

# Enhancing Research Output in Higher Institutions of Learning: A Case Study of Busitema University Research Model

ASAPH KEIKARA MUHUMUZA<sup>1\*</sup>, FULGENSIA KAMUGISHA MBABAZI<sup>2</sup>, REBECCA MUHUMUZA NALULE<sup>3</sup>, ABUBAKAR MWASA<sup>4</sup>, ANNET KYOMUHANGI<sup>5</sup>,  
STEPHEN KADEDESYA<sup>6</sup>

<sup>1,2,3,4,5,6</sup>Busitema University P. O. Box 236, Tororo, Uganda

Emails:

<sup>1</sup>amuhumuza@sci.busitema.ac.ug

<sup>2</sup>fmbaba1zi@gmail.com

<sup>3</sup>rnalule@sci.busitema.ac.ug

<sup>4</sup>amwasa@sci.busitema.ac.ug

<sup>5</sup>akyomuhangi@sci.busitema.ac.ug

<sup>6</sup>skadedesya@sci.busitema.ac.ug

\*Corresponding author contact: +256(0)701465550; email: amuhumuza@sci.busitema.ac.ug

(Accepted: 17 November 2022 / Published: 20 December 2022)

## Abstract

University rankings have become a standard criterion of characterising higher institutions of learning irrespective of their specialisation, be it social sciences, natural sciences, health sciences or technology. The most highly ranked institutions worldwide are based on the same criteria despite the area of specialty and the geographical location. Higher institutional rankings are mainly based on pedagogy, strategic placement, research output in terms of publications, academic staff-student ratio, international linkage or partnerships, management of technological resources, and the existing human and infrastructural resources. This article attempts to address the possible ways to enhance research in developing institutions with a case study of Busitema University, Uganda. We propose the Busitema University Research (BUR) Model that can be used to analyse why the performance of higher institutions of learning (HIL) should be ranked based on the criteria of institutional research output (IRO). A survey was also conducted from 29 respondents and the data was analysed using Spreadsheet. From the generated results, it was established that the quality of academic staff highly determines the research output and thereby the increased university ranking. The results also formed the basis of the BUR Model development. The developed model will further be tested during a comprehensive study involving different HIL, especially in computing their respective institutional research index and rankings.

**Keywords:** *Higher institutions of learning; Institutional research index; Institutional research output; Research model; University ranking.*

## Introduction

Research and development (RD) play a critical role in the socio-economic growth and development of a nation (Bayarçelik & Taşel, 2012; Blanco et al., 2016). Target 9.5 of the Sustainable Development Goals (SDGs) emphasises the enhancement of scientific research (SR) and upgrading the technological capabilities of industrial sectors in all countries by 2030 (United Nations, 2017). Countries are expected to achieve this target by encouraging innovation and increasing research expenditure and output in higher institutions of learning (HIL). Thus, HIL, in particular universities, play a pivotal role in championing the attainment of the global development goal through scientific research and innovations, providing the necessary expertise to implement the process and increasing RO as a source of required information (El-Jardali et al., 2018; The World Bank, 2007).

African governments have emphasised the growth of higher education (HE) on the basis that HE is a hypothetically transformational area of investment (Aduda, 2018). This is because HE has far-reaching social and political impacts in terms of creating policies and executing projects that would drive a nation's development agenda. This is only achievable if universities produce the intellectuals and the research output (RO) of the highest quality, which can only be done with adequate funding. Thus, funding for research in HE is desirable in almost all developing countries, including those in Africa (Saric et al., 2018). However, global assessment of the research and development expenditure, as a proportion of the Gross Development Product (GDP), reveals that many of the African countries invest less than 1% in RD, which is the African Union target (Karimi, 2015; Maiyo, 2015; UNESCO Institute of Statistics, 2018). In addition, the number of African researchers is found not to be proportional to the African population. For example, apart from Morocco, all the other African countries have less than 1,000 active researchers per one million inhabitants (UNESCO Institute of Statistics, 2018). This meagre funding for HE and research cannot directly translate into the quality (RO) and knowledge base required to ensure the sustainable socio-economic development and transformation of a nation. The RO of some African universities is generally very low in comparison with some of the leading research universities, such as the University of Cape Town in South Africa (Musiige, 2014).

The scenario briefly described above proposes that African developing countries and, in particular, HIL need to revisit their respective research agendas, taking into consideration the critical role of scientific research in their national development agenda (Mwendera et al., 2017). As such, more emphasis should be put on the contribution of the higher institutions of learning to scientific research output (SRO) and knowledge creation (Clegg, 2012). Therefore, there is an urgent need to further explore the factors that contribute to RO in higher institutions of learning in developing countries so as to have informed guidelines for improving RO and thus university visibility in terms of ranking at national, regional and international levels.

Thus, quality research in HIL is increasingly becoming of great importance in terms of improved RO, knowledge base and other controls, as set by accrediting bodies. This is further evidenced in worldwide rankings of institutions (Marconi, Ritzen, 2015; Aithal, 2016; Taylor & Braddock, 2007). Universities are periodically ranked globally, regionally and nationally by the Ranking Web of Universities. The key determinants of institutional rankings are based mainly on the number of publications in peer-reviewed journals, the number of books published and the number of case studies and /or book chapters published during a given time (Aithal, 2016). For instance, in Uganda, Makerere University and Busitema University are ranked as the first and fifth, respectively, as per the July Edition 2022.1.3b (<https://www.webometrics.info/en/Africa/Uganda>).

Research output, as well as dissemination of new educational practices, is one of the major requisites for an academic lecturer to gain promotion in any HIL (Perry et al., 2015). But to this effect, there is such a low response of academic staff to the requirement to actively participate in scientific writing, leading to RO in terms of publications. This problem of a decline in RO cuts across all HIL especially in developing countries. Other than being the standard criterion for academic staff promotion to senior positions or professorship, RO has several other purposes, including the production of new knowledge, the transfer of existing knowledge to industry and other end users, upgrading of existing knowledge, improving the quality of teaching, learning and innovation, especially for Science, Technology, Engineering and Mathematics (STEM), and promoting creativity and skills development for the socio-economic transformation of the nation.

There has been such a rapid increase in the number of public and private universities in Uganda in the past few years. Uganda has a total of 68 universities and colleges considered under the ranking of universities (<https://www.webometrics.info/en/Africa/Uganda>). However, only 52 of these universities are accredited. They include 11 public and 41 private universities that have the potential to produce research output that can help in guiding the country in development and formulating policies (<https://ugcolleges.com/list-of-universities-in-uganda/>). In the most recent ranking, Busitema University has maintained its 5th position, thus continuing to be a leading university in the Eastern region of Uganda. The university has played a leading role in producing quality research and innovations, which will earn it a better ranking and potential to grow. With inadequate financial support to researchers, the research output of HIL remain low.

Generally, universities highly contribute to the process of generating scientific and innovative ideas to feed the nation's development process (Clegg, 2012). However, in most developing countries, scientific research capacity (SRC) still leaves a lot to be desired. For instance, academic staff are assessed based on courses taught and probably the number of students supervised, while the postgraduate students are assessed based on theses or dissertations, with less emphasis on publications in terms of scientific research output (Kpolovie & Dorgu, 2019).

The purpose of this study is to propose a model and state factors that will help developing countries like Uganda enhance scientific research output in HIL based on the factors associated with RO; and address the question of how to motivate researchers in HIL with a case study of Busitema University.

We suggested three main questions and their solutions to complete the key objective of this study. This study will help supervisors and students to increase research output in higher institutions of learning through reading, writing, understanding, analysis and dissemination of findings, which lead to the visibility and ranking of HIL.

## Literature Review

Institutional repositories (IRs) play a significant role in changing and developing institutions. They have potentially increased the public value, ranking, prestige and visibility of researchers, and relevant universities (Asadi et al., 2019). The IRs that comprise research output need to be shared outside of the institution (across institutions and industries) so that institutions can know one another's research works and creativity for future collaborative projects (Sarker, Davis and Tiropanis, 2010).

In 2014, a study conducted at Uganda's oldest national university, Makerere, highlighted lessons and recommendations about PhD programme start-up, recruitment, supervision, international

collaboration, research infrastructure and environment for building institutional research capacity (Akuffo et al., 2014). Studies done by Tan and Thurasamy (2015) and Fauzi et al. (2019) assessed knowledge-sharing (KS) behaviour determinants to determine the factors that can contribute to an academic's research productivity, and the findings showed that an academic's KS behaviour has a substantial impact on research productivity.

According to a study by Kyaligonza, Kimoga and Nabayego (2015), severely constrained financial budgets coupled with other competing demands highly affect the financing of research in universities worldwide, particularly in Sub-Saharan Africa, and this has become a major problem for both government-aided and private universities. However, a study by Dundar et al. (1998) identified institutional factors as also a major contributor to successful research output and an institution's visibility in terms of ranking. Therefore, these factors, coupled with funding constraints, highly hinder research output in HIL, Busitema University inclusive.

There are some models that have been developed to increase the research output in HIL. Aithal (2016) formulated a model of improving the higher educational output. Aithal discussed strategies to be followed to increase the number of research publications and subject book publications through effective faculty involvement and business case development through student involvement. Aithal and Kumar (2016) developed an ABC model based on calculating an institutional research index and a weighted research index and this was used to give grades to HIL.

A logistic regression model was used to determine the research productivity of academic staff at Universiti Teknologi MARA (UiTM). The results showed that personal, environmental and behavioural factors were paramount in influencing RP among the academic staff (Henry, 2020).

Whereas the above studies suggested strategies for increasing research productivity, there is need to enhance research output in HIL. The BUR Model seeks to answer the following research questions:

**RQ1.** What are the effects of the quality of academic staff on research output at Busitema University?

**RQ2.** What is the scale of research effort in terms of funding and time spent on research output at Busitema University?

**RQ3.** What is the effect of industrial partnership and collaborations on the perceived university rankings and research output at Busitema University?

The remainder of the study is organised as follows: Section 2 discusses the methodology used in this research; Section 3 presents the set-up of the BUR Model; Section 4 presents research findings and discussion; and Section 5 provides conclusions and recommendations.

## Methodology

### Online survey

An online survey study was conducted by researchers in STEM faculties. Reliability and content validity prior to surveying the targeted population of Busitema University researchers was critically done. An electronic-based questionnaire was designed in Google Survey form and the web-link was shared to different faculties and departments of Busitema University through e-mails and WhatsApp for a period of three weeks in August 2022. Twenty-nine participants from different departments, including Mathematics/Statistics, Technology and Engineering, Health Sciences and Education provided feedback. The questionnaire is provided in Appendix A of this article.

At this stage, simple descriptive statistics regarding data characterisation in terms of frequency distributions, percentages, means and medians were computed and used to display the existing

data patterns. The descriptive profile of the study sample used tables, bar charts or histograms to depict the patterns of influence of policies and practices.

### **Busitema University Research Model**

This study aims to build a model that can be used as a tool for enhancing research output in HIL using Busitema University as a case study. Research output refers to publishable or published scholarly research, which may include articles in scientific or academic journals, book chapters in book series, papers, conference proceedings, posters, patents or lecture materials (<https://www.lawinsider.com/dictionary/research-output>).

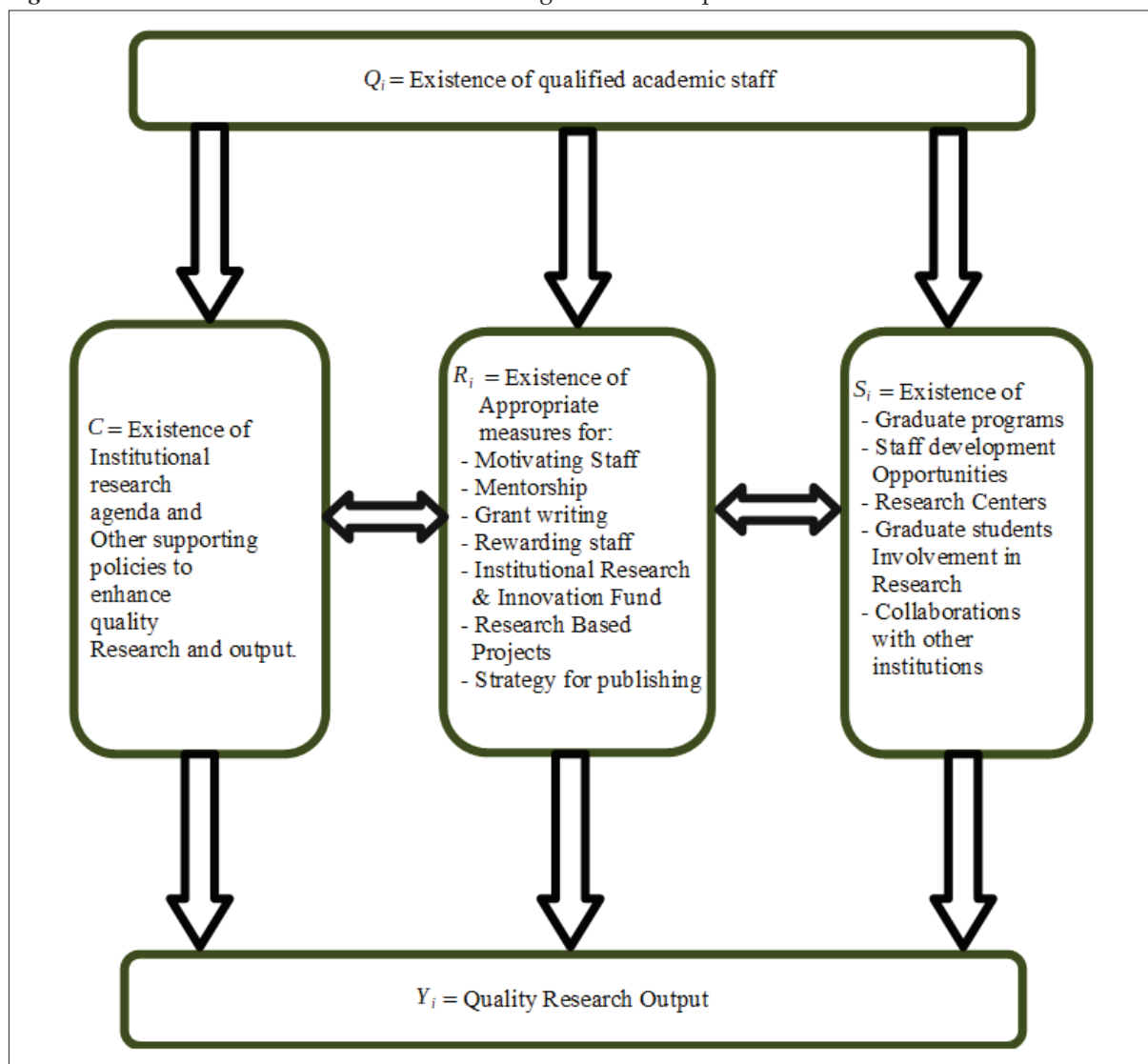
We state the following assumptions:

- A1: There are qualified staff to conduct research on a regular basis.
- A2: The university management is committed to motivating staff to actively engage in research.
- A3: There is an operational university research agenda.
- A4: There are senior staff to mentor junior staff in conducting research.
- A4: There are fully developed master's and doctoral programmes.
- A5: There are master's and doctoral students to actively engage in research.
- A5: There are established collaborations with other institution in the region.

The above assumptions can be summarised into three major factors that highly contribute to a high rate of research output. These factors include:

- (i) The quality of academic staff to steer ahead an institution's research agenda,
- (ii) The scale of the research effort in terms of funding determined by the existence of appropriate measures for motivating staff, mentoring junior staff, training in grant writing, proper rewarding of staff, awarding the institutional research innovation fund, designing research-based projects, and a defined strategy for publishing.
- (iii) The percentage of partnerships and collaborations with other institutions in the region where a particular university is located as well as the existence of graduate programmes, staff development opportunities, operational research centres, graduate students, and active involvement in research with other collaborating institutions.

Figure 1: The Structured BUR Model for Enhancing Research Output



From Figure 1, it can be seen that the major identified factors expected to influence the rate at which a given university is cited is the quality of its academic staff, the existence of an institutional research agenda, the existence of appropriate measures to motivate staff and the existence of graduate programmes. The second factor is what is often emphasised by policymakers in terms of the scale of a university's active involvement in research and development activities in a given area, whereby a critical mass of quality researchers and equipment is considered to influence quality research output. Thirdly, the university's industrial partnerships and collaborations with other researchers. This is because there are obvious advantages in a university working with industrial partners and research collaborators, and keeping abreast of all developments and innovations at the universities and in industries. Thus, one must expect that the universities collaborating with many researchers both in higher education institutions and industries would be mostly cited.

These factors would be represented by the variables:

$P_i$  = the variable number of research outputs including, say, articles, book chapters and books obtained by the  $i$ th department or faculty in determining the university's ranking.



$Q_i$  = the variable for the measure of the quality of the  $i$ th university's academic staff in the  $i$ th department or faculty.

$R_i$  = the variable for the measure resource input, say money or technology spent by the  $i$ th department or faculty on research and development in the relevant area.

$S_i$  = the variable for the measure of percentage of partnerships and collaborations of the  $i$ th department or faculty with other departments or faculties in the given universities in the region.

$q_i$  = the parameter that measures the increase in the quality of staff in the  $i$ th department or faculty.

$r_i$  = the parameter that measures the increase in commitment of resources to the  $i$ th department.

$s_i$  = the parameter that measures the increase in the collaborations and partnerships as well as graduate recruitment into master's and doctoral programmes for the  $i$ th department or faculty.

Thus, the overall research output for the  $i$ th department or faculty department would be expressed as

$$P_i = (q_i \times Q_i + r_i \times R_i + s_i \times S_i) \dots\dots\dots(1)$$

and the total research output from a given university would be given by

$$P = \sum_{i=1}^n P_i = \sum_{i=1}^n (q_i \times Q_i + r_i \times R_i + s_i \times S_i) \dots\dots\dots(2)$$

To compute the institutional research index that is used to determine the university's ranking, we consider the following:

$X_i$  = the variable the measure of the number of, say, journal articles produced by the  $i$ th department or faculty.

$Y_i$  = the variable the measure of the number of, say, book chapters produced by the  $i$ th department or faculty.

$Z_i$  = the variable the measure of the number of, say, books produced by the  $i$ th department or faculty.

$\alpha_1$  = the parameter for the measure of increase in the number of, say, journal articles produced by the  $i$ th department or faculty.

$\beta_1$  = the parameter for the measure of increase in the number of, say, book chapters produced by the  $i$ th department or faculty.

$\gamma_1$  = the parameter for the measure of increase in the number of, say, books produced by the  $i$ th department or faculty.

$C$  = the parameter for the measure of the coefficient of good research agenda and relevant policies that support research output.

Thus, the university's research index would expressed as:

$$\Phi = \sum_{i=1}^n C (\alpha_i \times X_i + \beta_i \times Y_i + \gamma_i \times Z_i) / P \dots\dots\dots(3)$$

where is as expressed in equation (2).

## Results and Discussion

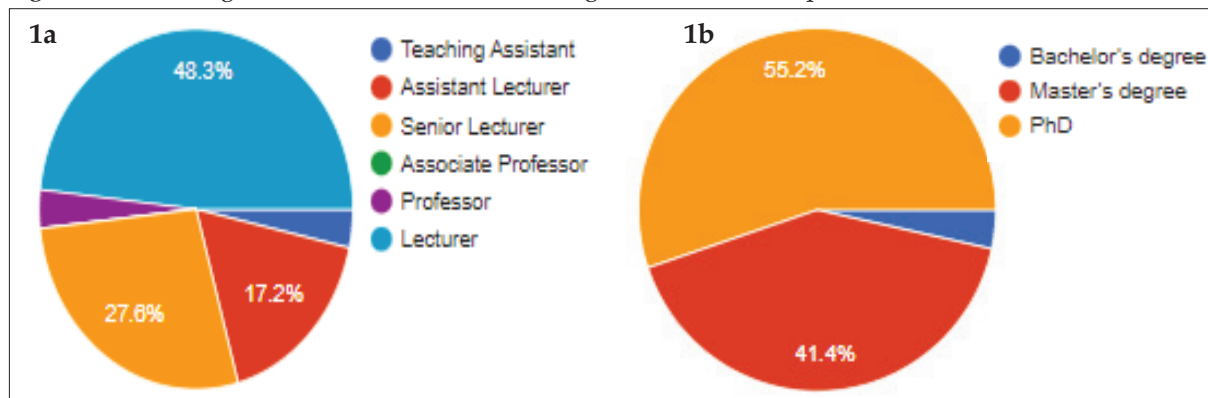
In this chapter we present the research findings and discussion of the results.

### Quality of academic staff

Staff quality in the university is a major contributing factor to research output and, hence, university ranking. The university with quality staff in terms of academic qualification, including professors, senior lecturers and lecturers, is highly ranked. This study found that only a small percentage of academic staff are professors, while the largest percentage, at 48.3%, are lectures, 27.6% of whom hold senior positions and 17.2% are assistant lectures. Therefore, the results indicate that Busitema University should improve on the quality of academic staff by recruiting or promoting staff to professorship, associate professorship and senior lecturer positions in order to improve on the ranking the BUR Model suggests. Whereas 55.2% are PhD holders, 41.4% hold master's degrees,

indicating that the biggest number of Busitema academic hold a PhD. Figure 1a and Figure 1b show the representation percentages of the academic staff level and academic qualification, respectively.

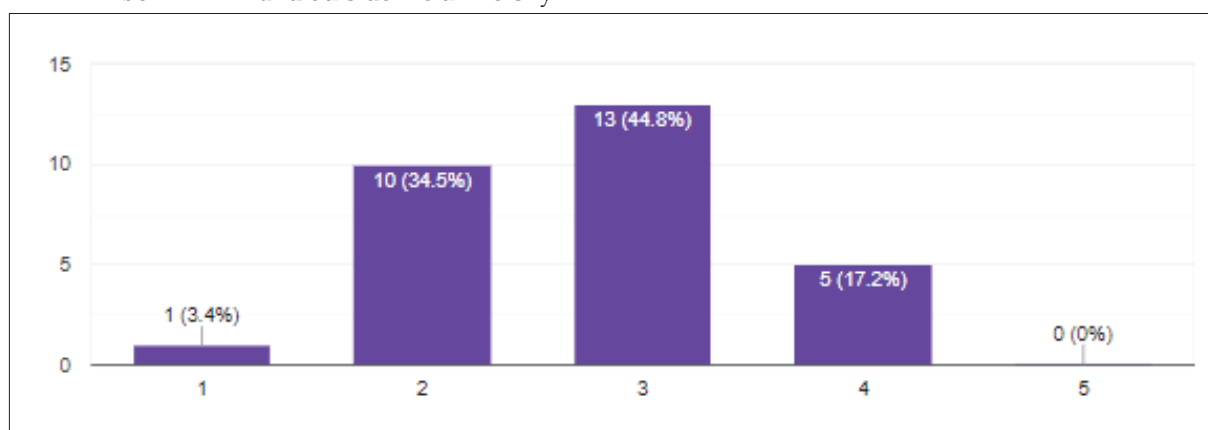
**Figure 1a:** Percentage of academic staff level; and **Figure 1b:** Academic qualification



### Funding research and innovation

The study also revealed that Busitema University provides adequate teaching resources, research funds and time to influence research output. The university dedicates time and funds for seminars, workshops and training in research and innovation activities to its staff. For example, in July 2022 a three-day research writing retreat which was organised by the Directorate of Graduate Studies, Nagongera Campus and this gave opportunity to staff to commit time to research activities where the participants were able to polish and submit articles to peer-reviewed journals. Figure 2 provides the percentages of staff who either strongly agree, agree, disagree or strongly disagree that they are facilitated in professional research and innovation. Only 3.4% strongly disagreed.

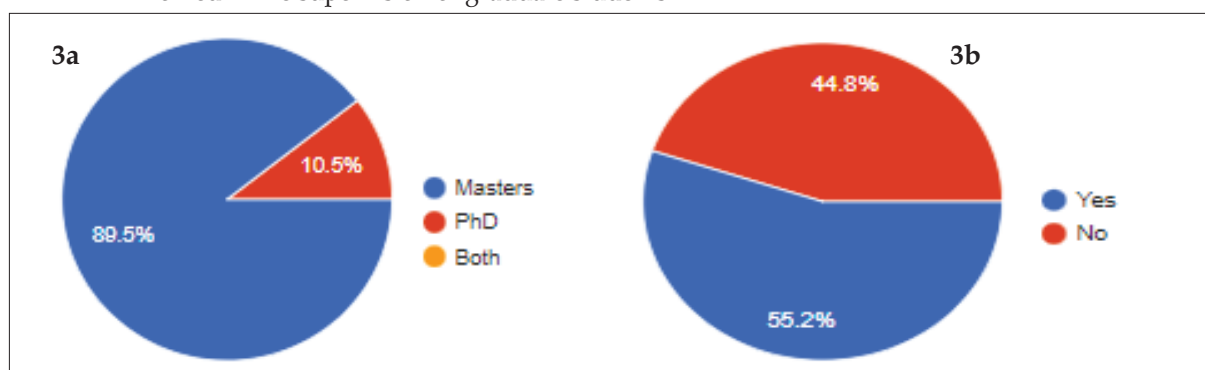
**Figure 2:** Facilitation of academic staff to attend professional research innovation and development activities both within and outside the university



The BUR Model also suggests that another avenue for increasing research output is through having graduate and postgraduate programmes at the university. This study shows that Busitema University has these programmes in some of the faculties, therefore graduate students carry out research, a requirement for completion of the programmes. Figure 3a shows that these programmes exist and Figure 3b indicates that the biggest percentage of Busitema University staff are involved in the supervision of graduate students.



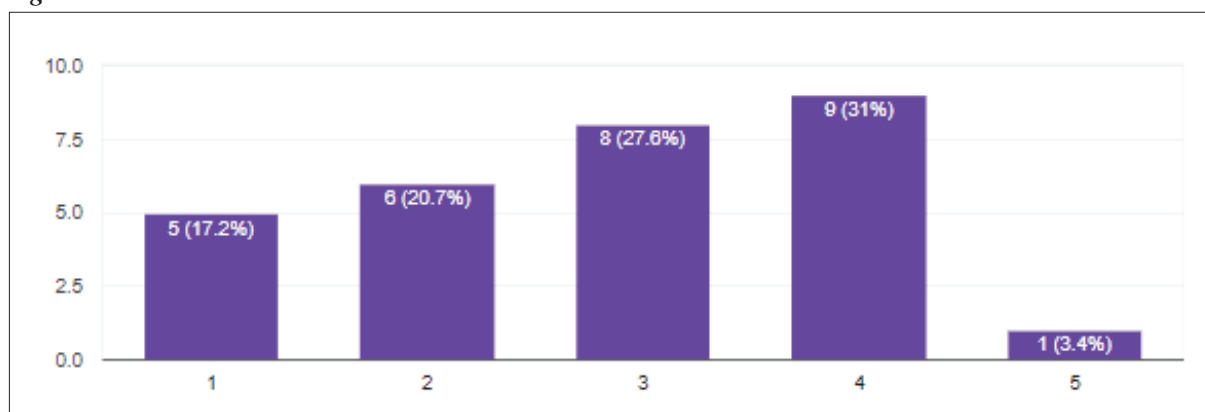
**Figure 3a:** Percentage of graduate programmes in the university; and **Figure 3b:** Percentage of academic staff involved in the supervision of graduate students



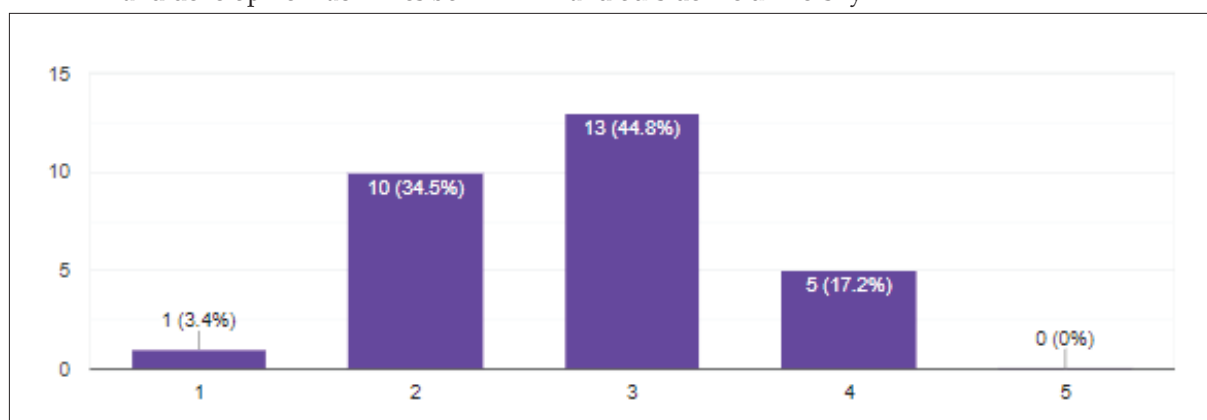
### Partnerships and collaborations

Partnership and collaboration between researchers allow them to interact and, by so doing, they share new research ideas, methods and electronic library resources and sometimes undertake joint publications which, as well, leads to an increase in research outputs. The results of this study indicate that Busitema University academic staff corroborate those of other universities at both local and international levels (Figure 4). Through partnerships, the university applies for grants, though it was outside the interest of this study to investigate the number of grants won. Such grants support the academic staff in the publication, collection and management of data, and other activity in research. Figure 4 provides the details. The study also revealed that the university provides adequate teaching and research funds and time to influence research output. The academic staff provide an average amount of time for consultation with students and the university allocates funds for research to the staff. Busitema University has an institutional management system of reliable time schedules for research and innovation activities. It strongly dedicates time and funds for seminars, workshops and training in research and innovation, as shown in Figure 5. On average, the academics are facilitated to attend professional research, innovation and development activities, both within and outside the university. This contributes highly to research output, hence improving on the university citation and ranking. The university provides email and internet services, which boosts staff capacity to carry out research and innovation activities. It also provides sound policies to give feedback on matters concerning research and innovation initiatives. Research output is the result of efforts undertaken by staff of all ages and genders (see Figure 6) at Busitema University.

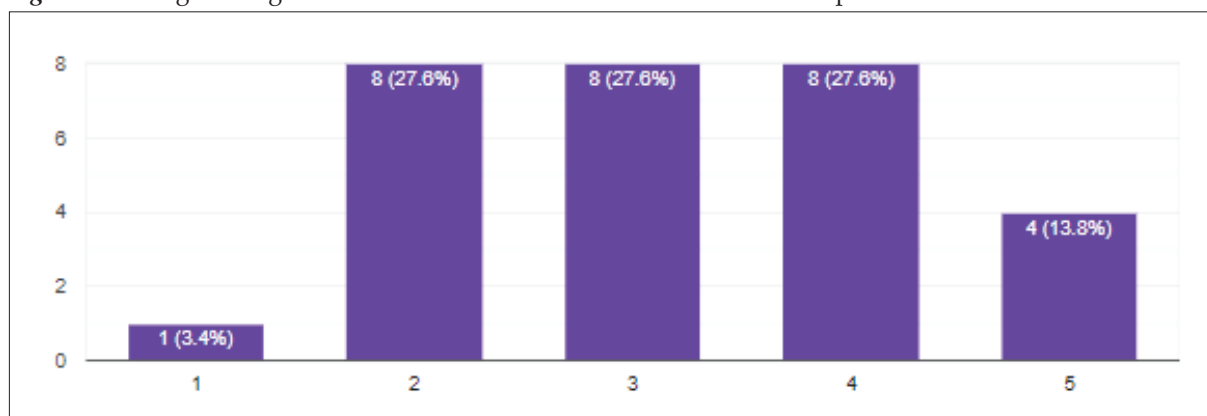
**Figure 4:** Collaboration with other universities



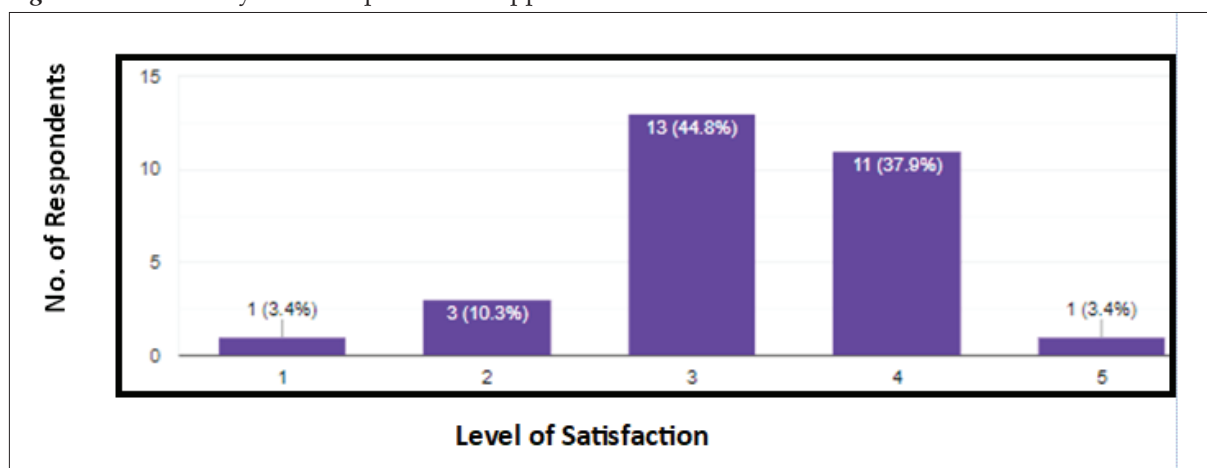
**Figure 5:** Academic staff are supported by Busitema University to attend professional research, innovation and development activities both within and outside the university



**Figure 6:** All ages and gender of academic staff influence the research output of the institution



**Figure 7:** Availability of sound policies to support research and innovation activities



Research output is combined with the availability of a number of resources, including internet resources, a library, books and access to scientific databases, among others. The BUR Model considers this item under partnership and collaboration. The study eventually found that the minimum load at Busitema University is twelve hours, exclusive of time for supervision. This also contributes to low research output. Therefore, the BUR Model suggests that supervision hours be part of load allocation to staff to allow them to commit more time to research. Every staff member must get

involved in research irrespective of gender. Busitema University is gender-sensitive in terms of staffing and support for research and innovation activities.

*Figure 8: Availability of adequate library facilities at the university*

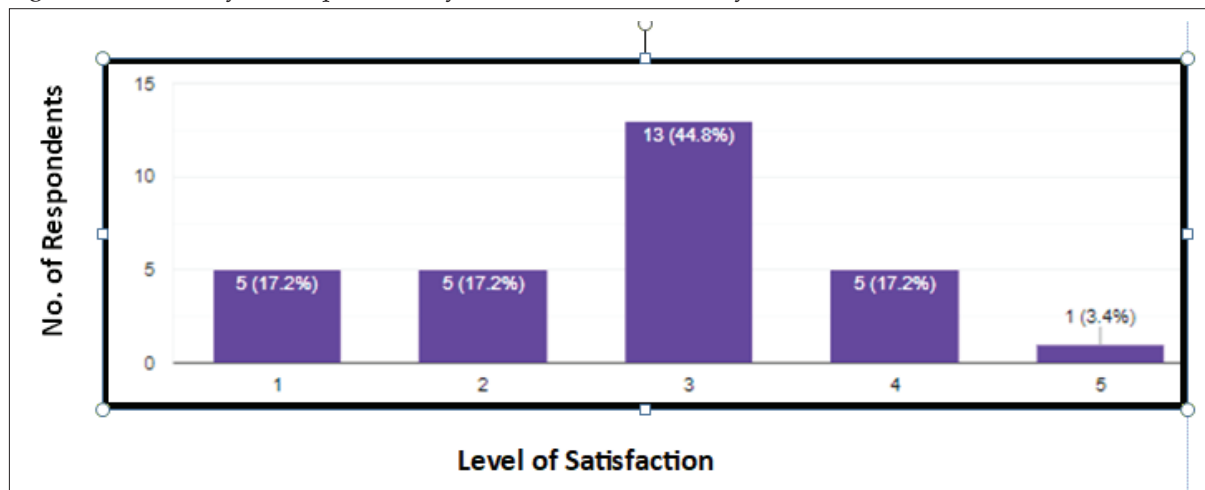
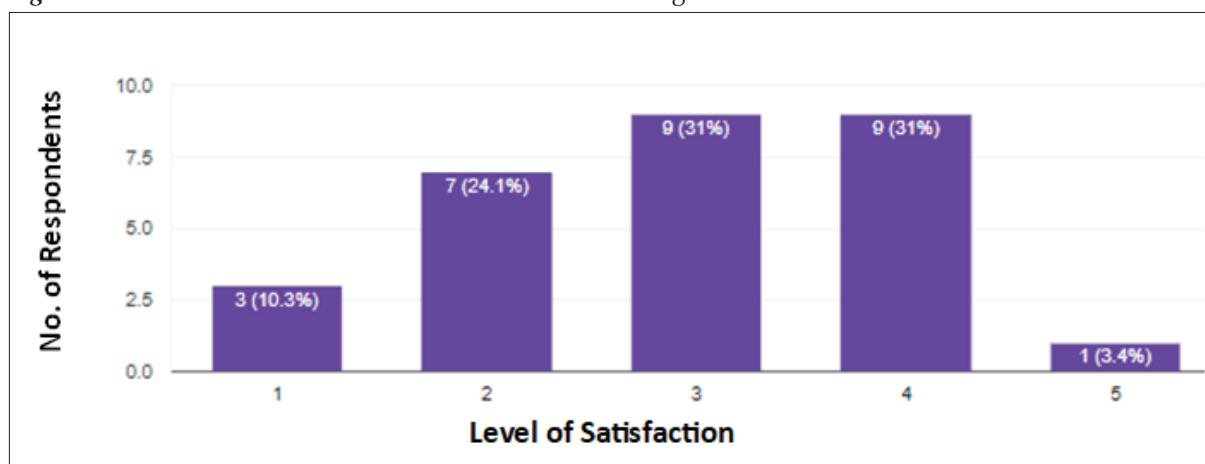


Figure 8 shows that the university tries to support the qualification influence of academic staff involvement in research and innovation by allocating average time and funds to supporting research and innovation output. Busitema University promotes sustainable support and coordination of staff development initiatives. It makes available all the necessary research information, funding opportunities and authorisation for external research and innovations.

*Figure 9: Allocation of time and funds to staff for conducting research*



However, there are insufficient computer laboratories and appropriate software for quality programming. The teaching in Busitema University is no different from other public and private universities of Uganda in terms of credit hours per course, which is 3CU. The difference lies in the load allocation, which is 12 hours, as compared to 6–9 hours per week in other universities. The graduate school at Busitema University handles all research activities, including the research agenda and innovations. Although the fund is not substantial as compared to the allocation in some reputable Ugandan universities, such as Makerere University, at least an allocation is made to the research vote. Recently the government allocated Ush. 1 billion to the university to support research

and innovation. The Busitema academic staff are supported to attend seminars, disseminate results in conferences and workshops and undertake training in research and innovation activities.

Industrial partnership and collaboration contribute to only 2% in the BUR Model, yet through collaboration new research ideas and innovations are created, which increases research output. Through collaboration, e-learning materials are shared, joint research activities are carried out, and joint supervision of MSc and PhD students, is easily done and, therefore, improves citation and the visibility of the university.

## Conclusion and Recommendations

Following the findings we, therefore, make a number of conclusions. First, there are fewer lecturers at PhD level than are required to spearhead research output. Second, the university does not allocate at least 3% of its budget to research activities. Third, the teaching policy does not reflect the time lecturers spend on research activities when calculating workload. Fourth, the university does not have adequate computers and computing software to carry out big simulations, computing and data analysis. Fifth, the university does not provide institutional or departmental support for research initiatives that are key to the improvement of research output at any given university.

The study further discovered that some institutional factors play a great role in enhancing research output and the university ranking. These include adequate teaching and research time, a reliable time schedule for research activities, encouraging staff attendance of professional research development activities both within and outside the university, and building research infrastructural facilities such as research laboratories, research teams and research institutes.

Finally, the study concludes that following and implementing the BUR Model would increase research productivity in public and private universities in Uganda, in particular, Busitema University. There is a need to motivate academic staff to fully embrace research activities so as to increase research output and improve rankings. Building industrial partnerships and collaborations highly contribute towards research and development activities. The allocation of adequate time for research activities in the university is paramount in increasing research output and improving ranking. Supporting collaborations in terms of research teams builds confidence and mentorship for research output. Providing sustainable support and coordinating academic staff development initiatives as well as allowing access to sufficient research information, both internally and externally, play a significant role in building research capacity and output, thereby increasing the visibility of the university.

The study recommends that the Government of Uganda as well as the stakeholders in both public and private universities should double their efforts in sourcing for and allocating grants to finance research and development projects. This can be achieved through establishing partnerships and collaborations with the responsible ministries, higher education supervising bodies like the National Council for Higher Education (NCHE), the Inter-University Council of East Africa, University Councils of the respective public and private universities within Uganda, non-governmental agencies that deal with cross-cutting issues, professional bodies and institutions like banks, industries and donors so as to influence research and the socio-economic development of the nation. Busitema University should come up with published and operational policies which adequately remunerate researchers as well as increasing their respective budget allocation to fully equip libraries and laboratories, fund research projects and procure modern equipment, supercomputers and any other material or equipment that can support research output by both graduate students and academic staff.

The study also recommends that the university should develop clear policies on teaching, research and innovation that enable staff to attend local and international conferences and workshops as a means to build their research capacity and to mentor them. The policies would act as a stimulus to enhance the research agenda in the institutions, hence boosting research output and university ranking.

The study further recommends that universities should motivate academic staff to adopt a new culture on research, conference participation and publication to increase research output of the institutions. This can be achieved through the establishment of modern research infrastructure to transform the universities into research-oriented institutions, conducting capacity training and mentorship programmes for the academic staff and implementing policies that will compel academic staff members to treat research activities as the only means to steer the socio-development and transformation of the nation and the world at large.

### Acknowledgements

The authors would like to extend their thanks to the Faculty of Science and Education, Nagongera Campus, Busitema University for the financial support given. Without the support, this article would not be in existence.

To the Busitema University community, the authors are grateful for the timely feedback that was shared and to the anonymous reviewers for the wonderful comments that improved the manuscript.

The authors are also thankful to Eva Mirembe for designing the online survey tools that helped in the collection and analysis of data that has greatly improved the manuscript.

### Conflict of Interest

The authors declare that there is no conflict of interest pertaining to the publication of this work.

## References

- 
- Acs, Zoltan, David Audretsch, Maryann Feldman. (1992). Real effects of academic research: Comment. *American Economic Review*, 82, 363–367.
- Adams J., Gurney K., Hook D., et al., (2014). International collaboration clusters in Africa. *Scientometrics*, 98(1), 547-556.
- Aduda, G.K. (2018). *Challenges of government-financed public universities. A case study of Moi University, Kenya*.
- Aithal, P. S. (2016). How to increase research productivity in higher educational institutions–SIMS model. *International Journal of Scientific Research and Modern Education (IJSRME)*, 1, 447–458.
- Aithal, P. S., & Kumar, P. M. (2016). ABC model of research productivity and higher educational institutional ranking. *International Journal of Education and Management Engineering (IJEME)*, 6(6), 74-84.
- Akuffo, H., Freeman, P., Johansson, E., Obua, C., Ogwal-Okeng, J., & Waako, P. (2014). Doctoral education and institutional research capacity strengthening: An example at Makerere University in Uganda (2000–2013). *Higher Education Policy*, 27(2), 195–217.
- Asadi, S., Abdullah, R., Yah, Y., & Nazir, S. (2019). Understanding institutional repository in higher learning institutions: A systematic literature review and directions for future research. *IEEE Access*, 7, 35242–35263.

- Bamus, G. A. (2002). Curriculum development and changes in mathematics education in Nigeria. *A paper presented during the Mathematics Education Summit at National Mathematical Centre, Abuja*. Federal Republic of Nigeria. National Policy on Education 4th Edition.
- Bayarçelik E. B., Taşel F.(2012). Research and development: Source of economic growth. *Procedia Sco Behav Sci.*, 58, 744–753.
- Beaver, D.D. (2001). Reflections on scientific collaboration (and its study): Past, present, and future. *Scientometrics*, 52, 365–377.
- Blanco L.R., Gu J., & Prieger J. E. (2016). The impact of research and development on economic growth and productivity in the U.S. States. *South Econ J.*, 82(3), 914–934.
- Clegg S., (2012). Conceptualising higher education research and/or academic development as ‘fields’: A critical analysis. *High Educ Res Dev.*, 31(5), 667–678.
- Dundar, H., & Lewis, D.R. (1998). Determinants of research productivity in higher education. *Research in Higher Education*, 39(6), 607–631
- El-Jardali F., Ataya N., & Fadlallah R. (2018). Changing roles of universities in the era of SDGs: Rising up to the global challenge through institutionalising partnerships with governments and communities. *Health Res Policy Syst.*, 16(1), 38.
- Fauzi, M. A., Nya-Ling, C. T., Thursamy, R., & Ojo, A.O. (2019). Knowledge sharing: Role of academics towards research productivity in higher learning institution. *VINE Journal of Information and Knowledge Management Systems*, 49(1), 136-159.
- Henry, C., Ghani, N. A. M., Hamid, U. M. A., & Bakar, A. N. (2020). Factors Contributing towards Research Productivity in Higher Education. *International Journal of Evaluation and Research in Education*, 9(1), 203-211.
- Karimi, F.K. (2015). Academic programmes in universities in East Africa: A catalyst to development. *International Journal of Higher Education*, 4(3), 140–155.
- Kpolovie P.J., & Dorgu I. E. (2019). Comparison of faculty’s research productivity (HIndex and Citation Index) in Africa. *European Journal of Computer Science and Information Technology*, 7(6), 57-100.
- Kyaligonza, R., Kimoga, J., & Nabayego, C. (2015). Funding of academic staff’s research in public universities in Uganda: Challenges and opportunities. *Makerere Journal of Higher Education*, 7(2), 147-162.
- Maiyo, J. (2015). Education and poverty correlates: A case of Trans-Nzoia County, Kenya. *International Journal of Educational Administration and Policy Studies*, 7(7), 142–148.
- Mansfield, E. (1991a). Academic research and industrial innovation. *Research Policy*, 20, 1–12.
- Mansfield, E. (1991b). Estimates of the social returns from research and development, in M. Meredith, S. Nelson, and A. Teich (eds.), *Science and Technology Yearbook* (Washington, D.C.: American Association for the Advancement of Science, 1991b), 313-320.
- Mansfield, E. (1992). Academic research and industrial innovation: A further note. *Research Policy*, 21, 295–296.
- Mansfield, E. (1995). Academic research underlying industrial innovations: Sources, characteristics, and financing. *The Review of Economics and Statistics*, 55–65.
- Marconi, G., & Ritzen, J. (2015). Determinants of international university rankings scores. *Applied Economics*, 47(57), 6211–6227.
- Musiige, J. (2012). Higher education research. *The International Journal of Higher Education Research*, 71(3), 343–359.
- Mwendera C.A., de Jager, C., Longwe, H., et al. (2017). Malaria research in Malawi from 1984 to 2016: A literature review and bibliometric analysis. *Malar J.*, 16(1), 246.



- Perry, M., Hopson, L., House, J. B., Fischer, J. P., Dooley-Hash, S., Hauff, S., ... & Santen, S. A. (2015). Model for developing educational research productivity: The medical education research group. *Western Journal of Emergency Medicine*, 16(6), 947.
- Powered By UgColleges (2022). List of accredited universities in Uganda. Retrieved on 19<sup>th</sup> October, 2022, <https://ugcolleges.com/list-of-universities-in-uganda/>.
- Ranking Web of Universities, 2022. Retrieved from <https://www.webometrics.info/en/Africa/Uganda>.
- Research output definition. <https://www.lawinsider.com/dictionary/research-output>.
- Saric J., Utzinger J., & Bonfoh B. (2018). Research productivity and main publishing institutions in Côte d'Ivoire, 2000-2016. *Global Health*, 14(1), 88.
- Sarker, F., Davis, H., & Tiropanis, T. (2010). The role of institutional repositories in addressing higher education challenges. *SemHE'10: The Second International Workshop on Semantic Web Applications in Higher Education*, University of Southampton, Southampton SO17 1BJ, United Kingdom.
- Tan, C. N. L., & Thurasamy, R. (2015). Improving research productivity through knowledge sharing: The perspective of Malaysian institutions of higher learning. *Academia*.
- Taylor, P., Braddock, R. (2007). International university ranking systems and the idea of university excellence. *Journal of Higher Education Policy and Management*, 29(3), 245-260.
- The World Bank (WB) (2007). Annual report. In *End, extreme poverty, boost shared prosperity*. WB
- UNESCO Institute of Statistics: Research and Development Data Release. *Research and development data release*. 2018.
- United Nations (2017). Resolution adopted by the General Assembly on 6 July 2017. *Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development* (A/RES/71/313 Archived 28 November 2020 at the Wayback Machine).
- Uwizeye D, Karimi F, Thiong'o C, et al. (2021). *Factors associated with research productivity in higher education institutions in Africa: a systematic review*. AAS Open Research, 4.
- van Rijnsoever, F.J., & Hessels, L.K. (2021). How academic researchers select collaborative research projects: A choice experiment. *J Technol Transf*, 46, 1917–1948.
- Vázquez, J. L. (2001). The importance of mathematics in the development of science and technology. *Boletín de la Sociedad Española de Matemática Aplicada*, 19, 69–112.

## ■ Appendix A (Guidelines used to generate the Google Online Survey tool)

**Table 1.** The effects of the quality of academic staff on research output at the university.

A = Natural Sciences, B = Engineering, C = Technology, D = Health Sciences, E = Natural Sciences

Q <sub>i</sub> = Quality of Academic Staff A		Department/Faculty									
		%	B	%	C	%	D	%	E	%	
Busitema University has a few lecturers with at least a PhD to spearhead research output	Assis. Lecturer										
	Lecturer										
	Sen. Lecturer										
	Assoc. Prof.										
	Prof.										
The remuneration/ facilitation of teaching staff at the university is not attractive enough to encourage academic staff to actively engage in research and innovation activities											
The university has limited access to technology equipment and internet resources to support research activities											
The university does not allocate a mandatory (3%) percentage of its total budget to support research and innovation activities											
The teaching policy at the university does not consider the time lecturers should spend on research and innovation activities when calculating the workload											
The university does not have enough computers and computer software resources for computing, simulations and advanced data analysis											
The university does not have internal collaborative initiative as staff research teams											
The university does not provide adequate departmental support to coordinate research initiatives											

**Table 2.** The scale of research effort in terms of funding and time on research output at the university.  
**A** = Natural Sciences, **B** = Engineering, **C** = Technology, **D** = Health Sciences, **E** = Natural Sciences

R <sub>i</sub> = Funding Research and Innovation	University									
	A	%	B	%	C	%	D	%	E	%
The university provides adequate teaching and research funds and time to influence research output										
There is effective use of consultation time and funds to meet the students by academic staff members at the university										
The university has an institutional management system of reliable time schedules for research and innovation activities										
The university dedicates time and funds to seminars, workshops and training in research and innovation activities										
The university facilitates academic staff to attend professional research, innovation and development activities both within and outside the university										
The university supports the use of email and internet services to provide feedback on matters concerning research and innovation initiatives										
The university encourages all ages and gender of academic staff in influencing research output of the institution										
The university provides sound policies to support research and innovation activities										
The university facilitates the development of research infrastructural facilities such as research laboratories, research agenda, research teams and research directorates										

**Table 3.** The effect of industrial partnerships and collaborations on the perceived university rankings and research output at the university.

A = Natural Sciences, B = Engineering, C = Technology, D = Health Sciences, E = Natural Sciences

L <sub>i</sub> = Partnerships and Collaborations	University									
	A	%	B	%	C	%	D	%	E	%
Availability of adequate library facilities at the university										
Availability of adequate internet services at the university										
The university builds a positive attitude of the academic staff towards full engagement in research and innovation activities										
The university contributes towards building a culture of collaborative research and innovation activities										
The university gives support towards qualification influence of academic staff involvement in research and innovation										
The university allocates adequate time and funds to support research and innovation output										
The university established partnerships and collaborations with other institutions in promoting research and innovation teams										
The university builds research and innovation teams to increase publication										
The university has clear guidelines and a clear institutional policy on rewarding research and innovation output										
The university has clear procedures for timely submission of research progress reports										
The university promotes the sustainable support and coordination of staff development initiatives										
The university makes available all the necessary research information, funding opportunities and authorisation for external research and innovations										