Ethiopian-affiliated Research in Scopus and Web of Science: A Bibliometric Mapping

Addisalem Tebikew Yallew [a] Asrat Dereb [b][1]

[a] PhD. Candidate, Faculty of Education, University of the Western Cape, Cape Town, South Africa
[b] PhD. Candidate, Department of Educational Planning and Management, Bahir Dar University, Ethiopia; Faculty of Management and Business, University of Tampere, Finland

Abstract

This paper explores the research landscape in Ethiopia using 20-year data drawn from Scopus and Web of Science (WoS) databases. The focus was to assess yearly research productivity, key research areas, journals in which researchers publish, collaborating countries, languages used to publish papers, and major agencies that fund research. The findings indicate that research productivity has been increasing over the past decades, with biomedical research dominating much of the output. Addis Ababa, Gondar, Jimma, Mekelle and Bahir Dar universities were identified as the institutions with a relatively higher level of research productivity than the other universities in the country. The top five collaborating countries for Ethiopian researchers were found to be the US, UK, India, Germany, and South Africa. The dominant language of research was English. However, since the country has a strong tradition of producing knowledge in local languages, this finding indicates the need to incorporate research published in African languages in journals and databases.

Introduction

The research function of universities in Africa has garnered much attention in recent years (Andoh, 2017; Cloete et al., 2015; Schalkwyk & Cloete, 2019) as the function of the universities as central institutions for the production of new knowledge has come into the limelight (Altbach, 2009; Douglass, 2016; Salmi, 2009). This continental commitment to research has also been amplified in documents such as the Africa Union's Agenda 2063 and Science Technology and Innovation Strategy for Africa 2024 (STISA). Against this backdrop, this paper provides a bibliometric overview of research productivity from the second most populous country in Africa, Ethiopia, using data mainly obtained from Scopus and the Web of Science (WoS).

This analysis was conducted with the idea that data on research performance helps to inform strategic decisions by providing a partial view of the strengths and weaknesses of

---

[1]**CONTACT** Asrat Dereb, email: asd.dereb5@gmail.com

----

institutions and systems at the macro, meso, and micro levels. Considering their respective missions and priorities, systems and universities could also utilize bibliometric data to set goals, chart progress, make budgetary and hiring decisions, invest in facilities, and work with external agencies.

To this end, this article focuses on addressing the following main research question: What discernible patterns can be deduced regarding research and publication from Ethiopia considering data from Scopus and WoS? The study also attempts to answer the following specific questions: (1) how much research is published? (2) has the level of productivity been increasing or decreasing? (3) what is the level of productivity in the most research-productive institutions? (4) what are the primary publication sources/outlets? (5) what does the publication landscape look like when considered from the vantage point of main research areas? And (6) what can be deduced from collaboration and funding patterns as well as languages of publication?

This mapping of a national higher education research system was undertaken while recognizing the transnational and global nature of science. Nevertheless, besides the practical significance mentioned above, making bibliometric and scientometric analysis, especially in nation-states such as Ethiopia, where such mappings have not been undertaken, was expected to provide a much needed, albeit partial picture of research and publication landscapes.

Literature Review

This section presents a brief literature review. The review focuses on the state of research in higher education institutions of Ethiopia and the key aspects of bibliometric and bibliometric study.

Higher Education and Research in Ethiopia

A country of 117.9 million people (United Nations Population Fund (UNFPA), 2021), Ethiopia currently has 51 public Higher Education Institutions (HEIs) (Tamrat, 2022). Like other higher education systems in African, the research function of these institutions has gained more traction in the past two decades. This development has been especially the case since the establishment of the then Ministry of Science and Higher Education (hereafter, MoSHE) in 2018. Between 2018 and 2021, the former ministry (a subdivision of the Ministry of Education since October 2021) has produced a number of reports and policy directives regarding the enhancement of research productivity. These include: developing a differentiated system of higher education, adopting a national open access policy, compiling a list of nationally accredited journals, ratifying a national science and higher education internationalization policies, and providing policy for promotion and research incentivization (MoSHE, 2020a, 2020b, 2020d, 2020c).

The science policy (MoSHE, 2020d) puts forward specific strategies for promoting research and innovation in the country. This includes the need to establish a national science fund and a national research council, strengthen research linkages among universities, research institutions, and industries, and develop mechanisms to identify, collect, organize, disseminate,

----

and utilize science and technology to support and facilitate technology transfer and diffusion at national, regional, and international levels.

Although the research function is given priority in policy documents and university mission and vision statements, research output from the country's higher education system is still considered low. Studies suggest that Ethiopian higher education remains overwhelmingly teaching-oriented (Van Deuren et al., 2016; Yallew, 2020) and the impressive gains made in expanding the country's higher education system do not seem to be accompanied by a parallel expansion in terms of research productivity (Ashcroft, 2011; Van Deuren et al., 2016; Weldemichael, 2014). For example, at Mekelle University, the institution with relatively higher normalized research impact, among a total of 1456 academic staff members not more than 25 articles were published in 2013 (Weldemichael, 2014)**.** A case study at Jimma University confirms that university teaching staff members are only marginally engaged in research (Melese, 2013).

In addition to poor research culture, research productivity in Ethiopian higher education is also linked to the low or chronic under-investment and financial support allocated to this function of higher education (Kitaw, 2006; Yallew, 2020). The fifth Education Sector Development Program (ESDP V) indicates that research funding in Ethiopian universities accounted for only 1% of their total budget (Ministry of Education (MoE), 2015). Compared to other countries in Africa, for example, South Africa, Ethiopia's research and development expenditure was three times less (Molla & Cuthbert, 2016). Many public universities, including the national flagship university, Addis Ababa University, also seem to depend on limited government and donor funding for research and lag behind African countries in seeking grants and international research funding. Yigezu (2013, p.59) also expressed the concern that HEIs like Addis Ababa University have budget expenditures that are "skewed towards salaries and food rather than academic activities", leaving only about 30–40% of the recurrent budget for the critical elements of academic activities such as research, publication, innovation, and postgraduate training.

In addition to challenges pertaining to funding, other reasons provided for the limited research engagement and productivity include qualitative and quantitative shortages of research staff, limited research infrastructure, lack of clear research priorities and agendas, and poor research management and support systems (Kitaw, 2006; MoE, 2015; Weldemichael, 2014). Constraints on academic freedom also limit the aspirations of academic staff in taking the initiative to conduct research and address critical societal issues (Weldemichael, 2014). Low graduate student enrolment, too, results in limited research outputs since a considerable amount of higher education research is derived from research undertaken by graduate and postgraduate students. It is encouraging that many of the challenges mentioned above are recognized in the national science policy.

Bibliometric Research and this Study

This paper operationalizes bibliometric analysis as the quantitative study and statistical analysis of scientific publications such as journal articles, communication in science, science

----

policy, and citation counts (Milojević & Leydesdorff, 2013). Bibliometrics has been employed worldwide for quantification and assessment of the research output of researchers, research institutions, academic institutions, and countries.

By focusing on publications from Ethiopia, this article adds to the limited but already existing research in bibliometrically mapping research output from Africa. A survey of bibliometric literature from the continent indicates that much of the research focuses on assessing research mainly from specific disciplinary vantage points, especially in the health and natural sciences. These include studies in biomedical sciences (Nwagwu, 2006); biotechnology (Molatudi & Pouris, 2006), bioinformatics (Molatudi et al., 2009), health sciences research (Mugomeri et al., 2017; Uthman et al., 2015; Wiysonge et al., 2013; Wonkam et al., 2011); and the natural sciences (Matthews, 2012; Sooryamoorthy, 2013). When it comes to bibliometric analysis on higher education studies, there has been some research exploring collaborations (Schubert & Sooryamoorthy, 2010), university rankings (Matthews, 2012), and the validity of research metrics (Bouabid & Martin, 2009; Kahn, 2011). Many of these studies are conducted in the context of South Africa. Moreover, there is a dearth of research when it comes to the context this study focuses on.

Methods

In this study, Scopus and WoS were chosen since the study aimed to investigate research affiliated with Ethiopia archived in the international domain. National and institutional documents also make regulations and guidelines for research publishing by including these databases as benchmarks (MoSHE, 2020b). In addition, it is worth stating that there were no alternative comprehensive national archives to enable this analysis.

An advanced search was conducted in Scopus and the WoS Core Collection using the word "Ethiopia" in the country field. For Scopus, a country affiliation search was done. This last search for information was conducted in March 2021. The WoS information was obtained with an advanced search (CU=Ethiopia), and the "Refine results" option was used to collect information about the various dimensions the study explored. For WoS, data were extracted from the following datasets:

- Science Citation Index Expanded (SCI-EXPANDED)
- Social Sciences Citation Index (SSCI)
- Arts & Humanities Citation Index (A&HCI)
- Emerging Sources Citation Index (ESCI)
- Conference Proceedings Citation Index Science (CPCI-S)
- Conference Proceedings Citation Index Social Science (CPCI-SSH)
- Book Citation Index Sciences (BKCI-S), and
- Book Citation Index Social Sciences (BKCI-SSH).

Then, metadata, including the year of publication, titles, main research areas, source journals, names of authors publishing the articles, collaborating countries and institutions, and funding agencies, were downloaded into Microsoft Excel. As the study sought to provide a

panoramic view of publications pertaining to Ethiopia, no document types were excluded from the final analysis. Additional manual coding was used to refine and merge funding agencies and collaborating institutions that were assigned different values in the databases because they were spelled differently but were the same agencies and institutions. The search was conducted on 25 March via the library of the University of Western Cape.

The analysis focused on 20 years (2001-2020) cognizant that the turn of the 21st century marks the era where African universities started to 'rediscover' their research mission (Andoh, 2017; van Schalkwyk et al., 2018). It also marks the turning point for Ethiopian higher education in that the early 2000s mark the birth of the main cohort of first-generation public universities. It is noteworthy that the country had only two public HEIs between the 1950s and the last decade of the 20th century (Yirdaw, 2016). However, expansion initiatives that started towards the end of the last decade of the 20th century increased state-run universities to eight by 2002 (Bishaw & Melesse, 2017).

Results and Discussion

This section presents the study findings along with discussing their implications in eight subsections. In line with the research questions and objectives, the subsections provide a description and assessment of overall research productivity, document types, most productive research institutions, publication outlets, main research areas, collaboration patterns, funding organizations, and languages of publication.

Research Output

The 20-year search (2001-2020) resulted in 32836 documents for Scopus and 28584 for WoS. As presented in Table 1 and Figure 1, productivity has been increasing for Ethiopian-affiliated research.

Table 1

Annual Research Productivity

	Scopus			WoS		
Year	#	%	Annual rate of change in %	#	%	Annual rate of change in %
2001	261	0.79		216	0.76	
2002	294	0.9	12.64	275	0.96	27.31
2003	362	1.1	23.13	300	1.05	9.09
2004	376	1.15	27.89	314	1.1	4.67

	Scopus			WoS		
Year	#	%	Annual rate of change in %	#	%	Annual rate of change in %
2005	431	1.31	14.62	332	1.16	5.73
2006	514	1.56	19.26	343	1.2	3.31
2007	624	1.9	21.40	451	1.58	31.49
2008	644	1.96	3.20	471	1.65	4.43
2009	771	2.35	19.72	588	2.06	24.84
2010	890	2.71	15.43	701	2.45	19.22
2011	1083	3.29	21.69	825	2.89	17.69
2012	1315	4	21.42	864	3.02	4.73
2013	1602	4.88	21.83	1116	3.9	29.17
2014	1911	5.82	19.29	1264	4.42	13.26
2015	2012	6.13	5.29	1846	6.46	46.04
2016	2224	6.77	10.54	2107	7.37	14.14
2017	3030	9.23	36.24	2947	10.31	39.87
2018	3627	11.05	19.70	3295	11.53	11.81
2019	4513	13.74	24.43	4163	14.56	26.34
2020	6352	19.34	40.75	6166	21.57	48.11
Total/ average	32836		19.92	28584		20.07

As it can be seen from Table 1 between 2001 and 2020 there has been an exponential increase of more than 23-fold for Scopus, and more than 27-fold for WoS indexed publications. On average, research output has increased by 19.92% annually for Scopus indexed research and by 20.07% for WoS. However, the most remarkable increase was registered between 2019 and 2020, with a 40.45% rise in output for data accessed through Scopus and 48.11% for WoS. Overall, it is worth noting that Scopus documents 4252 (an increase of 14.88%) more documents than WoS. This observation complements findings made by other studies (e.g. Mongeon & Paul-Hus, 2016; Vera-Baceta et al., 2019) that suggest Scopus' broader coverage.

Figure 1

A Twenty-year Overview of Research Output (Scopus, 2021; WoS, 2021)
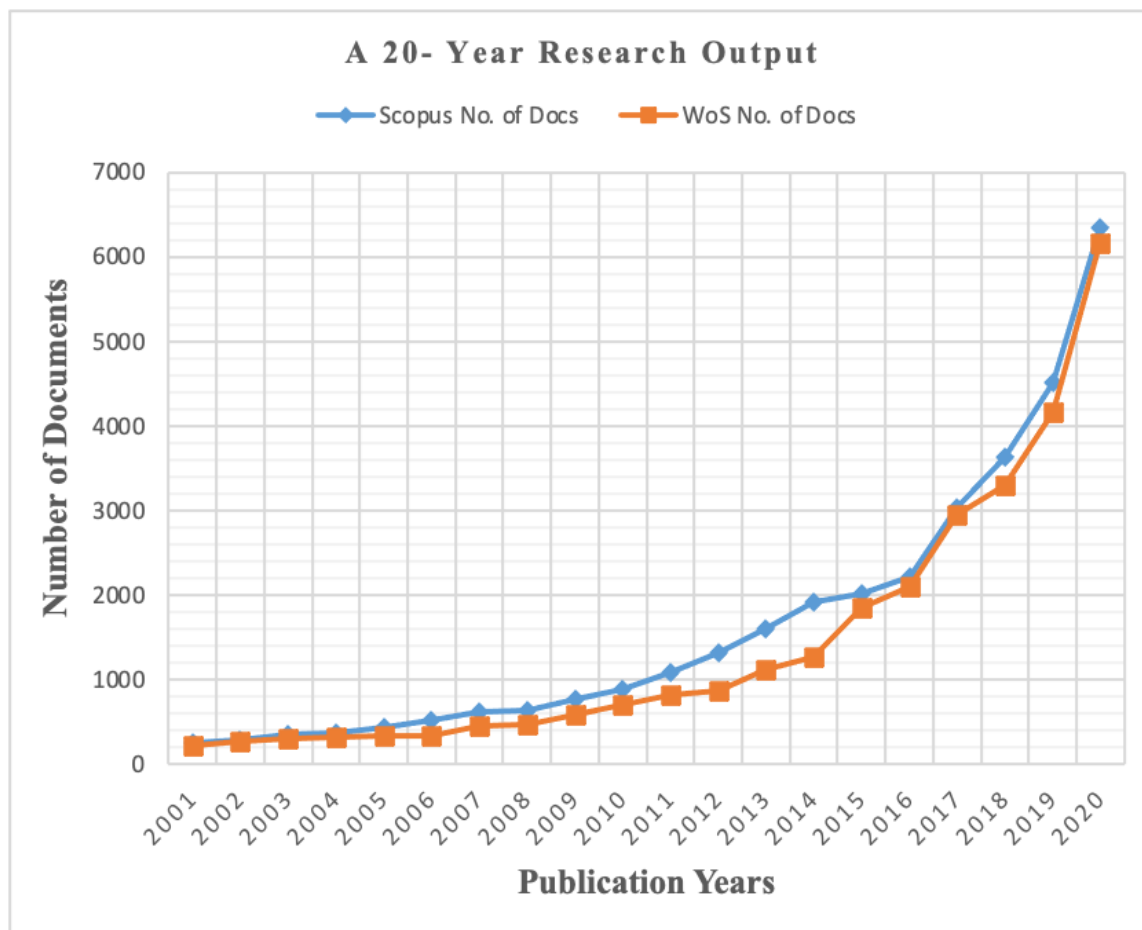
Also noteworthy is that in 2015, the year WoS introduced the Emerging Sources Citation Index, Ethiopian-affiliated research increased by 46.06% compared to 2014. This phenomenon highlights the importance of decisions like this to enhance research visibility from underrepresented regions.

Document Types

Table 2

Document Types

No.	Scopus			WoS		
	Document type	**#**	**%**	**Document type**	**#**	**%**
1	Article	27801	84.66	Article	24082	84.25
2	Review	1840	5.60	Review	1622	5.68
3	Conference paper	1360	4.14	Meeting abstract	1328	4.65

No.	Scopus			WoS		
	Document type	#	%	Document type	#	%
4	Book chapter	999	3.04	Proceedings' paper	863	3.02
5	Note	191	0.58	Book chapter	678	2.37
6	Editorial	177	0.54	Editorial material	483	1.69
7	Letter	165	0.50	Early access	321	1.12
8	Erratum	164	0.50	Letter	162	0.57
9	Book	61	0.19	Correction	140	0.49
10	Data paper	31	0.09	Book review	74	0.26
11	Short survey	30	0.09	Data paper	34	0.12
12	Retracted	10	0.03	News item	24	0.08
13	Undefined	7	0.02	Bibliography	10	0.04
14				Retraction	7	0.02
15				Biographical item	5	0.02
16				Retracted publication	5	0.02
17				Poetry	3	0.01

As indicated in Table 2, researchers affiliated with Ethiopian universities and research centers published a significant share of their work as journal articles, i.e., 84.66% and 84.25% in Scopus and WoS, respectively. Reviews account for 5.60% of the documents in Scopus and 5.67% in WoS. This finding might have to do with the fact that both databases have focused on indexing journals rather than other types of documents. Therefore, it is not surprising that the coverage of books and conference proceedings in both databases for Ethiopia-affiliated research was generally low. The WoS' Book Citation Index was added only in 2011 while Scopus' Book Expansion Project was undertaken between 2013 and 2015 (Pranckutė, 2021).

Research-productive Institutions

This section provides an overview of research productivity per HEI or research center. To this end, (1) we provided an overview of the top 20 research productive universities and research centers in the two databases, and (2) we calculated the per capita (per researcher) research productivity of mainly public universities to show a more nuanced picture of the level of research productivity. This section of the analysis focused only on 2020, for we were able to obtain publicly available, university disaggregated academic staff data only for this particular year. Research institutions were also excluded because of the paucity of staff-related data.

We would like to indicate that we removed non-Ethiopian affiliated institutions from this analysis since our objective was to map the country's research landscape. As presented in Table 3, the oldest university in the county, Addis Ababa University, is the leading university in research productivity. What are conventionally known as first-generation universities, namely: Gondor, Jimma, Mekelle, Bahir Dar, Haramaya, and Hawassa, take the following six places. This dominance of Addis Ababa University is understandable since the university is the oldest and the most prominent institution with higher research funding and collective research capacity. A decade ago, the university had 530 Ph.D. holders, while the remaining 21 universities had 586 of the same (Areaya, 2010). Though this capacity gap is narrowing, 2020 data indicates that Addis Ababa University has more than twice as many assistant professors and above (N=1291) compared to the second and third most research-productive universities (Gondar and Jimma) combined (N=1178).

Table 3

Research Productivity per Institution

No.	Scopus			WoS		
	Institution	**#**	**%**	**Institution**	**#**	**%**
1	Addis Ababa University	9239	28.14	Addis Ababa University	8452	29.57
2	University of Gondar	3084	9.39	University of Gondar	4362	15.26
3	Jimma University	2824	8.60	Jimma University	2419	8.46
4	Mekelle University	2552	7.77	Mekelle University	2325	8.13
5	Bahir Dar University	2324	7.08	Bahir Dar University	2025	7.08
6	Haramaya University	2095	6.38	Hawassa University	1736	6.07
7	Hawassa University	1895	5.77	Haramaya University	1665	5.83
8	Ethiopian Institute of Agricultural Research	815	2.48	International Livestock Research Institute (ILRI)	769	2.69
9	International Livestock Research Institute Addis Ababa	789	2.40	Arba Minch University	623	2.18
10	Ethiopian Public Health Institute	765	2.33	Ethiopian Institute of Agricultural Research Eiar	577	2.02
11	Arba Minch University	730	2.22	Debre Markos Univ	478	1.67
12	Debre Markos University	629	1.92	Ethiopian Publ Hlth Inst	440	1.54
13	Wollo University	603	1.68	Armauer Hansen Res Inst	438	1.53
14	Armauer Hansen Research Institute	576	1.75	Ambo University	436	1.53

No.	Scopus			WoS		
	Institution	#	%	Institution	#	%
15	Aksum University	499	1.52	Adama Science Technology University	367	1.28
16	Ambo University	461	1.40	Debre Berhan University	348	1.22
17	Wollega University	457	1.39	Wolaita Sodo University	347	1.21
18	Debre Berhan University	446	1.36	Dilla University	344	1.20
19	Wolaita Sodo University	424	1.29	Wollo University	340	1.19
20	Dilla University	391	1.90	Wollega University	333	1.17

Besides, Table 4 presents the 2020 per capita publication output. After filtering the data for the specific year, which yielded a total of 6353 publications for Scopus and 6200 for WoS, documents for the top 20 research-productive institutions were retained. Academic staff data extracted from the document compiled by MoSHE to develop a differentiated higher education system (MoSHE, 2020a) was then used to calculate the per capita output. This calculation was made taking into consideration: (1) the number of full-time academic staff (lecturer and above) each university reported for 2020 to align the analysis with systemic expectations, and (2) the number of assistant professors and above (Ph.D. degrees and above) to provide a profile of research productivity close to international comparisons. It is worth elaborating that an assistant professorship in Ethiopia can automatically be obtained when academic staff obtain their PhDs or through earning two publication points without having a Ph.D. (MoSHE, 2020b). Therefore, we would like to state that the assistant professor rank-based analysis not only includes Ph.D. holders as often used to assess research capacity and output, but it also includes academic staff with master's degrees that fulfilled the publication expectations.

The per capita analysis indicates that the universities with better research capacity, which are also dubbed as research universities (Addis Ababa, Gondor, Bahir Dar, Mekelle, Jimma) in the latest higher education differentiation scheme of the country (MoSHE, 2020a), have either slightly more than one or close to one publication per capita. Given their minimal research capacity, especially the number of assistant professors and Ph.D. holders, some of the newly established universities (universities of applied sciences and comprehensive universities) also demonstrated a higher per capita research output than the older generation universities.

Table 4

Per Capita Research Productivity for 2020

No.	University	Scopus (N=6353)					University	WoS (N=6200)				
		Annual research output	Academic staff (lecturer and above)	Per capita research output (lecturer and above)	Academic staff (Asst. Prof. and above)	Per capita research output (Asst. Prof. and above)		Annual research output	Academic staff (lecturer and above)	Per capita research output (lecturer and above)	Academic staff (Asst. Prof. and above)	Per capita research output (Asst. Prof. and above)
1	Addis Ababa University	1239	2889	0.43	1291	0.96	Addis Ababa University	1,266	2889	0.44	1291	0.98
2	University of Gondar	750	2648	0.28	682	1.1	University of Gondar	760	2648	0.29	682	1.14
3	Bahir Dar University	659	1626	0.41	510	1.29	Bahir Dar University	598	1626	0.37	510	1.17
4	Mekelle University	546	1580	0.35	572	0.95	Mekelle University	538	1580	0.34	572	0.94
5	Jimma University	537	1392	0.39	496	1.08	Jimma University	514	1392	0.37	496	1.04
6	Hawassa University	370	1345	0.28	418	0.89	Hawassa University	361	1345	0.27	418	0.86
7	Haramaya University	322	956	0.34	335	0.96	Haramaya University	322	956	0.34	335	0.96
8	Wollo University	253	750	0.34	137	1.85	Wollo University	247	750	0.33	137	1.8
9	Arba Minch University	216	1091	0.2	291	0.74	Debre Markos University	195	728	0.18	99	1.97
10	Debre Markos University	205	728	0.28	99	2.07	Arba Minch University	188	1091	0.26	291	0.65

		Scopus (N=6353)					WoS (N=6200)					
No.	University	Annual research output	Academic staff (lecturer and above)	Per capita research output (lecturer and above)	Academic staff (Asst. Prof. and above)	Per capita research output (Asst. Prof. and above)	University	Annual research output	Academic staff (lecturer and above)	Per capita research output (lecturer and above)	Academic staff (Asst. Prof. and above)	Per capita research output (Asst. Prof. and above)
11	Debre Berhan University	204	861	0.24	224	0.91	Debre Berhan University	183	861	0.21	224	0.82
12	Debre Tabor University	164	389	0.42	11	14.9	Ambo University	161	1347	0.12	475	0.34
13	Ambo University	160	1347	0.12	475	0.34	Debre Tabor University	160	389	0.86	11	14.55
14	Aksum University	158	773	0.2	67	2.36	Wollega University	139	735	0.18	167	0.83
15	Dilla University	144	729	0.2	86	1.67	Aksum University	136	773	0.19	67	2.03
16	Wollega University	144	735	0.2	167	0.86	Dilla University	131	729	0.18	86	1.52
17	Adigrat University	123	600	0.21	75	1.64	Adama Science and Technology University	126	650	0.19	207	0.61
18	Woldia University	123	515	0.24	27	4.56	Mizan Tepi University	126	691	0.24	44	2.86
19	Mizan-Tepi University	121	691	0.18	44	2.75	Adigrat University	124	600	0.21	75	1.65
20	Wolaita Sodo University	112	640	0.18	159	0.7	Woldia University	124	515	0.24	27	4.59

However, it is worth noting that this is a rough indicator that does not present disciplinary and individual differences. It could be more nuanced through a longitudinal analysis considering staff profiles and publication outputs over several years. We were not able to do that because we could not obtain data for the staff profile of universities except for 2020. Yet another potent indicator is the weighted per capita knowledge output that considers a researcher's publication and supervision profiles. In this regard, the average number of master and Ph.D. students a researcher supervised to completion could be calculated along with the publication output to provide an institution's research capacity.

Publication Outlets

Table 5

Top Journals for Ethiopian-affiliated Research

No	Scopus			WoS		
	Source title	#	%	Source title	#	%
1	Plos One	1152	3.50	Plos One	1145	4.01
2	Ethiopian Medical Journal	707	2.15	BMC Public Health	479	1.68
3	BMC Research Notes	694	2.11	Ethiopian Journal of Health Development	384	1.34
4	BMC Public Health	479	1.46	Tropical Animal Health and Production	319	1.12
5	Livestock Research for Rural Development	319	0.97	American Journal of Tropical Medicine and Hygiene	310	1.09
6	Tropical Animal Health and Production	319	0.97	BMC Infectious Diseases	299	1.05
7	Ethiopian Journal of Health Development	309	0.94	Ethiopian Journal of Health Sciences	281	0.98
8	BMC Infectious Diseases	299	0.91	BMC Pregnancy and Childbirth	254	0.89
9	Ethiopian Journal of Health Sciences	258	0.79	Tropical Medicine International Health	224	0.78
10	BMC Pregnancy and Childbirth	255	0.78	Cogent Food Agriculture	207	0.72
11	Malaria Journal	204	0.62	Malaria Journal	205	0.72
12	Plos Neglected Tropical Diseases	195	0.59	Plos Neglected Tropical Diseases	196	0.69
13	BMC Health Services Research	163	0.50	Ethiopian Medical Journal	183	0.64
14	BMJ Open	161	0.50	Transactions Of the Royal Society of Tropical Medicine and Hygiene	167	0.58

Reflective of Ethiopia's biomedicine-research dominated publication landscape, the prominence of journals related to these fields of study is noticeable. Another noteworthy observation is the limited visibility of Ethiopian journals in the top 20 list. Only three journals, affiliated with institutions, and societies from Ethiopia are represented in this list. Overall, only five Ethiopian-affiliated journals are indexed in Scopus and four for WoS. This finding is concerning since there are 72 Journals published by well-known institutions in Ethiopia (Ethiopian Academy of Sciences (EAS), 2017).

The Ethiopian-affiliated journals indexed in WoS and Scopus are published by three universities and two professional societies, namely:

- Ethiopian Medical Association-affiliated *Ethiopian Medical Journal*
- The Addis Ababa University-affiliated *Ethiopian Journal of Health Development*
- Jimma University-affiliated *Ethiopian Journal of Health Sciences*
- The Mekelle University-affiliated *Momona Ethiopian Journal of Science*, and
- Chemical Society of Ethiopia-affiliated *Bulletin of The Chemical Society of Ethiopia*.

Research Areas

The primary research areas in the university mainly focus on medical and health sciences, and agriculture and life sciences as demonstrated in Table 6. This finding is also backed up by a World Bank report by Blom et al. (2015), which indicates that 21% of the research coming out of Ethiopia is concentrated on these particular disciplines. From the report, it can be inferred that close to 70% of the research in the country is concentrated on medical sciences, engineering, agriculture, and the natural sciences.

The share of engineering is only 4% and, like in the other parts of Africa, research in STEM fields seems to be lagging behind other disciplines, though policy-wise the country gives considerable attention to the pivotal role science and technology play in achieving the goals set by the Ten-Year National Development Plan (2021-2030) which replaced the Growth and Transformation Plans (GTPs). The ten-year plan is aligned with international and regional commitments such as the Sustainable Development Goals (SDGs) and the African Union's Agenda 2063. The findings also suggest a significant under representation of research in social sciences and humanities.

Table 6

Main Research Areas

No.	Scopus			WoS		
	Research Area	**#**	**%**	**Research Area**	**#**	**%**
1	Medicine	11981	22.16	Public Environmental Occupational Health	3519	12.31
2	Agricultural and Biological Sciences	8385	15.51	Agriculture	2917	10.21
3	Environmental Science	4281	7.92	Environmental Sciences Ecology	2467	8.63
4	Biochemistry, Genetics and Molecular Biology	4191	7.75	Science Technology Other Topics	2356	8.24

No.	Scopus			WoS		
	Research Area	#	%	Research Area	#	%
5	Social Sciences	3778	6.99	Infectious Diseases	1872	6.55
6	Immunology and Microbiology	2290	4.23	Tropical Medicine	1555	5.44
7	Engineering	2153	3.98	Engineering	1161	4.06
8	Earth and Planetary Sciences	1969	3.64	Health Care Sciences Services	1024	3.58
9	Multidisciplinary	1665	3.08	Chemistry	992	3.47
10	Veterinary	1403	2.59	General Internal Medicine	982	3.44
11	Computer Science	1374	2.54	Veterinary Sciences	908	3.18
12	Pharmacology, Toxicology and Pharmaceutics	1230	2.27	Plant Sciences	906	3.17
13	Chemistry	1209	2.23	Pharmacology Pharmacy	840	2.94
14	Physics and Astronomy	1079	1.99	Business Economics	829	2.90
15	Materials Science	988	1.82	Parasitology	826	2.89
16	Nursing	920	1.70	Water Resources	789	2.76
17	Economics, Econometrics and Finance	900	1.66	Obstetrics Gynecology	759	2.66
18	Energy	736	1.36	Geology	732	2.56
19	Mathematics	721	1.33	Materials Science	586	2.05
20	Chemical Engineering	663	1.23	Pediatrics	583	2.04

Collaboration Patterns

As presented in Table 7, Ethiopian-affiliated institutions and researchers collaborate with researchers from around the world. The collaboration patterns suggest the dominance of the US and Western European countries. This particular finding is similar to the findings of (Adams et al., 2014) and Narváez-Berthelemot et al. (2002) in that the dominant collaboration and co-authorship patterns are with European and North American countries, and that there seems to be limited south-south and intra-Africa collaboration. Encouraging signs of south-south collaboration are also noted with countries such as India, South Africa, Kenya and China featuring in the top 20 list. Researchers affiliated with Nigeria, Uganda and Tanzania are also represented in the list.

Table 7

Collaborations by Country

No.	Scopus			WoS		
	Country	#	%	Country	#	%
1	United States	4694	10.42	USA	4699	16.44

No.	Scopus			WoS		
	Country	#	%	Country	#	%
2	United Kingdom	2830	6.46	England	2585	9.04
3	India	2648	6.04	India	1976	6.91
4	Germany	1822	4.16	Germany	1709	5.98
5	South Africa	1665	3.80	South Africa	1565	5.48
6	Netherlands	1571	5.59	Netherlands	1525	5.34
7	Belgium	1329	3.03	Belgium	1328	4.65
8	Kenya	1231	2.81	Australia	1165	4.08
9	Australia	1159	2.65	Kenya	1154	4.04
10	Norway	1156	2.64	Norway	1124	3.93
11	Sweden	1084	2.48	Sweden	1079	3.78
12	China	899	2.05	China	941	3.29
13	France	875	2.00	Canada	884	3.09
14	Canada	854	1.95	France	858	3.00
15	Italy	837	1.91	Italy	790	2.76
16	Switzerland	756	1.73	Switzerland	789	2.76
17	Nigeria	591	1.35	Nigeria	622	2.18
18	Uganda	589	1.35	Spain	586	2.05
19	Spain	558	1.27	Uganda	555	1.94
20	Tanzania	551	1.26	Japan	532	1.86

It is worth noting, however, that different collaboration patterns emerge when the analysis is disaggregated by individual institutions. For instance, if we take the national flagship HEI, Addis Ababa University, many of the top collaborating institutions are other Ethiopian HEIs. This corroborates Adams et al. (2014, p. 551) assertion that "Ethiopia's research base is distinctive in being substantial, growing and yet almost entirely domestic." This suggests   that though there are ties with researchers mainly from the global north, Ethiopian researchers considerably collaborate with colleagues within the country's higher education system as well. Admittedly, this claim needs to be backed up with a further network analysis.

Funders

The findings suggest public universities' output is derived from limited research funding. For instance, the WoS data indicated 13789 records (48.24%) do not contain data for the funding dimension analyzed. This finding could lead one to assume that individual researchers conduct the majority of research and that there is limited state or international funding support. This funding-related analysis could be reflected upon considering the

----

country's higher education budgeting, which accounts for 34% of the overall education budget. According to data obtained from Ministry of Finance and Economic Development (MoFED, 2020), in the last six consecutive years, the research and development budget share of public HEIs accounts for about 4% or less of universities' budget, which has four major program components: administration and management, teaching-learning, research and development, and consultancy and community services.

Table 8

Major Funders

No.	Scopus		WoS	
	Funding agency	**#**	**Funding agency**	**#**
1	Addis Ababa University	1010	European Commission	837
2	Bill and Melinda Gates Foundation	464	United States Department of Health Human Services	789
3	United States Agency for International Development	418	National Institutes of Health (NIH USA)	685
4	University of Gondar	378	Addis Ababa University	631
5	Jimma University	366	United States Agency for International Development (USAID)	549
6	Mekelle University	309	UK Research Innovation UKRI	548
7	Medical Research Council	295	Bill Melinda Gates Foundation	499
8	National Institutes of Health	279	CGIAR	445
9	National Natural Science Foundation of China	258	University Of Gondar	386
10	Bahir Dar University	251	Jimma University	347
11	Wellcome Trust	246	Wellcome Trust	343
12	National Science Foundation	230	National Natural Science Foundation of China (NSFC)	305
13	Haramaya University	223	National Science Foundation (NSF)	260
14	Deutscher Akademischer Austauschdienst	215	Medical Research Council (UK-MRC)	259
15	Styrelsen för Internationellt Utvecklingssamarbete	206	Deutscher Akademischer Austausch Dienst (DAAD)	241
16	European Commission	189	Mekelle University	228
17	Seventh Framework Programme	186	World Health Organization (WHO)	180
18	Natural Environment Research Council	185	Haramaya University	168
19	Ethiopian Institute of Agricultural Research	164	Natural Environment Research Council (NERC)	167
20	Hawassa University	161	NIH Fogarty International Center (FIC)	164

International donors and funding agencies support a considerable percentage of the limited overall funding for published research, as presented in Table 8. Reliance on international funders is unsustainable, though it is undeniable that international funders and agencies have played a significant role in building research capacities in Ethiopia and on the African continent at large. The case of UK Research and Innovation (UKRI), the sixth-largest funder for Ethiopian-affiliated research according to WoS, is a case in point here. It was reported that the organization's aid-related budget cut worth $166 million for 2021-2022 sent shockwaves around research communities across the African continent (Nordling, 2021). This reliance is concerning since, in a way, it influences what is researched, who decides the agenda, where and how the research is published and disseminated, and which disciplines gain more attention while others do not (van Schalkwyk et al., 2018). Initiatives and provisions to set up a competitive national research fund as stipulated in both the science and higher education policies (MoSHE, 2020d, 2020c) could help create a more sustainable and self-reliant research ecosystem.

Figure 2

Budget Share of Research and Development in Public Universities in Comparison to Other Core Activities
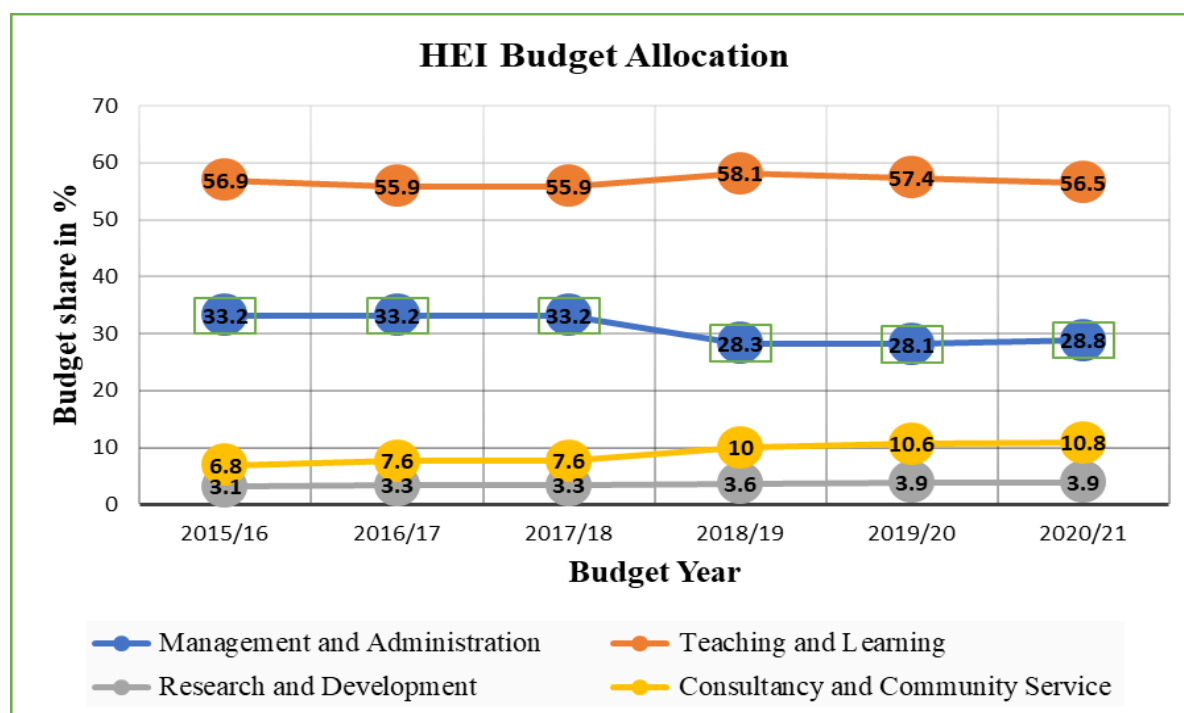
Source. Ministry of Finance and Economic Development (2020)

Languages

As presented in Table 9, almost all of the studies are published in English. This finding is similar to research in other contexts as well. According to Vera-Baceta et al. (2019), 92.64% of global research archived in Scopus is in English, while the language accounts for 95.37% in WoS. A closer analysis of the Ethiopian linguistic context where English is a foreign language to researchers might lead one to find this trend concerning. (Mendisu & Yigezu, 2014), for instance, question the dominant use of the language, taking

----

the case of *The Journal of Ethiopian Studies* though the journal is indexed neither in Scopus nor in WoS. It is, however, worth mentioning that English is the official medium of instruction in the country's higher education system.

Table 9

Languages of Publication

No.	Scopus			WoS		
	Language	#	%	Language	#	%
1	English	32771	99.80	English	28546	99.87
2	French	47	0.14	German	15	0.05
3	Spanish	23	0.07	French	12	0.04
4	German	19	0.06	Spanish	9	0.03
5	Portuguese	7	0.02			
6	Dutch	4	0.01			
7	Polish	4	0.01			
8	Russian	4	0.01			
9	Chinese	3	0.01			
10	Croatian	3	0.01			
11	Turkish	3	0.01			
12	Afrikaans	2	0.01			
13	Arabic	2	0.01			
14	Hungarian	2	0.01			
15	Italian	2	0.01			
16	Norwegian	2	0.01			
17	Thai	2	0.01			

Though it is often a taken-for-granted notion, English's preeminence as the language of research and publication in these databases needs to be interrogated, especially considering contexts where it is a second, third or even foreign language (Kuteeva & Mauranen, 2014; Yallew et al., 2021). As much as English is lauded as the lingua franca bringing together global scientific communities, studies have shown that non-native scholars face linguistic, socio-cultural, political and economic disadvantages (Flowerdew, 2013; Hanauer & Englander, 2011; Lillis & Curry, 2010; Yen & Hung, 2018). Additionally, the epistemic implications of the dominance of the language in African contexts such as Ethiopia need to be investigated, engaging with renewed debates on intellectual dependence, the cognitive empire and decolonizing the academia and knowledge production in particular (Ndlovu-Gatsheni, 2018).

Conclusions

The present article set out to map the research publication landscape in Ethiopia. The findings suggest that productivity for Ethiopian-affiliated research is increasing. Strong representation of research from biomedical sciences and agriculture could be regarded as strength of the system. However, there is a significant underrepresentation of social sciences and humanities research on the one hand, and STEM research on the other. First-generation universities constitute the relatively dominant institutions in terms of levels of research productivity in pure quantifiable terms. When it comes to per capita research output, almost all first-generation research-oriented universities either slightly exceed or come close to one paper criteria per researcher. Even though they lag behind in the number of publications, the country's second and third-generation universities are also performing reasonably well given their limited research capacity.

The analysis of publication outlets suggests the need to enhance the representation of Ethiopian-affiliated journals to match the burgeoning research and publication function of HEIs. It is an encouraging development that MoSHE developed a list of nationally accredited journals. However, there is a need to harmonize accredited journals with an international accredited list. For example, Ethiopian journals accredited in WoS and Scopus are not officially listed among the 16 nationally accredited journals except for the Ethiopian Journal of Health and Development. In addition, to keep predatory publishing at bay, the Ministry stipulates those other publications should appear in journals indexed in WoS and Scopus. We suggest, however, that a more inclusive accredited journals database could be developed to acknowledge quality publications that do not appear in these databases. Not being indexed in these databases does not necessarily mean that a publication is of poor quality or is published in a predatory journal.

A few noteworthy statements could also be made regarding funding patterns. Though universities, through government funding, are still some of the most significant sources of reported research funding, the system is highly dependent on the US and European countries. Moreover, for nearly half of the publications, no funding was reported. Funding patterns also potentially provide clues regarding the dominance of biomedical, agricultural and life sciences research since the dominant funding agencies mainly focus on these areas. Though it needs further investigation, dominant research areas seem to follow the money and the priorities of dominant funders. To enhance research output, and promote autonomy and flexibility of setting research agendas, we recommend for the establishment of more sustainable national and institutional funding mechanisms, especially for those institutions designated with 'research university' status in the differentiated public university system.

With regards to languages, the complete dominance of English is noticeable. This finding is understandable given that the language is considered the lingua franca of global science. However, it could be deemed as concerning considering a contextual specificity where there are Ethiopian languages with the potential to be incorporated as viable alternative languages of research and publication. This finding, therefore, highlights the need to promote linguistic plurality in research publishing.

In conclusion, this overview of research output and productivity in Ethiopian higher education also indicates the need to systematically develop instruments, frameworks, databases, and research repositories for measuring and archiving research and publications,

----

be it at the national or institutional levels. In terms of archiving research and making it available via open access, initiatives such as The National Academic Digital Repository of Ethiopia (NADRE) and the establishment of a national science information system (MoSHE, 2020d), and the Ethiopian Journals Online (EJOL), which was launched in 2014 and currently hosts 35 journals, need to be encouraged and expanded. Along with databases, the development of interfaces, searching, and analyzing tools is also crucial to enabling systematic and comprehensive access to research. Access to detailed, accurate, and publicly accessible academic staff data both at the macro and meso levels is needed to make analyses such as this one more nuanced.

Study Limitations

This study was conducted with a modest objective of providing an overview of research affiliated with Ethiopia archived in international databases. Therefore, no claims of comprehensiveness are made since the output from many Ethiopian journals may not be indexed in these databases and thus are not included, and unpublished research and graduate student's theses are not included. The other limitation is that this quantitative metrics-based overview also incorporates all the limitations that metrics-based analysis entails. While recognizing the insights in this bibliometric mapping, we would like to underscore that what we discussed in the present paper should be backed up with a more in-depth socio-historical analysis that also considers power relations and the transnational nature of global science (Marginson, 2021). As Marginson (2021, p.4) argues, between WoS and Scopus and scientific communities worldwide, "lies a long story of epistemic, linguistic, institutional, and political-economic power". The critique that Scopus and the WoS databases archive mainly English medium research from biomedical and natural sciences (Mongeon & Paul-Hus, 2016) also applies here. Because of these limitations, we do not recommend that the findings be used for strict comparisons and rankings.

Disclosure Statement

The authors report no potential conflict of interest.

References

Adams, J., Gurney, K., Hook, D., & Leydesdorff, L. (2014). International collaboration clusters in Africa. *Scientometrics*, *98*(1), 547–556. https://doi.org/10.1007/s11192-013-1060-2

Altbach, P. G. (2009). Peripheries and centers: Research universities in developing countries. *Asia Pacific Education Review*, *10*(1), 15–27. https://doi.org/10.1007/s12564-009-9000-9

Andoh, H. (2017). Research: The "Lost Mission" of African universities. *International Higher Education*, *91*, 20–22. https://doi.org/10.6017/ihe.2017.91.10133

Areaya, S. (2010). Tension between massification and intensification reforms and implications for teaching and learning in Ethiopian public universities. *Journal of Higher Education in Africa*, *8*(2), 93–115.

Ashcroft, K. (2011). *Higher education in development: lessons from sub-Saharan Africa*. Information Age Publishing.

Bishaw, A., & Melesse, S. (2017). Historical analysis of the challenges and opportunities of higher education in Ethiopia. *Higher Education for the Future*, *4*(1), 31–43. https://doi.org/10.1177/2347631116681212

Blom, A., Lan, G., & Adil, M. (2015). *Sub-Saharan African science, technology, engineering, and mathematics research: A decade of development*. The Wrld Bank. https://doi.org/10.1596/978-1-4648-0700-8

Bouabid, H., & Martin, B. R. (2009). Evaluation of Moroccan research using a bibliometric-based approach:Investigation of the validity of the h-index. *Scientometrics*, *78*(2), 203–217. https://doi.org/10.1007/s11192-007-2005-4

Cloete, N., Bunting, I., & Maassen, P. (2015). Research universities in Africa: An empirical overview of eight flagship universities. In N. Cloete, P. Maassen, & T. Bailey (Eds.), *Knowledge Production and Contradictory Functions in African Higher Education* (Vol. 1, pp. 18–31).

Douglass, J. A. (Ed.). (2016). *The new flagship university : Changing the paradigm from global ranking to national relevancy*. Palgrave Macmillan. https://doi.org/10.1057/9781137500496

Ethiopian Academy of Sciences (EAS). (2017). *National journal evaluation and accreditation: A strategy for standardising the assessment of performance in scholarly publishing in Ethiopia*. Eclipse Printing Press.

Flowerdew, J. (2013). English for research publication purposes. In B. Paltridge & S. S. Eld (Eds.), *The handbook of English for specific purposes* (pp. 301–321). John Wiley & Sons.

Hanauer, D. I., & Englander, K. (2011). Quantifying the burden of writing research articles in a second language: Data from Mexican scientists. *Written Communication*, *28*(4), 403–416. https://doi.org/10.1177/0741088311420056

Kahn, M. (2011). A bibliometric analysis of South Africa's scientific outputs – some trends and implications. *South African Journal of Science*, *107*(1/2), 1–6. https://doi.org/10.4102/sajs.v107i1/2.406

Kitaw, D. (2006). Towards solving existing industrial problems. In *Conference on launching a program to transforming university-industry-government relations in Ethiopia*. Addis Ababa: United Nations Conference Center.

Kuteeva, M., & Mauranen, A. (2014). Writing for publication in multilingual contexts: An introduction to the special issue [Article]. *Journal of English for Academic Purposes*, *13*, 1–4. https://doi.org/10.1016/j.jeap.2013.11.002

Lillis, T., & Curry, M. J. (2010). *Academic writing in global context*. London: Routledge.

Marginson, S. (2021). Global science and national comparisons: Beyond bibliometrics and scientometrics. *Comparative Education*, 1–22. https://doi.org/10.1080/03050068.2021.1981725

Matthews, A. P. (2012). South African universities in world rankings [Article]. *Scientometrics*, *92*(3), 675–695. https://doi.org/10.1007/s11192-011-0611-7

Melese, W. (2013). Research-teaching link in higher education institutions of Ethiopia : The case of Jimma university. *Basic Research Journal of Education Research and Review*, *1*(6), 85–98.

Mendisu, B. S., & Yigezu, M. (2014). Restoring African studies to its linguistic identity: Reflections on Ethiopian studies. *Social Dynamics*, *40*(2), 289–307. https://doi.org/10.1080/02533952.2014.946267

Milojević, S., & Leydesdorff, L. (2013). Information metrics (iMetrics): a research specialty with a socio-cognitive identity? *Scientometrics*, *95*(1), 141–157. https://doi.org/10.1007/s11192-012-0861-z

Ministry of Education(MoE). (2015). *Education Sector Development Program V (ESDP V): Program action plan*. Addis Ababa:MoE.

Ministry of Finance and Economic Development (MoFED). (2020). *Budget*. Addis Ababa: MoFED. https://www.mofed.gov.et/resources/budget/

Ministry of Science and Higher Education(MoSHE). (2020a). *Differentiating the higher education system of Ethiopia: A study report*. Addis Ababa: MoSHE.

Ministry of Science and Higher Education(MoSHE). (2020b). *Harmonized standard for academic staff promotion in public universities*. Addis Ababa: MoSHE.

Ministry of Science and Higher Education(MoSHE). (2020c). *Higher education policy and strategy*. Addis Ababa: MoSHE.

Ministry of Science and Higher Education(MoSHE). (2020d). *National science policy and strategy*. Addis Ababa: MoSHE. https://www.moshe.gov.et/files/1611127015019.pdf

Molatudi, M., Molotja, N., & Pouris, A. (2009). A bibliometric study of bioinformatics research in South Africa. *Scientometrics*, *81*(1), 47–59. https://doi.org/10.1007/s11192-007-2048-6

Molatudi, M., & Pouris, A. (2006). Assessing the knowledge base for biotechnology in South Africa: A bibliometric analysis of South African microbiology and molecular biology and genetics research. *Scientometrics*, *68*(1), 97–108. https://doi.org/10.1007/s11192-006-0085-1

Molla, T., & Cuthbert, D. (2016). In pursuit of the African PhD: A critical survey of emergent policy issues in select sub-Saharan African nations, Ethiopia, Ghana and South Africa. *Policy Futures in Education*, *14*(6), 635–654. https://doi.org/10.1177/1478210316641567

Mongeon, P., & Paul-Hus, A. (2016). The journal coverage of Web of Science and Scopus: a comparative analysis [Article]. *Scientometrics*, *106*(1), 213–228. https://doi.org/10.1007/s11192-015-1765-5

Mugomeri, E., Bekele, B. S., Mafaesa, M., Maibvise, C., Tarirai, C., & Aiyuk, S. E. (2017). A 30-year bibliometric analysis of research coverage on HIV and AIDS in Lesotho. *Health Research Policy and Systems*, *15*(1), 21–21. https://doi.org/10.1186/s12961-017-0183-y

Narváez-Berthelemot, N., Russell, J. M., Arvanitis, R., Waast, R., & Gaillard, J. (2002). Science in Africa: An overview of mainstream scientific output [Article]. *Scientometrics*, *54*(2), 229–241. https://doi.org/10.1023/A:1016033528117

Ndlovu-Gatsheni, S. J. (2018). *Epistemic freedom in Africa : Deprovincialization and decolonization* (First edit). Routledge.

Nordling, L. (2021). *UK aid cuts send tremors through African research*. Research

----

Professional News. https://www.researchprofessionalnews.com/rr-news-africa-pan-african-2021-3-uk-aid-cuts-send-tremors-through-african-research/

Nwagwu, W. (2006). A bibliometric analysis of productivity patterns of biomedical authors of Nigeria during 1967-2002 [Article]. *Scientometrics*, *69*(2), 259–269. https://doi.org/10.1007/s11192-006-0152-7

Pranckutė, R. (2021). Web of Science (WoS) and Scopus: The Titans of bibliographic information in today's academic world. *Publications (Basel)*, *9*(1), 12. https://doi.org/10.3390/publications9010012

Salmi, J. (2009). *The challenge of establishing world-class universities*. World Bank.

Schalkwyk, F. Van, & Cloete, N. (2019). Research universities in Africa : Aspiration versus reality. *In Paper Presented at the 8th European Conference on African Studies Conference (ECAS2019) (Vol. 11, p. 14).*

Schubert, T., & Sooryamoorthy, R. (2010). Can the centre–periphery model explain patterns of international scientific collaboration among threshold and industrialised countries? The case of South Africa and Germany. *Scientometrics*, *83*(1), 181–203. https://doi.org/10.1007/s11192-009-0074-2

Sooryamoorthy, R. (2013). Scientific research in the natural sciences in South Africa: A scientometric study. *South African Journal of Science*, *109*(7/8), 1–11. https://doi.org/10.1590/sajs.2013/20120001

Tamrat, W. (2022, May 5). Can university exit exams fix some systemic problems? *University World News*. https://www.universityworldnews.com/post.php?story=20220502212905541

United Nations Population Fund(UNFPA). (2021). *World Population Dashboard: Ethiopia*. https://www.unfpa.org/data/world-population/ET

Uthman, O. A., Wiysonge, C. S., Ota, M. O., Nicol, M., Hussey, G. D., Ndumbe, P. M., & Mayosi, B. M. (2015). Increasing the value of health research in the WHO African region beyond 2015—reflecting on the past, celebrating the present and building the future: a bibliometric analysis [Article]. *BMJ Open*, *5*(3), e006340–e006340. https://doi.org/10.1136/bmjopen-2014-006340

Van Deuren, R., Kahsu, T., Mohammed, S., & Woldie, W. (2016). Ethiopian new public universities:Achievements, challenges and illustrative case studies [Article]. *Quality Assurance in Education*, *24*(2), 158–172. https://doi.org/10.1108/QAE-12-2014-0054

van Schalkwyk, F., Bunting, I., & Cloete, N. (2018). *Research universities in Africa*. African Minds. https://doi.org/10.5281/zenodo.1479114

Vera-Baceta, M.-A., Thelwall, M., & Kousha, K. (2019). Web of Science and Scopus language coverage. *Scientometrics*, *121*(3), 1803–1813. https://doi.org/10.1007/s11192-019-03264-z

Weldemichael, D. G. (2014). *Research practice in public universities of Ethiopia:The case of Mekelle university (Master's thesis)*. https://www.duo.uio.no/bitstream/handle/10852/43040/Weldemichael-Master.pdf?sequence=1

Wiysonge, C. S., Uthman, O. A., Ndumbe, P. M., & Hussey, G. D. (2013). A bibliometric analysis of childhood immunization research productivity in Africa since the onset of the expanded program on immunization in 1974. *BMC Medicine*, *11*(1), 66–66. https://doi.org/10.1186/1741-7015-11-66

Wonkam, A., Kenfack, M. A., Muna, W. F. ., & Ouwe-Missi-Oukem-Boyer, O. (2011). Ethics of human genetic studies in sub-Saharan Africa: The case of Cameroon through a bibliometric analysis. *Developing World Bioethics*, *11*(3), 120–127. https://doi.org/10.1111/j.1471-8847.2011.00305.x

Yallew, A. T. (2020). Higher education in Ethiopia: Recent developments and challeges. *AfricArXiv Preprints*. https://doi.org/10.14293/111.000/000009.v1

Yallew, A. T., Langa, P. V., & Nkhoma, N. (2021). English language in African higher education: A systematic review. *Southern African Linguistics and Applied Language Studies*, *39*(1), 5–29. https://doi.org/10.2989/16073614.2021.1914695

Yen, C.-P., & Hung, T.-W. (2018). New data on the linguistic diversity of authorship in philosophy journals. *Erkenntnis*, *84*(4), 953–974. https://doi.org/10.1007/s10670-018-9989-4

Yigezu, M. (2013). Funding higher education in Ethiopia: Modalities, challenges, opportunities and prospects. In T. Damtew (Ed.), *Funding higher education in sub-Saharan Africa* (pp. 38–70). Palgrave Macmillan, London. https://doi.org/10.1057/9781137345783_3

Yirdaw, A. (2016). Quality of education in private higher institutions in Ethiopia. *SAGE Open*, *6*(1), 1–12. https://doi.org/10.1177/2158244015624950