality assurance. Part of these efforts resulted in the establishment of the Evaluation and Accreditation Commission in 2003 as a specialized authority to create and encourage a culture of quality assurance

and accreditation within all HEIs, and to check out that the HEIs are accountable and effective in delivering academic programmes and services. However, the statistics from face to face interviews indicate that there is a quality gap between intended and actual quality assurance practices. Practical implications and recommendations for improved quality assurance practices at Sudanese universities are provided. Therefore, it is the time for current policy makers of HE in Sudan to question what has gone wrong and what has been forgotten in an attempt to put it right in their future policy priorities.

The HE system in Sudan has been affected negatively under the previous governments and many changes with profound cultural and political implications were introduced. The overall impact of these changes is to attempt a social transformation in line with the ideology of the fundamentalist regime. The impact on the economy of the country and the much needed skilled manpower is of grave consequences as changes are motivated by hasty needs for political conformity. At the core of the high and persistent level of poverty in Sudan lie low job creation rates, increasing unemployment and a low level of productivity and know how.

Political instability and the changing state of world economy, coupled with hasty and inadequate and sometimes corrupt economic decisions, caused the failure and abandonment of several projects. The stabilization of oil prices and the development of indigenous work force, reduced employability of Sudanese workers in the Gulf. All this coupled with austerity measures in Sudan have resulted in a serious problem of unemployment among graduates.

For students and for society, a core aspect of HE is to prepare for future employment. Research on employability has to be taken as the starting point for targeted training investment, to align with the labour market. However, what has been done does not take into consideration changes in the labour marked that might make it easier or more difficult to obtain a job independently of the qualifications of the candidates. Knight and Yorke (2004) suggested four main areas of competence that constitute employability: Understanding: mastery of the subject matter of a field; Skillful practices: called "generic skill" in addition to subject specific skills; Efficacy beliefs: trust that one can make some impact on situations and events; and Metacognition: awareness of one's own competence as well as limitations combined with an insight in how to learn more and called the USEM model.

Currently, effective quality management systems within HEIs are becoming priority in national HE strategies for almost all countries throughout the world. Since the 1990s Sudan has experienced mass HE, associated with growing number and size of institutions and the diversity of programmes delivered. Hence, concerted efforts should be undertaken to assess and improve HEIs quality. One of these efforts has to lead to work actively with private sector and civil society institutions through Boards and by establishing joint research and outreach platforms.

CONCLUSIONS

There are 36 public universities distributed in 26 cities and 20 private universities distributed in six cities out of the total 26 cities in 26 States in Sudan. The HEIs offer various disciplines that include education, humanitarian, social, administration and law, agriculture, health, science, information technology, engineering and others as services studies. Number of students in HEIs has multiplied nine times since the early eighties (26,000) compared to 2018 (300,000). Percentage of female students has increased from 37% in 1980 to 54% in 2018 while percentage male students have reduced from 63% in 1980 to 46% in 2018. Most students register in social followed by education and health studies. Surprisingly, few numbers

of students register in agricultural studies, science and information technology. Further, highest numbers of staff were employed in health followed by social and education studies. The lowest numbers of employed staff were in information technology followed by administration and law and other disciplines like service studies.

Data showed that lecturers and the teaching assistants are significantly more than professors, and assistant professors; 64% of total number of employed staff are males and 36% are females. This study found out that the averaged ratio of affiliated staff to enrolled students is 1:32 (thirty two students for every staff member) which is considered higher than the averaged world ratio of 1:16.5 (World University Rankings, 2020). Amongst the 600 best universities in the World University Rankings in 2019, none has more than nine students for every staff member. A joint pilot study conducted by the Association of African Universities, Ghana's National Council for Tertiary Education and the Population Reference Bureau shows that Ghana alone needs an additional 3,410 faculty who are PhD holders to achieve the government's desired teacher-student ratio, and as many as five times that number if the country is to achieve its policy goals by 2025. Certainly, the situation is much worse in Sudan than Ghana, calling for more than trippling investments in HE in the country.

It is apparent from the data that the staff number has not kept pace with students numbers, requiring more trained staff. The rapid expansion of HE was not accompanied by the increase in staff quantity and quality, not to mention the small number of professors nor in infrastructure development. The impact of this shortfall is that students do not fully understand what is being taught because there are not enough faculty members to tailor learning, track students' grades, track absentees or provide any additional support.

The revolution of 1990 made HE accessible for all students regardless of socio-economic status and constraints. The Central region (Khartoum and Gezira states) had the highest percentage of public universities (66.4%). The Eastern region had 8% of them as universities and private colleges, Darfur (6.4%) and White Nile (6.4%) regions had low percentages of HEIs. There is a need to establish HEIs in the Blue Nile and Sinnar region because they had the lowest percentage (2.4%) followed by Kordofan (4.8%) and the Northern (5.6%) regions. The Central region had 89% of the private HEIs which is the highest percentage. This could be attributed to the presence of private sector interests and high population size. There is need to establish private HEIs in Darfur, Kordofan and Blue Nile and Sinnar regions too. However, the Northern, White Nile and Eastern regions accounted for 11% of the private HEIs. Outside the Central region (42%), Darfur (17%), Kordofan (11%) and Northern (11%) regions had modest public university percentages. The Eastern (8%), White Nile (6%) and Blue Nile and Sinnar regions had low percentages of public universities. Generally, there is need for government and private sectors to establish institutes in those regions with low HEIs so as to give opportunity to more students in those regions.

The private universities and private colleges are not only concentrated in one location, Central region, but also not well-prepared to address issues related to diversification besides having low enrolment. There are no major differences between disciplines offered by public and new private institutions. It may be said that private institutions are based on profit rather than addressing the needs of the country. Accessibilty of HEIs has been made possible by the opening of non-conventional education such as distance education which also serves as a response to the growing social demand for more diverse academic programmes. But lack of qualified teaching staff and education infrastructure coupled with the mass waves of students has led

to low quality and quantity output of training and research. Currently, university environment is not conducive to conduct quality research. Moreover, there is need for the Government to expand agricultural educational assistance by building capacity of the HEIs to enhance food and nutrition security.

Higher Education in Sudan has proven to be long-lasting despite eras of change and social upheaval. Today, 125 Sudanese HEIs face the most challenging time with issues thrust upon them by elected officials, economic changes, shifting values, political polarization and diverse demographics. However, these HEIs should use this time to focus their efforts and search for opportunities rather than hope for the past, continue to attract students, local, regional and international collaborators and employers for better cooperation to meet the needs of their communities. Innovation and improved services will contribute to production of high human capitals that will have an effective role on economic and social growth. Continuous reform and adoption of modernized curricula and improved teaching methods and practical solving research problems will gain the confidence of the labour market and increase opportunities for more jobs and unemployment reduction.

In Sub Saharan Africa, the value added from a college degree boosts earnings by over 20% (Chamorro-Premuzic and Frankiewicz, 2019). While university qualifications become more commonplace, employers will increasingly demand them, regardless of whether they are actually required for a specific job. Therefore, universities could substantially increase the value of the college degree if they spent more time teaching their students critical soft skills. Chamorro-Premuzic and Frankiewicz (2019) reported that half of organizations listed problem solving, collaboration, customer service, communication, adaptability, culture fit, and growth potential for in-demand technical skills as the most valued skills requested by employers. Additionally, employers like Google, Amazon and Microsoft have highlighted the importance of learnability, which is being curious and having a hungry mind, as a key indicator of career potential.

Nevertheless, the HE revolution reform of 1990 in Sudan led to the degrading culture of research that accommodates society needs and concentrates on teaching as the main institutional function. Like other HE systems in developing countries, the HE sector in Sudan is currently experiencing substantial challenges. Some of these challenges include, among others, unplanned enrolment expansion according to community needs, brain drain among the academic affiliated staff and immigration to seek for high payment, and shortage of regional and international funds and scholarship opportunities due to sanction from USA which steered staff training to be local and only very few lucky staff find personal chances for regional or international training. Besides, deterioration of research due to lack of research funding, there is no research policy to direct research to address community needs and this is made worse by lack of partnership with leading organizations in Africa and across the globe. Also poor English language that is reflected in failure to write manuscripts and fundable research proposals adds to the challenge of dwindling resource base and regional and global isolation.

RECOMMENDATIONS

September 2020 marks five years since UN Member States unanimously adopted the SDGs, laying out 17 goals for the world to be achieved by 2030 with a view to ending poverty, protecting the planet and ensuring that all people enjoy peace and prosperity. Sudan is not excluded from this action. In order to make change and be able to achieve the mentioned SDGs, Sudan Government should support the MOHE to be able to focus on several issues. For example, MOHE with support from the Government should consider developing a policy to train,

promote and support HEIs affiliated staff and graduates to participate in curriculum and innovative research development and fund raising. The ministry should also seek more collaboration with private sector towards finding solutions and technologies that fit their interests and secure funding for their students. On the other hand, academic writing skills mostly involve the linguistic competence development of the students which many English Second Language learners, like the Sudanese, may identify as a challenging task. Some editors might describe the writing proficiency of the Sudanese university students to be poor as many students lack the basic skills required for communication writing. The Government through the MOHE should step in and help affiliated staff and students enrolled in HEIs to enhance their academic writing and grammar skills. The graduates need to be familiar with authentic written materials so that they can observe how writing is used by native speakers. Writing instructors and syllabus designers should consider this issue when devising writing materials and activities.

Nevertheless, curriculum and teaching methods reforms in universities are needed to ensure a focus on SDGs. A big challenge to meeting the SDG time frames is brain drain. Youth are leaving Sudan as soon as they graduate, which is depleting the country of the skilled human resource that it seriously needs. Sudan needs this manpower back and needs to come up with programmes that can successfully answers the needs of the society that support it, provide employment to youths, and give incentives to the highly qualified so that the country can retain them. It is also important for MOHE and HEIs leaders to revisit educational programmes and focus especially on education in the fields of science, technology, engineering and mathematics, while paying attention to girls because the science and mathematics gap by gender is very wide (Figures 3 and 5). In the same vein, MOHE and HEIs leaders should rethink their higher educational systems and use them to prepare young people for specific types of work. Young people can then take advantage of the Sudanese or African or Arabic evolving megatrends. There is a need to start building capabilities of the future generations of Sudan by nurturing them to become better at seeking and creating opportunities for employment.

Besides, resilience enhancement has potentially many ingredients. For example, it challenges HEIs leaders to improve everybody's awareness of challenging situations, create partnership networks to address short-term students' needs and run stress testing drills to clarify crisis management roles and provide an additional protective layer. Further action points can be identified through focusing on the enhancement of organizational resilience by strengthening the institution's anti-fragility mechanisms. There is a need to use financial flexibility and/or enhancing this further or obtaining contingent funding to cover short term liquidity gaps and to find approaches to address the long-term gaps and move away from a reliance on private students to finance poor students' fee subsidies and staff salaries. Also anti-fragility mechanisms build on institutional resilience and also aim to generate strategic benefits as a result of the disruption. The 2020 Covid-19 pandemic highlights this issue. Thus, the HEIs should be more responsive to change and be more willing to make adjustments to find the best way forward, which can potentially improve HEIs market positions relative to others and reap the rewards accordingly. The need to find new ways of widening and ensuring access to HE is evident. Quality assurance and continuous improvement of services will also attract foreign students who will create international experience to the staff and students, bring new mindsets and a global outlook that enriches academic and social environment.

There is also urgent need for accreditation of HEIs to be carried out to raise the quality of HE

services. Accordingly, there is need to activate the role of universities boards of directors and inclusion of private sector representatives in these boards will assist in assuring that graduates have the right skills for the labour market. Importantly, there is urgent need for strategic investment in infrastructure and human resource capacity to support Higher Education and research in Sudan; and indeed the wider education and S&T value chains. This would require among others:

a. Investment in infrastructure development for training and research in Sudan universities and research institutions, paying attention to regional balance.
b. Investment in human capital development in terms of increasing intake for postgraduate training and for staff development for universities and research institutions. This needs attention in light of the urgent need to strengthen staffing and research capacity in Sudan. In these efforts attention needs to be paid to inclusivity issues.
c. Strengthening integration of Sudan Higher Education and Research into especially Africa Higher Education space, utilizing platforms such as the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). In this regard Sudan Government needs to put in place mechanisms for training its Postgraduate students in different African universities, and also bringing in students from other African countries to train in Sudan.
d. There is need to reposition Sudan as a Higher Education and research hub in Africa, in strategic areas to Sudan development and in areas where Sudan has comparative advantage. As such it is recommended that Sudan Government through well-structured and independent review processes establishes HE Centres of Excellence in targeted fields. Possible areas could include Centres of Excellence in Agro-Food Systems, Management of Water resources and Irrigation, Management of Transboundary Animal Diseases (Centre for Animal Diseases Control), Climate Change Studies and Agro-meteorology, Centre for Human Health Disease Control, Digital Innovations including Data Science and Foresight studies, amongst others.
e. The MOHE and Government of Sudan need to promote Technical and Vocational Education and Training (TVET). The TVET addresses the need for skilled manpower in both existing and emerging economic sectors to be able to compete in and outside Sudan. There is thus need to offer various technical programmes to provide human resource training to meet the needs of the world of work at the middle professional level.
f. There is need to set up programmes to build entrepreneurial skills of Sudan youth and enhance their employability
g. Finally, there is need to establish a Research and Innovation Fund for generating research outputs and innovations, and for supporting linkage with Industry.

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STATEMENT OF NO-CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this paper.

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