

Research Application Summary

Strengthening research capacity for innovation in sub-Saharan Africa

Alio, D.,¹ Agea, J.G.,^{1,2} Egeru, A.,² Okwakol, M.J. N.³ & Adipala, E.^{2,4}

¹Department of Extension and Innovation Studies, Makerere University, P.O. Box 7062, Kampala, Uganda

²Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), P.O. Box 16811, Wandegaya, Kampala, Uganda

³Busitema University, P.O. Box 236, Tororo, Uganda

⁴ Research and Education Agency, P.O.Box 29152, Kampala, Uganda

Corresponding Author: deborah.alio@yahoo.com

Abstract

Research and innovation capacity are defining facets for knowledge economies. All global economies that have advanced as well as the economies of Brazil, Russia, India and China (BRICs) that are rapidly advancing in economic transformation are reliant on a vibrant research and innovation capacity of its citizens. However, sub-Saharan Africa's research and innovation capacity has considerably lagged behind; with limited advances in scientific output including patent registration and acquisition. This review paper brings to the fore the need for increasing research and innovation capacity in sub-Saharan Africa (SSA) as a sound basis for agricultural transformation in the region. This work argues that, for research and innovation capacity within SSA to be realized; institutional leadership that is pro-advancement of innovation and prioritizes talent identification, mentorship and structures and facilitates institutions through an enabling environment will need to rapidly emerge within the region. Further, SSA governments need to appreciate the value of transitioning to knowledge led economies and thereby undertake strategic investments within higher education and research institutions and support a deliberate evolution of the an innovation ecosystem within the region. Finally, systems and institutions are because of what their leadership is; as such, a deliberate focus on thought leadership capacity development to driver innovative and transformative universities and research institutions is critical for today and the future.

Key words: Africa, BRICs, innovation, capacity, knowledge economy, research output

Résumé

Les capacités de recherche et d'innovation sont des facettes déterminantes des économies du savoir. Toutes les économies mondiales qui ont progressé ainsi que les économies du Brésil, de la Russie, de l'Inde et de la Chine (BRIC) qui progressent rapidement dans la transformation économique dépendent d'une capacité de recherche et d'innovation dynamique de ses citoyens. Cependant, la capacité de recherche et d'innovation de l'Afrique subsaharienne est considérablement à la traîne ; avec des progrès limités dans la production scientifique, y compris l'enregistrement et l'acquisition de brevets. Ce document de synthèse met en avant la nécessité d'accroître la capacité de recherche et d'innovation en Afrique Subsaharienne (ASS) en tant que base solide pour la transformation agricole dans la région. Ce travail soutient que, pour que la capacité de recherche et

d'innovation au sein de l'ASS soit réalisée ; un leadership institutionnel favorable à l'avancement de l'innovation et donnant la priorité à l'identification des talents, au mentorat et aux structures et facilitant les institutions grâce à un environnement favorable devra émerger rapidement dans la région. En outre, les gouvernements d'ASS doivent apprécier la valeur de la transition vers des économies axées sur la connaissance et ainsi entreprendre des investissements stratégiques dans les établissements d'enseignement supérieur et de recherche et soutenir une évolution délibérée d'un écosystème d'innovation dans la région. Enfin, les systèmes et les institutions sont à cause de leur leadership ; en tant que tel, il est essentiel pour aujourd'hui et pour l'avenir de se concentrer délibérément sur le développement des capacités de leadership éclairé pour stimuler les universités et les instituts de recherche innovants et transformateurs.

Mots clés: Afrique, BRIC, innovation, capacité, économie du savoir, résultats de la recherche

Introduction

Africa's current position in the global innovation space is marginal becoming the last (number 7) in the global innovation index assessment in 2018. This despite some improvements, with the entry of countries such as Kenya, Rwanda, Mozambique, Malawi and Madagascar as being innovation achievers at least three times in the past eight years (Cornell University *et al.*, 2018). In spite of the fact that Africa's position in the global innovation index remains low, the global innovation index highlights a fundamental fact that innovation and wealth are components of a self-reinforcing virtuous circle in which innovation can lead to higher productivity, higher productivity in turn generates a greater output, greater output then translates into more innovation (Global Finance, 2018). With only 1% of share of the global knowledge contribution (Teferra, 2015), Africa's haul to the global competitiveness in science, technology and innovation is still a long walk. But, what is the root cause of Africa's limited innovation capacity? According to Juma (2016), African universities were created in colonial times to train civil servants, emphasising conformity, not creativity and innovation. This pattern seems to have continued to be perpetuated into post-colonial times thereby limiting the local capacity to advance innovation (Frankema, 2015).

Global and regional dynamics are rapidly evolving with a high level of competitiveness. Consequently, Africa's future lies in its scientists to drive the desirable development pathways from urbanisation to agriculture, climate change to pandemics, the continent needs science, technology and innovation (STI) to secure a prosperous and sustainable future. At present, Africa has less than 100 scientists per a million people compared to the global average of 800 per a million people (Mayaki, 2017). The continent certainly needs to invest in increasing the capacity of scientists, technicians and engineers at all levels. To make this transition and leap forward, Africa needs exceptional leaders with exceptional character and skills to drive the transformation (Adeyemi, 2017). Accordingly, cultivating leadership qualities in emerging researchers and scientists is one of the mechanisms for forming a cohort of generational transformers. This is particularly so as it is often difficult to teach someone who occupies a high position in government how to lead during side talks at global events because the alignment between the sense of identity of the leader and that of the followers is formed overtime and within context (Makeka, 2016).

Africa is certainly responding to the need to grow the number of scientists; the continent has in the last two decade seen a dramatic increase in the number of students enrolled into higher institutions of learning. Subsequent to this has been a more than double the number of graduates emerging out

of the universities. At present, Africa has close to 700 universities but most of these universities especially in sub-Saharan Africa on average graduate less than 30% student in science, technology, engineering and mathematics. Importantly, even with the observed increases in higher education enrolment, Africa's tertiary enrollment remains marginal at merely 7 percent compared to 72% in United States and 30% in China. As such, even if Africa builds 200 new Harvard-sized universities each year for the next 15 years, it still will not close its prevailing skills gaps with India, and will have barely impacted the lot of its young population, yet by 2050, 70% of the global labour force will be coming from Africa (Swaniker, 2016). All these point to the need for Africa to rethink how it trains, positions and builds capacity of its labour force to facilitate innovation across the continent. The paper provides some insights into strengthening research and leadership capacity to facilitate innovation in Africa especially in sub-Saharan Africa.

Need for strengthening research capacity in Africa. Africa has a high level of inexperienced pool of researchers which can be harnessed for research capacity development. Academic staff act as the engine of any higher education institution and their training has significant implications for improving the quality of research of students, institutions and nations alike. However, the level of research in most African universities has not been sufficient enough to support quality research programs (Teferra, 2015). For example, in the last 25 years, there has been a decline in output of African scholars which is usually measured by international journal publications. This has especially been so in Sub-Saharan Africa where African publications have registered a decline of 31% since 1987. This decline has partly been attributed to the limited funding for training masters and PhD students, resulting in a reduction in quality of research (Sawyerr, 2004). In addition research in most African countries has been affected by poor remuneration, heavy teaching loads, inability to mentor young faculty members and inadequate infrastructure (Sawyerr, 2004). Hayward (2012) argues that in order to improve the quality of research, universities need to train masters and PhD students who will serve as advisers, mentors and research models. Teferra (2015) also adds that production of quality research requires a strong committed academic profession. These are issues confronting both new and older universities across the continent, but is especially acute in new universities such as Busitema University in Eastern Uganda. It is also so for countries with weaker or small National Agricultural Research Systems such as Burundi.

Africa's contribution to global knowledge is still very low. In fact, African universities contributed only 0.7% towards scientific literature in 2004 with a citation rate of only 10% (Bloom *et al.*, 2014). However this is only based on research articles coauthored outside the African continent. Figure 1 shows a global analysis of the Scientific and Technical Journals (S&TJnl), number of patent applications filled and gross expenditure on Research and Development (GERD). From Figure 1, Africa registers lowest level of knowledge production compared to other continents with only 54 Scientific and technical journals produced, 438 patent filled, 0.24% patent and 0.4% of gross expenditure towards research and development compared to Europe (4134) Scientific and technical journals, 48.55 titles, 56,500 patent filled, 30.86% patent and 1.6 GERD. This indicates poor scientific and technical performance and limited access to critical knowledge by Africa countries compared to other regions. According to Friesenhahn (2016), Africa needs to strategically and systematically increase its level of knowledge production particularly in science and technology in order to compete with other countries in the global market. The implication is that a) Africa needs to escalate postgraduate training in its universities, b) there is need to increase research funding to African universities, that would increase graduate students research projects, c) there is need to inculcate the culture of inter-disciplinary research and training, d) there is

need to make it mandatory for graduate students to publish especially in peer reviewed journals, e) Universities need to establish Research Chairs to promote research excellence and to provide quality apprentice opportunities especially for post-doctoral fellows and f) universities need to establish mentoring programmes for faculty and administrators, and to support graduate students. It is noteworthy that efforts are in place to address the above issues such as those being undertaken by the Regional Universities Forum for Capacity Building in Agriculture (see www.ruforum.org).

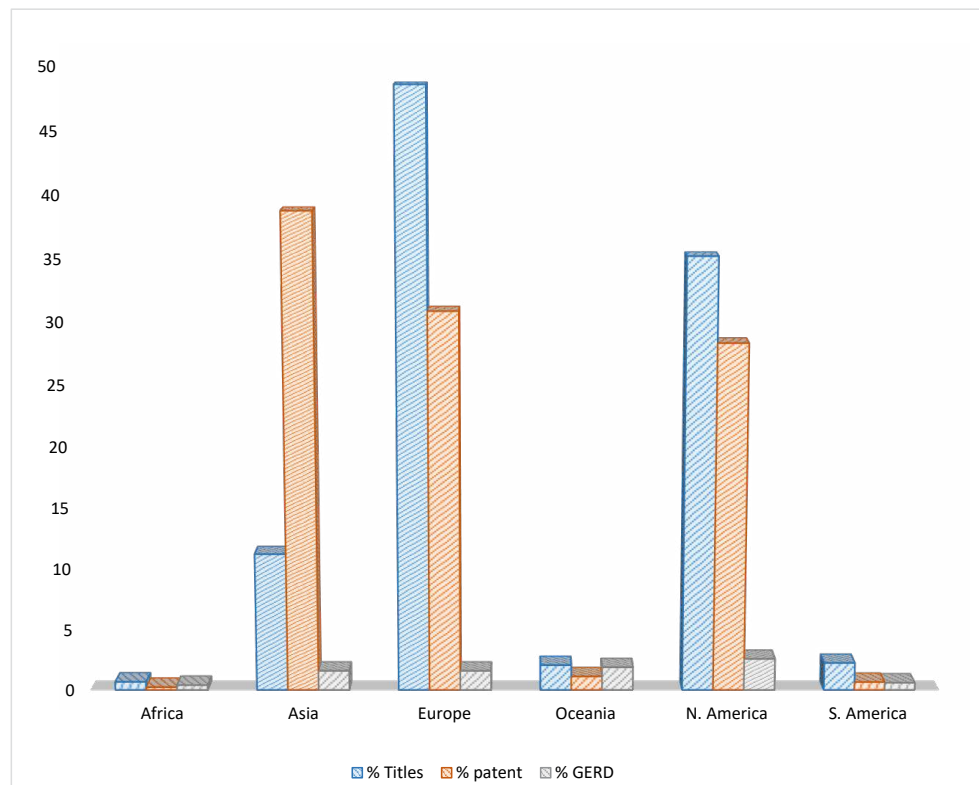


Figure 1. Science and Technology journals, patent applications, and R&D expenditure

Source: Assefa *et al.* (2012)

Africa' response to research capacity needs. There is a general observation for the need for research capacity development in Africa. According to Sawyerr (2004) initiatives to improve research capacity development in Africa should be targeted at increasing public funding towards research, strengthening graduate training, improving management of research, providing specialized programs especially those that enhance scientific research. Indeed countries like South Africa, Benin, Egypt, and Mauritius have great achievement regarding national investment and productivity in science and technology, while the rest of the countries in the continent still fall behind. It is argued that in order for science to enhance developmental activities in Africa, there is need for equitable participation by all countries in research (Osei-Atweneboana *et al.*, 2012). It has also been recognized that Africa's future rests with the development of its intellectual capital through strong higher education systems and development of locally applicable research and innovation structures.

Universities training in Africa. Africa's response to its research capacity needs has generally involved the targeting of individual skills development, funding research activities, improvement

in quality of research work, putting in place adequate infrastructure, and provision of research incentives. Key players in this direction has mainly been: Nigeria, South Africa, Senegal, Kenya, Angola, Ethiopia and Kenya by prioritizing higher education, research productivity and PhD training. For example in Nigeria there has been an increase in research productivity and PhD training and intensification of the staff development with major emphasis on postgraduate training which necessitates the employment of more lectures at professional level (Akudolu and Adeyemo, 2018).

In order to respond to funding challenges, several support systems have been established to support PhD students. These include university scholarship programmes, postgraduate teaching assistantship, international student scholarships, external grant fellowships and senate research grants. Universities in Africa have also put in place recurrent university budgets and Tertiary educational fund to support and sustain PhD training (Akudolu and Adeyemo, 2018). Improvement in the quality of research has involved the introduction of central Research Funds to fund and support top-quality multidisciplinary research in the universities for development. Efforts towards improvement in incentives in African Universities have involved the initiation of Universities Doctoral These Award Scheme and Special Doctoral Studies Scholarships for University teachers to encourage high quality research and training among doctoral students such as in Nigeria (Akudolu and Adeyemo, 2018). According to Harlie (2013) strengthening research capacity in Africa lies in the strength of its academic staff especially number of staff holding doctorates. Hence a number of universities in Africa have responded to this challenges by increasing the number of enrollment in science and technology (SET) programmes and implementing doctoral programmes. This has resulted in a rise in number of doctoral graduates as well as doctoral staff in African Universities (HERANA, 2017).

Figure 2 shows the performance of eight universities in Africa based on a report by Higher Education and Advocacy Network in Africa (HERANA) in 2017. Evaluation of the performance of the eight Universities was based on each universities having a high academic rating which would make it a world class university or at least a leading university in Africa. Secondly the universities had to be engaged in high quality research and scholarship, thirdly the universities had to be a centre of excellence, and lastly ability of the university to enhance, through its knowledge output, national and regional development (HERANA, 2017). From Figure 2, Cape Town, Makerere, Mauritius and Eduardo Mondlane met the HERANA target of 40% in Science, engineering and Technology (SET) while Nairobi, Dar es Salam, Ghana and Botswana were below the target. The implication of this is that there is need for increasing programs that cater for science and technology needs in Africa. Generally the universities enroll low proportions of postgraduate students at PhD level with Cape Town being best performer in enrolling PhD students. This implies that incentives for supervision of PhD students are limited or lacking among the universities. It also implies that the systems in these universities especially the policies do not encourage enrollment in PhD programs. Also the quality of the PhD output from certain universities may discourage students from enrolling into PhD programs. Lastly it also implies that the time of completion of PhD in African universities is generally too long hence discouraging students from enrolling in PhD programs in African universities and hence students opt to study abroad.

Figure 2 also shows that all the universities generally performed well in terms of permanent staff with doctorates with six universities meeting the target of 50% and only two universities falling below the target. This implies the availability of supervisors for doctoral students. According to Cloete and Maassen (2015), Staff members with doctoral degrees play an essential role in the

production of research. The universities also fairly registered good performance in terms of doctoral graduates with Ghana, Dar es Salam, Mauritius and Nairobi having 50% of doctoral graduates while Makerere and Edwardo Mondlane had less the 15% of doctoral graduates. This can be explained by differences in supervisory incentives available to the staff and the long duration in completion of doctoral programs in African universities.

Improvements in terms of infrastructure, national expertise and national and international academic prestige have also been achieved. Investments in research and innovative technologies have also tremendously improved especially in areas of health as a result of policies and priorities for research activities at institutional, national, and regional levels (Osei-Atweneboana *et al.*, 2012). This provides evidence of the existence of structures that in turn trigger investment for sustainable research in Africa (Whitworth *et al.*, 2008).

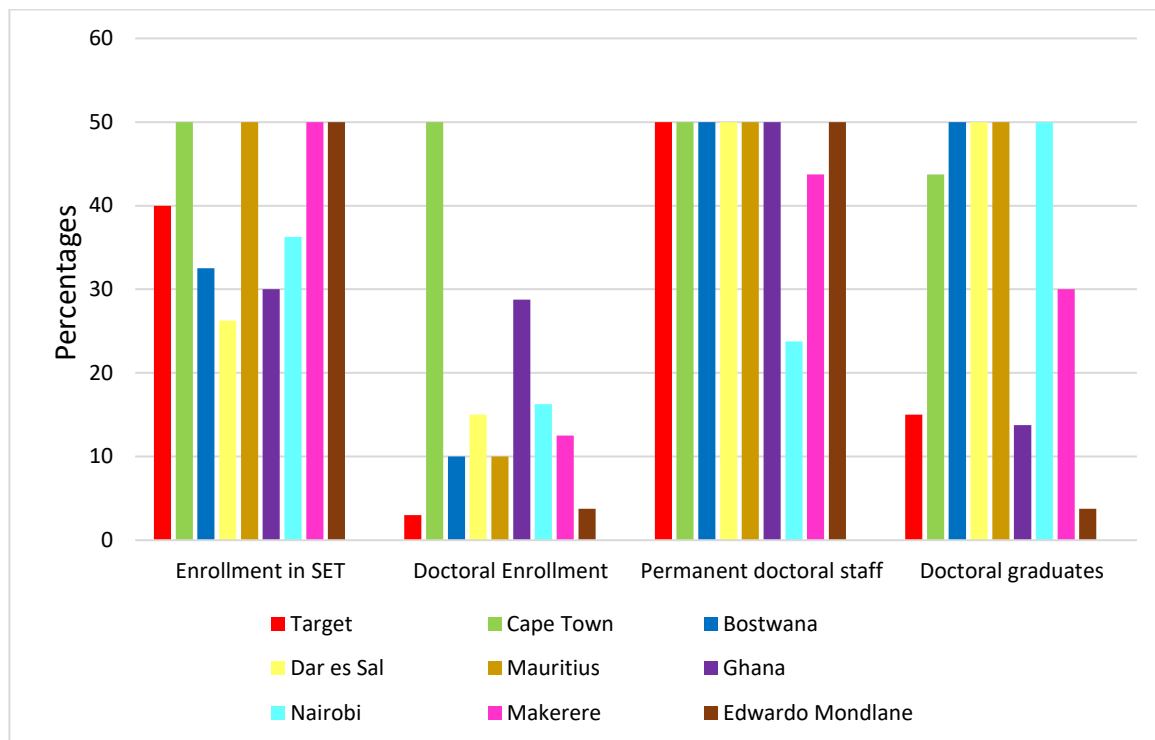


Figure 2. Scorecard summary performance of the eight HERANA Universities in 2015

Source: HERANA, 2017

Universities operating as networks. Research networks have also been established to improve the research capacity of African nations. Notable examples include RUFORUM, a Network of 149 Universities in Africa and the Partnerships between African Universities and universities in Europe, North America and elsewhere. Others initiatives have included direct support to specific universities, disciplinary and interdisciplinary research networks, and regional collaborative programmes for research or postgraduate training (Harlie, 2013). Figure 3 shows university networks in Africa carrying out capacity building initiatives in various dimensions. For example the African Academy of Sciences (AAS) based in Kenya aims at stimulating, designing and coordinating regional interdisciplinary and multidisciplinary science education programs of

crucial importance in Africa. African Network of Scientific and Technological Institutions (ANSTI) is based in Kenya and aims at pooling resources available in Africa to enhance training and research in various scientific disciplines. The Consortium for Advanced Research Training in Africa (CARTA) also based in Kenya is concerned with training and retaining a critical mass of African researchers with complementary research skills. The African Regional Capacity Development (ARCADE) focuses on post graduate, doctoral and post-doctoral training in Low and Medium income countries and strengthening educational services, financial and administrative research management, research uptake and network building. Higher Education Research and Advocacy in Africa (HERANA) aims to investigate the relationship between higher education and development, economic and democracy in Africa (Cloete and Maassen, 2015). The Southern

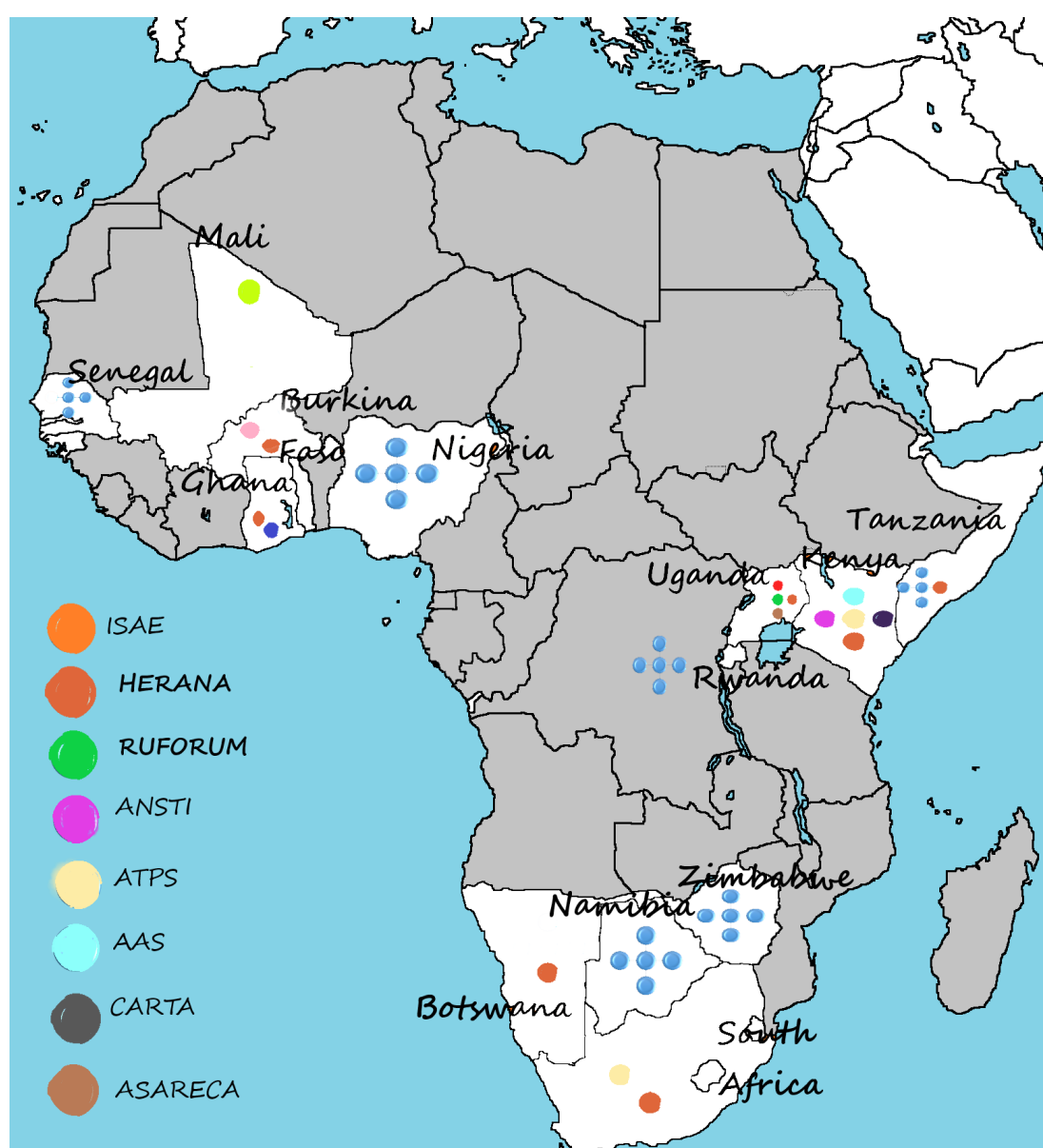


Figure 3. Universities operating as networks in Africa

Africa Consortium for Research Excellence (SCORE) based in Malawi focuses on postgraduate training while the Initiative to Strengthen Health Research Capacity in Southern Africa (SACIDS) aims at harnessing innovations from Science and Technology to develop capacity in Africa. Based in Uganda the Institute of Statistics and Applied Economics (ISEA) provides facilities for high level professional training in Statistics and Applied Economics in East Africa and other English speaking countries in Africa.

The Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) also based in Uganda, is concerned with enhancing regional collective action in agricultural research for development, extension and agricultural training and education to promote economic growth, fight poverty and enhance resource use in Eastern and Central Africa. The Regional Initiative in Science and Education (RISE) has its major objective of strengthening science research and education in Sub-Saharan Africa. The International Institute for Water and Environmental Engineering (EIER-ESTHER) based in Burkina Faso provides training to masters and PhD in Engineering (Osei-Atweneboana *et al.*, 2012). The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) based in Uganda, aims to strengthening the capacities of universities to foster innovations responsive to demands of small-holder farmers through training of high quality researchers. In 2004 RUFORUM trained 192 PhD students and currently has trained 568 PhD students. Busitema University, a relatively new University in Uganda, is establishing its pilot postgraduate training programmes in areas of public health, climate change management, and Irrigation engineering, amongst others. There is a pilot initiative to establish a mentoring programme, under a Post-Doctoral Fellowship Programme being supported by RUFORUM.

Science and technology is key driver of development. There is therefore a need for institutions that promote technological innovations and investment in order to foster development in Africa (Kabeba, 2007). Africa also needs to strengthen its educational systems and institutions in order to increase its research capacity (Sawyer, 2004). Previous initiatives for research capacity strengthening have focused mainly on individuals with more emphasis on professional development. This included providing fellowships towards training of researchers at masters and doctoral level at universities in high-income countries. TDR, for example, has supported training of individuals carrying out research on tropical diseases in developing countries. However, these trainings were sometimes not well tailored to the needs of Low and Medium income countries (LMICs). This resulted often for the newly qualified PhD and Masters candidates to confront a lack of established career pathways for researchers and teaching once they returned to their home countries (Essence Good Practice Document Series, 2014). A number of issues are associated with this challenge, which also confront in-country and in-region graduates but a partial remedy lies in establishing mentoring programmes for the recent graduates. This requires pairing them with older and more established scientists, and engaging them in research-teaching environment to hone their skills and establish new partnerships.

The South Africa National Development Plan 2030 has made bold proposals to train 100 PhDs per a million people translating to 1,420 PhDs per annum in 2010 to 5,000 per annum by 2030 (Adipala and Egeru, 2017). Doctoral education is a critical factor in strengthening university research capacity and serves the core function of research productivity and innovation in the global knowledge economy (Nerad and Heggelund, 2011). Given the focus of doctoral training, it is by nature expected to produce new, cutting-edge and original ideas and knowledge, through research and exchange of ideas, knowledge and information between professors, researchers and

students (Schoole, 2011). Accordingly, there has been an increased focus to increase the number of doctoral graduates globally. The Regional Doctoral Training Programmes in RUFORUM member universities currently provides opportunities of increasing doctoral production in disciplinary and multi-disciplinary spectrum with research quality (Adipala and Egeru, 2017).

Conclusion

This paper highlights the need for strengthening research capacity development by especially escalating graduate training in the continent. The paper concludes that Africa needs to increase its level of knowledge production by strengthening its educational systems and increasing funding towards research, as well carry out mentorship of graduate students. There is also need for development of technologies and innovations that are affordable to African farmers. Therefore, for research and innovation capacity within SSA to be realized, institutional leadership that is pro-advancement of innovation and prioritizes talent identification, mentorship and structures and facilitates institutions through an enabling environment will need to rapidly emerge within the continent. Further, SSA governments need to appreciate the value of transitioning to knowledge led economies and thereby undertake strategic investments within higher education and research institutions and support a deliberate evolution of innovation ecosystems within the continent. Finally, a deliberate focus on thought leadership capacity development to driver innovative and transformative universities and research institutions is critical for today and the future.

Acknowledgement

This paper is an output of the Carnegie Corporation of New York Post-Doctoral Fellowship to the first author. The fellowship is administered by the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). This paper is a contribution to the Seventh Africa Higher Education Week and RUFORUM Triennial Conference held 6-10 December 2021 in Cotonou, Benin.

References

- Adeyemi, S. 2017. Africa does not need charity, it needs good leadership. World Economic Forum. Accessed from: <https://www.weforum.org/agenda/2017/05/africa-doesn-t-need-charity-it-needs-good-leadership/> 25th August, 2018.
- Adipala, E. and Egeru, A. 2017. University research in development space in the wake of the Sustainable Development Goals: Perspectives for research development in Africa. *RUFORUM Working Document Series* 15: 35-50. Available from <http://repository.ruforum.org>.
- Ager, A. and Zarowsky, C. 2015. Balancing the personal, local, institutional, and global: multiple case study and multidimensional scaling analysis of African experiences in addressing complexity and political economy in health research capacity strengthening. *Health Research Policy and System* 13 (1): 1-9.
- Assefa, S., Rorissa, A., Alemneh, D.G. and Albright, K., 2012. Content divide: Africa and the global knowledge footprint sponsored by: SIG/III. *Proceedings of the American Society for Information Science and Technology* 49 (1): pp.1-3.
- Basu, A. 2018. The challenge of local feminisms: Women's movements in global perspective. Routledge.

- ESSENCE on Health Research, 2014. Seven principles for strengthening research capacity in low-and middle-income countries: simple ideas in a complex world. ESSENCE Good Practice Document Series.
- Cloete, N. and Maassen, P. 2015. Knowledge production and contradictory functions in African higher education. Vol. 1. African Minds.
- Cornell University, INSEAD and WIPO. 2018. The Global Innovation Index 2018: Energizing the World.
- Frankema, E. 2015. How Africa's colonial history affects its development. World Economic Forum. Accessed from: <https://www.weforum.org/agenda/2015/07/how-africas-colonial-history-affects-its-development/> 25th August, 2018.
- Friesenhahn, I. 2016. Making higher education work for Africa: Facts and figures. Scidevnet, <http://www.scidev.net/global/education/feature/higher-education-africa-facts-figures.html>, accessed, 3.
- Global Finance, 2018. Global Innovation Index 2018: Who's Up, Who is Down, and Why? Global Finance. Accessed from: <https://www.gfmag.com/global-data/non-economic-data/global-innovation-index> on 25th August, 2018.
- Harle, J. 2013. Strengthening research in African universities: reflections on policy, partnerships and politics. *Policy and Practice: A Development Education Review* 16: 80-100.
- HERANA, 2017. Institutionalizing data collection and analysis for evidence-based (research) information to strengthen knowledge production in a group of emerging research-intensive flagship Universities:1-46
- Juma, C. 2016. Let's reinvent and diversify Africa's universities to make them centers of innovation. QuartzAfrica. Accessed from: <https://qz.com/africa/766034/lets-reinvent-and-diversify-africas-universities-to-make-them-centers-of-innovation/> 25th August, 2018.
- Kabeba, M.R. 2012. Strengthening Institutional Capacity for Science, Technology and Innovation in Uganda. INTECH Open Access Publisher. pp. 332-340
- Katjavivi, P. 2000. Empowering African women through higher education. Women, power and the academy: From rhetoric to reality. Berghahn Books, New York- Oxford. pp. 59-71
- Lansang, M.A. and Dennis, R. 2004. Building capacity in health research in the developing world. *Bulletin of the World Health Organization* 82: 764-770.
- Makeka, M. 2016. Why it's time for a new generation of African leaders. World Economic Forum. Accessed from: <https://www.weforum.org/agenda/2016/05/why-its-time-for-a-new-generation-of-african-leaders/> on 25th August, 2018.
- Mayaki, I. 2017. Africa's future depends on its scientists. Time to stop the brain drain. World Economic Forum. Accessed from: <https://www.weforum.org/agenda/2017/01/africa-s-future-depends-on-its-scientists-time-to-stop-the-brain-drain/> 25th August, 2018.
- Mensah, S. and Egeru, A. 2017. Reforming African Universities for development relevance: What will it take? *RUFORUM Working Document Series* 15: i-vi.
- Nerad, M. and Heggelund, M. (Eds.). 2011. Toward a global PhD?: Forces and forms in doctoral education worldwide. University of Washington Press: 38pp
- Nilsson, M. 2017. Important interactions among the sustainable development goals under review at the high-level political forum 2017. Stockholm Environment Institute, Stockholm, Sweden. 46pp.
- Peden, D., Alemayehu, M., Amede, T., Awulachew, S.B., Faki, H., Hailelassie, A., Herrero, M., Mapezda, E., Mpairwe, D., Musa, M.T. and Tadesse, G. 2009. Nile basin livestock water productivity. CPWF Project Report Series, PN37. Colombo: CPWF:-86pp.
- Osei-Atweneboana, M.Y., Lustigman, S., Prichard, R.K., Boatın, B.A. and Basáñez, M.G. 2012. A research agenda for helminth diseases of humans: health research and capacity building in

- disease-endemic countries for helminthiasis control. *PLoS Neglected Tropical Diseases* 6 (4): p.e1602.
- Ramli, H.S.B., Chin, A.L.L. and Choo, A.C.P. 2016. Career success for women in higher education institution: The factors influencing the success of women academician. *International Business Management* 10 (17): 3929-3935.
- Schlenker, W. and Lobell, D.B. 2010. Robust negative impacts of climate change on African agriculture. *Environmental Research Letters* 5 (1): 1-8
- Stafford-Smith, M., Griggs, D., Gaffney, O., Ullah, F., Meyers, B., Kanie, N., Stigson, B., Shrivastava, P., Leach, M. and O'Connell, D. 2017. Integration: the key to implementing the Sustainable Development Goals. *Sustainability Science* 12 (6): 911-919.
- Swaniker, F. 2016. Great leaders aren't born – they're made. And Africa is showing us how. World Economic Forum, Accessed from: <https://www.weforum.org/agenda/2016/05/africa-leaders-new-generation/> on 25th August, 2018. with Innovation. Ithaca, Fontainebleau, and Geneva. Accessed from: http://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2018.pdf on 25th August, 2018.
- Teferra, D. 2016. African flagship universities: their neglected contributions. *Higher Education* 72 (1): 79-99.
- The National Council of Higher Education. 2018. The State of Higher Education and Training in Uganda 2015/16: A report on Higher Education Delivery and Institutions.1-115
- Whitworth, J.A., Kokwaro, G., Kinyanjui, S., Snewin, V.A., Tanner, M., Walport, M. and Sewankambo, N. 2008. Strengthening capacity for health research in Africa. *The Lancet* 372 (9649):1590-1593.