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Differing priorities: International research collaboration trends of South African universities, 2012–2021

Abstract

This study analyses international research collaboration (IRC) trends of South African public universities during the 2012-2021 period. While previous studies have explored IRC trends between South Africa and the rest of the world, there is a gap in literature when it comes to the analysis of institutional IRC trends. Using bibliometric data from Scopus, we analyse the internationally co-authored scholarly output of 24 public universities. Our focus is on the annual and overall institutional IRC trends; a comparison of IRC trends between different institutional types; and an analysis of institutional IRC trends broken down by world regions. Our findings show that the inequalities rooted in colonial and apartheid policies continue to be evident in South African higher education, and that most of the scholarly output through IRC is produced by historically white institutions (HWIs). The findings highlight that HWIs prioritise IRC with the Global North while neglecting research collaboration with the African continent and Global South. On the other hand, even though research output at historically black institutions (HBIs) is low, these institutions prioritise intra-Africa and South-South IRC. Our findings highlight the need for the government to move beyond the policy rhetoric and implement programmes that would enable HBIs to develop capacity to produce scholarly output through national and international collaboration. The government also needs to develop incentives for universities which are contributing to the expansion and strengthening of IRC within the African continent and Global South, in line with the national higher education and research priorities.

Keywords: *bibliometric analysis, higher education, internationalisation, international research collaboration, research, South Africa*

1. Introduction

Research collaboration is seen as key for the expansion and development of scientific knowledge. It includes collaboration within institutions and countries, and between institutions and researchers from different countries. International research collaboration (IRC) contributes to sharing ideas and perspectives across borders, strengthening academic, scientific and institutional networks and partnerships,

improving research performance, increasing accessibility to research infrastructure and funding, and strengthening research capacity (Kwiek, 2021; Vieira, 2022). IRC increases the visibility and impact of scholarly research (Asubiaro, 2019; Sooryamoorthy, 2019). Increasing IRC is also seen by many higher education institutions as an important means in the quest to improve institutional standings in international rankings (Sooryamoorthy, 2019).

Research collaboration is one of the core functions of all South African public universities (Sooryamoorthy, 2010). The Department of Higher Education and Training (DHET, 2013b; 2019) lists international research collaboration as one of the main priorities for the higher education sector. While during apartheid institutional and national collaboration dominated the co-authored scholarly output (Sooryamoorthy, 2019), the trends changed after 1994 when South African universities began expanding IRC with the rest of the world (Onyancha, 2011; Sooryamoorthy, 2019; Heleta & Jithoo, 2023). Studies by Onyancha (2011), Mouton *et al*. (2019a), Sooryamoorthy (2019) and Heleta and Jithoo (2023) have analysed IRC trends and patterns at different time periods for the South African higher education system. These studies have found that the public higher education system has since 1994 prioritised IRC with the Global North while neglecting collaboration with the African continent and most of the Global South.

South Africa's research capacity is half the size when compared to countries of similar size and population around the world. The country also lags behind when it comes to the investment in higher education and research, when compared to many similarly sized countries. Despite all the challenges, the higher education system still produces considerable research output (Mouton *et al*., 2019a). The country is the leading producer of scholarly output on the African continent (Sooryamoorthy, 2019). Notably, the higher education system has doubled the total number of scholarly publications between 2005 and 2017 (Mouton *et al*., 2019b). Between 2012-2021, almost half of South Africa's research output was produced through IRC (Heleta & Jithoo, 2023). However, the research capacity, infrastructure and publication figures in a highly unequal higher education system differ significantly when the institutions are compared, with six historically white universities producing almost half of the overall research output in the country in 2019, while eight historically black universities contributed less than 10% (DHET, 2021).

While the above-mentioned previous studies have explored and analysed IRC trends between South Africa and the rest of the world, there is a gap in the literature when it comes to the analysis of institutional IRC trends. This study unpacks and analyses IRC trends for South African public universities during the 2012-2021 period. For our analysis, we use the Scopus bibliometric data from 24 universities indexed by Scopus. Specifically, we focus on the examination and analysis of internationally co-authored scholarly output trends between 2012-2021 for South African universities; the analysis of annual and overall institutional IRC trends; the comparison of IRC trends between different institutional types; and the examination and analysis of institutional trends in co-authorship of scholarly output through IRC broken down by world regions. The study is structured as follows: the next section will discuss the methodology used in the study. This will be followed by a contextual background about South African higher education, including differentiation and inequality within the public higher education system, research mandates, academic staff demographics and research output, past trends in IRC, and a summary of policy priorities regarding IRC. The following section will unpack and discuss the findings that emerged in this study. The last section will present conclusions and recommendations.

2. Methodology

Bibliometric analysis is an important and widely used methodology for analysis and assessment of research performance (Pouris, 2012; Sooryamoorthy, 2019; Onyancha, 2021; Ngwenya & Boshoff, 2022), including the analysis of research collaboration trends for institutions and countries. Bibliometric studies that focus on co-authored publications can provide an indication of trends, patterns and extent of research collaboration and the magnitude of collaborative scientific work within and between institutions, both nationally and internationally (Sooryamoorthy, 2009; Mouton *et al*., 2019a). While other higher education collaboration trends and activities are not always easy to measure, bibliometric data allows researchers to assess, analyse and measure research co-authorship trends and patterns over time (Kwiek, 2020).

In this study, IRC refers to scholarly research co-authored by two or more researchers or academics from at least two different countries (Kwiek, 2021). Our focus is on scholarly output by academics and researchers affiliated with South African public universities, produced in collaboration with their counterparts in other countries. For examination and analysis of institutional data, we accessed Scopus-indexed publications data for each of the 24 South African universities for which the data are available. Scopus is one of the largest global curated bibliometric databases and includes academic journals, books, conference proceedings, as well as other scholarly output published by academic journals and publishers around the world. The Scopus database has more than 80 million publication records, with new publications added annually (Baas *et al*., 2020). The data from Sol Plaatje University and University of Mpumalanga, both established in 2014, are not included in our analysis as these two universities are not yet indexed by Scopus.

The data analysed in this study includes all academic fields and all internationally co-authored publications by academics and researchers affiliated with South African universities indexed by Scopus. The publication sets from each university were first analysed on the SciVal online platform, and relevant data were exported to Excel for an in-depth analysis of IRC trends. In terms of the data analysed in this study, the combined research output through international collaboration for the 2012-2021 period for 24 institutions indexed by Scopus was 118 322 publications. When all international collaborations are counted, academics and researchers affiliated with South African universities participated in 454 153 collaborations during this period. The difference here is that a co-authored publication can count as more than one international collaboration in cases where the authors are from more than two countries (for example, one co-authored publication by a South African researcher with researchers from Ghana, France and China will count as collaboration with three countries). The data were retrieved from Scopus between 22-27 February 2023. The latest Scopus/SciVal update for the data used in this study was on 15 February 2023.

Limitations of bibliometric analysis include the fact that not every IRC leads to a publication (Kwiek, 2018) and does not feature in the studies that rely on bibliometric data. In addition, other aspects of IRC – such as capacity building – are either difficult to measure or are measured through other methods and approaches (Kwiek, 2020). Thus, research collaboration is frequently measured by focusing on co-authored publications (Bozeman & Boardman, 2014). An additional limitation is the focus on Scopus bibliometric data, which ignores scholarly output not indexed by Scopus. Asubiaro (2019) highlights that many African journals are not indexed in large international indexes. Pouris (2012) adds that international bibliometric indexes such as Scopus and Web of Science focus largely on English-language

journals and academic books and neglect a significant amount of scholarly output produced in other languages. However, despite these challenges, it is important to note that Scopus and Web of Science are the largest indexes on the list of DHET-accredited journals where South African academics and researchers are expected to publish their scholarly output. In 2017, 74% of South Africa's scholarly output was published in journals indexed by Scopus or Web of Science (Mouton *et al*., 2019b). Furthermore, apart from the DHET's own list of South African journals and the Scientific Electronic Library Online South Africa (SciELO SA) list, all other lists of accredited journals are European-based indexes that index a small number of journals from Africa. No African (outside South Africa) or Global South-specific indexes were part of DHET's list of accredited journals between 2017-2023, the period for which the lists are available on DHET's (no date) website.

3. Ethical considerations

This study has received an ethics waiver from the ethics committee of Durban University of Technology as the data used in this study is available in the public domain.

4. Contextual background

While bibliometric studies rely primarily on quantitative bibliometric datasets, bibliometric research can benefit from a contextual background that provides an insight into higher education settings, histories, contemporary developments and challenges, institutions and relevant frameworks and policies that impact research and collaboration (Ngwenya & Boshoff, 2022). Due to this, this section provides the historical, contemporary and policy context relevant for the bibliometric analysis of institutional IRC trends in South African higher education during the 2012-2021 period. We unpack historical and contemporary differentiation and inequality in the system, institutional research mandates, academic staff demographics and research output, past trends in South African IRC, and what key policy documents say about IRC.

5. Differentiation and inequality

Colonialism and apartheid have had a profound influence on South African higher education. Through systemic inclusion of whites and systemic exclusion and marginalisation of black people for many decades, higher education has played a key role in the propagation and entrenchment of white supremacy and deepening of inequality between advantaged white and disadvantaged black populations (Badat, 2015; Kamola, 2016). During apartheid, the higher education system was racially segregated, with separate institutions for white, black, Indian and coloured people. While the Afrikaans and English white institutions had institutional independence and academic freedom as long as they did not challenge the apartheid system, black institutions were under strict control of the apartheid regime, which controlled their academic programmes, councils, and academic and administrative appointments (Nordkvelle, 1990; Kamola, 2016; Heleta, 2022). Institutional and research capacity of historically black institutions (HBIs) were deliberately and systematically curtailed, while historically white institutions (HWIs) were supported and funded (Nordkvelle, 1990; DoE, 1997; Badat, 2015; Breetzke & Hedding, 2018). Prior to 1994, only HWIs were seen as knowledge producers. HBIs were designed as producers of a small number of university-educated black graduates primarily on the undergraduate level, and not as research institutions. In a similar way, technikons (which became universities of technology after the end of apartheid) were seen as institutions involved primarily in training of undergraduate-level students and the development of technical skills, and not as producers of knowledge (Sooryamoorthy, 2010; Kamola, 2016).

During apartheid, HWIs received generous research grants, which were not given to HBIs. Despite the reforms that took place in the late 1980s and early 1990s, the proportion of research funds given to HWIs in 1991-1992 was 93%, while the HBIs received only 7% (Sooryamoorthy, 2010). According to Badat (2015: 177), "the fundamental differences in allocated roles" distinguished HWIs and HBIs and this "constituted the key differentiation and the principal basis of inequalities between them". Thus, the apartheid-era differentiation has had a profound impact on the capacity and ability of institutions to produce knowledge. In 1993, for example, white universities produced 92% and white technikons 1% of South Africa's research output, while black universities produced only 7% (Essop, 2020).

After the mergers in the early 2000s and the establishment of two new institutions in 2014, the South African public higher education system now comprises 26 institutions: 11 traditional universities (also known as research-intensive universities), 9 comprehensive universities (institutions that combine functions of traditional universities and universities of technology) and 6 universities of technology (DHET, 2022). The system remains differentiated alongside the colonial and apartheid divisions between HWIs and HBIs,[1] with research capacity inequalities rooted in the country's racist past and the policies that undermined the institutional and research capacity of HBIs for many decades (DHET, 2013a). These inequalities are still reflected in the research output produced by universities. In 2019, for example, 46% of South Africa's research output was produced by six HWIs. In comparison, eight HBIs produced only 9.73% of the research output, with the rest produced by merged institutions (DHET, 2021), many of which were created through mergers of large HWIs and smaller HBIs in the early 2000s (DHET, 2013a), and two new universities that were created in 2014. Essop (2020: 69) writes that the higher education system "is a mirror of the broader society and reflects the deep-seated social and economic inequalities inherited from apartheid, which endure and continue to act as a blight on the democratic foundations based on social justice established in 1994". Badat (2015: 187) adds that South African public higher education continues to be shaped by a "historical burden" of racist planning during apartheid which systematically "institutionalised inequities that resulted in universities characterised by educational, financial, material and geographical (white) advantage and (black) disadvantage".

6. Research mandate

For most of the apartheid years, only white universities had a research mandate and received support and research grants for development of research capacity and for conducting, publishing and disseminating academic research. Research mandates were added to the core functions of HBIs and technikons only in the 1980s (DoE, 1997; Sooryamoorthy, 2010). In the post-apartheid period, all public higher education institutions in South Africa – from research-intensive universities, comprehensive universities, to universities of technology – have research mandates and are expected to produce scholarly output linked to their institutional

1 After the mergers in the early 2000s, the South African public higher education system now consists of eight historically black universities: University of Fort Hare, University of Limpopo, University of the Western Cape, University of Venda, University of Zululand, Walter Sisulu University, Mangosuthu University of Technology and Sefako Makgatho Health Sciences University; six historically white universities: University of Cape Town, University of the Witwatersrand, Stellenbosch University, University of Pretoria, University of the Free State and Rhodes University; and ten institutions which were created through mergers of HWIs and HBIs: University of KwaZulu-Natal, University of Johannesburg, North-West University, University of South Africa, Nelson Mandela University, Tshwane University of Technology, Durban University of Technology, Cape Peninsula University of Technology, Vaal University of Technology and Central University of Technology (Bunting, 2006; DHET, 2013a; Hall, 2015). In addition, two new institutions were added to the system in 2014: the University of Mpumalanga and Sol Plaatje University.

focus areas, priorities and mandates (DoE, 1997; DHET, 2013b). Prioritisation of research at all universities is in part due to DHET's research funding model which pays subsidies to universities for publishing scholarly output, and because most universities are paying close attention to, or participating in, international university rankings (Essop, 2020). Badat (2015) adds that an assumption exists in the higher education sector that prestige and institutional status are linked to the universities being seen as producers of scholarly output and new knowledge. Scholarly publications also remain key factors for lecturers, academics and researchers building their academic careers and seeking promotions and professional growth at all universities (Mouton & Prozesky, 2018; Mouton *et al*., 2019b; Sooryamoorthy, 2019).

7. Demographics and research output

As noted by Badat (2015), racism and white supremacy have profoundly shaped the composition of academic staff in South African higher education. During apartheid, whites comprised the majority of academic staff at HWIs and HBIs. For example, out of 10 334 academic staff in South African higher education in 1984, 9 492 (91.85%) were white, 423 (4.09%) were black, 290 (2.8%) were Indian and 129 (1.24%) were coloured. In 1984, HWIs had 8 506 academic staff, while HBIs had only 1 828 academic staff, of whom the majority (1 217) were white (South African Institute of Race Relations, 1985, as cited in Nordkvelle, 1990). In 1994, whites comprised 83% of the academic staff in public higher education. Since then, the system has seen transformation. In 2020, whites, who make up less than 10% of the South African population, accounted for 41.3% of all permanent academic staff at public universities (DHET, 2022). However, while black South Africans make up the majority of all permanent academic staff in instruction and research at HBIs and some merged institutions, whites still dominate the academic staff component at HWIs (DHET, 2022).

Long after the end of apartheid, white academics and researchers still dominate the production of scholarly output in South African higher education. In 2005, white academics produced most of the scholarly output (84.7%), followed by black academics (5.5%), Indian/Asian academics (6.7%), and coloured academics (3.1%)[2]. In 2019, the share of the research output produced by white academics was 59.5%, followed by black academics (25.6%), Indian/Asian academics (10.5%), and coloured academics (4.4%) (DHET, 2021). One of the main reasons for the continued domination of white academics and researchers in terms of production of scholarly output is the fact that white academics make up the majority of senior academic staff in the country. For example, in 2015, 75% of professors in the public higher education system were white, 15% black, 6% Indian, and 4% coloured. Similar trends exist at the associate professor level (Breetzke & Hedding, 2018).

8. Past trends in South Africa's IRC

Between the 1960s and 1990s, the struggle against apartheid led to numerous pressures on the apartheid regime, including international sanctions and an academic boycott, which impacted the ability of South African universities to engage and collaborate internationally (Sooryamoorthy, 2010; Onyancha, 2011). The academic boycott was particularly strong across the African continent, Asia and the Nordic region (Nordkvelle, 1990), leading to significant isolation of South African universities internationally (Cross, Mhlanga & Ojo, 2011). However, despite the academic boycott, HWIs were still able to collaborate with several countries, institutions and researchers in the Global North (Nordkvelle, 1990; Cross *et al*.,

2 The demographic classification used in this section is based on the DHET's (2021) classification.

2011; Sooryamoorthy, 2019). A study by Sooryamoorthy (2009), which explored South Africa's IRC between 1966-2005, found that South African academics and researchers working at HWIs collaborated with the United States, Britain, West Germany, Australia, Canada, France and other countries in the Global North. The colonial, neocolonial and ideological ties were key factors driving academic collaboration between South Africa and above-mentioned countries during apartheid.

The apartheid differentiation between HWIs and HBIs and between universities and technikons has had an impact on the capacity of these institutions when it comes to internationalisation and IRC (DHET, 2019). The HWIs were generously supported by apartheid governments to build their infrastructure and academic and research capacity over many decades, while the HBIs were denied material support, research mandates and academic freedom for knowledge creation and engagement outside South Africa's borders (DoE, 1997; Badat, 2015). In particular, the apartheid regime feared the engagements between black South Africans and people from the rest of the African continent and elsewhere in the Global South, putting strict restrictions in place to prevent the free movement of people and ideas. Due to all these factors, HWIs were able to build their international reputation, linkages and partnerships during apartheid with colonial, neocolonial and geopolitical allies in the Global North (Sooryamoorthy, 2009) while largely neglecting the African continent and the Global South (Cross *et al*., 2011). At the same time, HBIs and black academics were not able to network, collaborate and engage freely on the African continent and elsewhere in the world due to the apartheid regime's strict controls and repression (Nordkvelle, 1990).

After the end of apartheid in 1994, the South African higher education system and institutions were allowed to 'rejoin' the rest of the world. Many institutions, researchers and academics took this opportunity to enhance existing links and partnerships and/or to establish new linkages and collaborations. However, in the post-apartheid period, universities have continued to favour engagements and collaboration with the Global North, while largely neglecting collaboration with the African continent and most parts of the Global South (Sehoole, 2006; Onyancha, 2011; Maringe & Ojo, 2017; Mouton *et al*., 2019a; Sooryamoorthy, 2019; Heleta & Jithoo, 2023). A study of South Africa's international research collaboration trends during 2012-2021 has highlighted that the higher education sector has collaborated primarily with the Global North during this period (64% of all co-authored publications), while collaboration with the Global South stood at 36%. In terms of the world regions, 44% of South Africa's IRC during 2012-2021 was with institutions in Europe, 18% with Asia Pacific, 15% with North America, 13% with Africa, 5% with the Middle East and 5% with South America (Heleta & Jithoo, 2023).

In the post-apartheid period, the lack of funding for research and IRC has been one of the main challenges facing HBIs. Other challenges include the lack of infrastructure and academic staff capacity for research-related activities (Kamola, 2016; Essop, 2020). Most HBIs remain disadvantaged and possess inadequate resources, infrastructure and research capacity, and continue to struggle to contribute to knowledge production (DHET, 2013a; Badat, 2015; DHET, 2021). At the same time, HWIs have institutional capacity, international linkages and reputations that assist them in attracting foreign collaborators and funding for research (DHET, 2013a; Kamola, 2016). The DHET (2020) highlights that HBIs require targeted support from the government to improve the capacity of institutions, academics and researchers to conduct and publish quality research and engage in IRC.

9. South African policy priorities and IRC

This section highlights key policy documents that discuss post-apartheid research priorities in South African higher education. The 1997 *Education White Paper* calls for the rethinking of all past practices linked to teaching, learning and research and for the redress of apartheid-era inequalities within the higher education system. The document further stresses that universities need to focus their research endeavours on South African needs and priorities, as well as the challenges and priorities of the African continent (DoE, 1997). According to the *White Paper on Post-School Education and Training* (DHET, 2013b), the purpose of research and knowledge production at public universities in South Africa should be to contribute to meeting the social and economic needs of the country and its people, engage in partnerships with national and international institutions to develop relevant new knowledge, and promote innovation and development. The White Paper further highlights that the national policy priorities and frameworks must guide institutional priorities and focus areas. It calls on universities to engage in socially responsive research partnerships and collaborations, and to prioritise collaboration with the African continent and Global South, while not neglecting collaboration with other parts of the world. The White Paper further stresses that all public universities must be involved in conceptualisation, production and dissemination of research through institutional, national and international collaborations. Finally, the White Paper notes that the institutions with low levels of research output need to be supported by the government and other stakeholders to develop capacity for high-quality scholarly research and IRC.

The Department of Science and Technology's (2019) *White Paper on Science, Technology and Innovation* notes that, as a leading African producer of knowledge, South Africa and its universities and research institutions have a responsibility to focus their internationalisation of research, science and technology efforts on the African continent, building research networks and contributing to development of knowledge and innovation aimed at meeting the needs and priorities of Africa and its people. The DHET's *Policy Framework for Internationalisation of Higher Education in South Africa* (2019) lists the expansion of IRC as one of its strategic aspirations. It specifically highlights the need to expand research collaboration within the Southern African Development Community (SADC) region and on the African continent. The policy framework further notes that public universities need to prioritise South Africa's own socio-economic, developmental and other interests and needs when conceptualising and planning internationalisation activities, including IRC. Universities are expected to prioritise regional, continental and Global South collaborations, while also continuing to engage with the Global North.

10. Results and discussion

10.1 Institutional research output trends

In this section, we analyse institutional research output trends for the 2012-2021 period. We compare different universities in terms of their research output production by type of collaboration and explore annual institutional IRC trends. Figure 1 shows the institutional research output trends, broken down in terms of international, national and institutional collaboration and single authorship. The figure highlights significant differences in terms of the proportion that IRC occupies in the overall research output. At three institutions – the University of Cape Town, University of the Witwatersrand and University of the Western Cape – scholarly output through IRC constituted more than 50% of the overall research output

during 2012-2021. This is higher than the percentage of South Africa's overall research output produced through IRC, which stood at 48.1% during the same period (Heleta & Jithoo, 2023). Two other institutions – Stellenbosch University (49.4%) and the University of KwaZulu-Natal (48.7%) – have co-authored scholarly output through IRC above the national average. On the other side of the spectrum are institutions such as the Vaal University of Technology, Mangosuthu University of Technology and Central University of Technology, which primarily produced scholarly output through national and institutional collaboration, while IRC constituted about 20% of the overall output at these institutions during 2012-2021. Due to the fact that the South African research funding model does not encourage national or international research collaboration – as institutions either share funding for national collaboration or receive less funding for IRC – it is not surprising that HWIs (with the University of the Western Cape as an exception) lead when it comes to scholarly output through IRC, as these institutions have more capacity and funding than other institutions in the country (DHET, 2013a) and do not need to prioritise scholarly output that would maximise their DHET research subsidies.

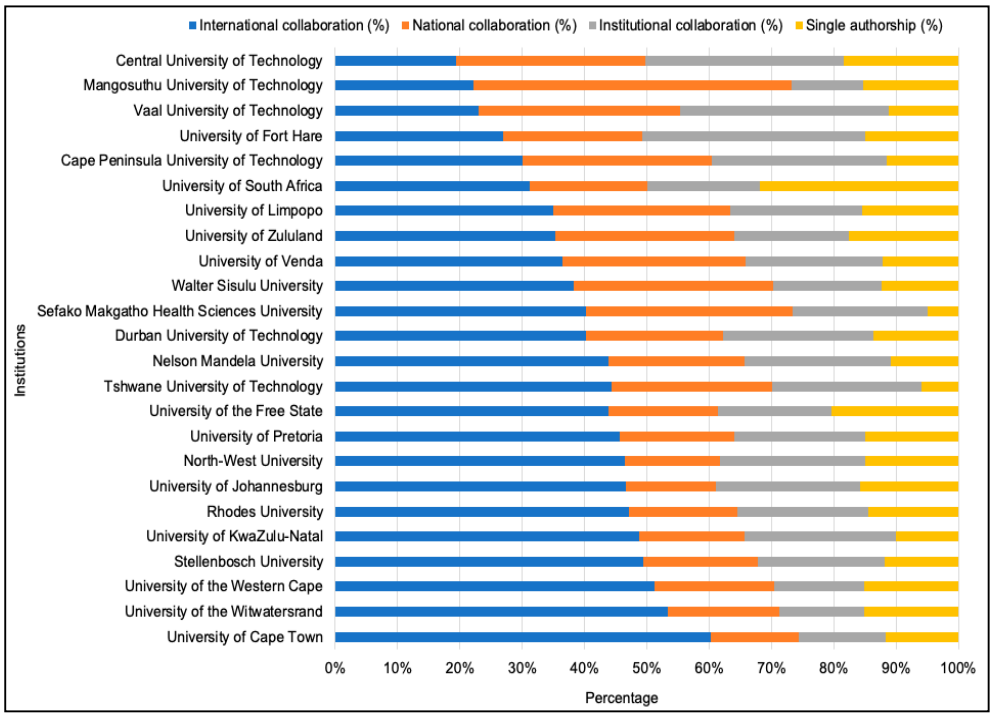

Figure 1: Institutional research output trends by type of collaboration, 2012-2021

Figure 2 highlights institutional IRC trends during the 2012-2021 period. The figure highlights three distinct groups of institutions. The first group shows significant growth in IRC at the University of Cape Town, University of the Witwatersrand, University of Stellenbosch, University of KwaZulu-Natal and University of Pretoria since 2012. Another significant growth is seen in the IRC trends at the University of Johannesburg, from 437 internationally co-authored publications in 2012 to 2 205 in 2021. The second group shows a moderate growth in IRC at North-West University, the University of the Free State, University of South Africa and University of the Western Cape. The third group of all other institutions shows limited to

no annual IRC increases. Similar to Figure 1, it is evident in Figure 2 that the significant growth in IRC between 2012-2021 has happened largely at HWIs, with limited to no growth at most HBIs. See Appendix 1 for a table with the detailed annual figures for all institutions.

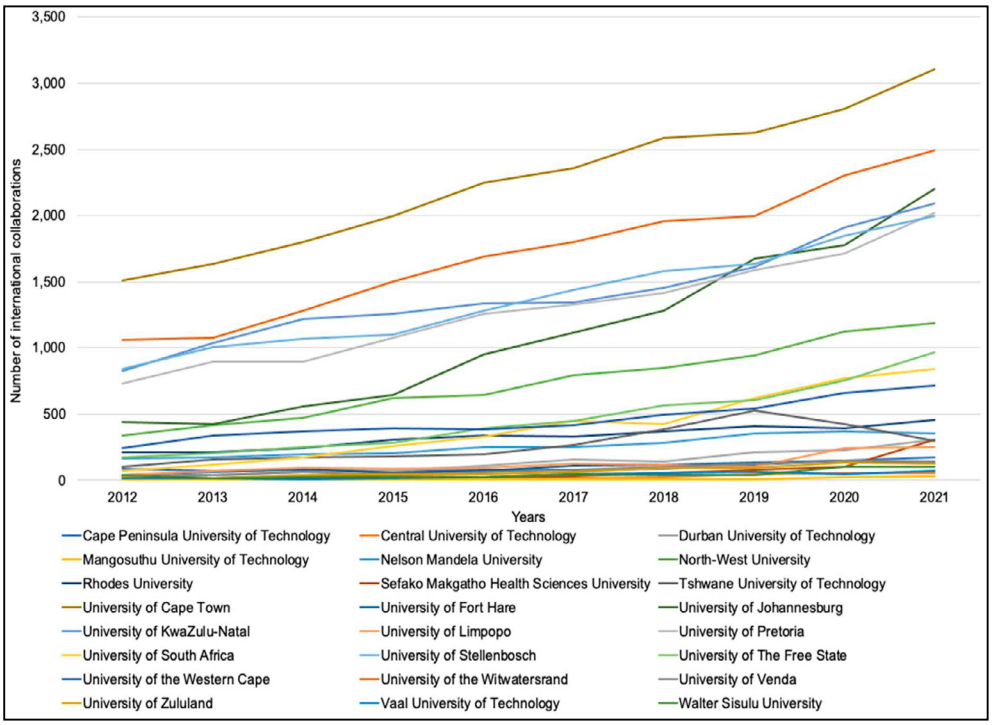

Figure 2: Institutional international research collaboration trends, 2012-2021

Figure 3 presents the overall scholarly output through institutional IRC during the 2012-2021 period. It is evident that the University of Cape Town dominates when it comes to the overall scholarly output produced through IRC, followed by the University of the Witwatersrand. Figure 3 also indicates that the University of Johannesburg leads among comprehensive universities, while the Tshwane University of Technology leads among universities of technology. The differentiation of institutions by type in Figure 3 is based on Hall's (2015) analysis of mergers and differentiation in the South African higher education system. Similar to Figure 2, Figure 3 highlights striking differences in the higher education sector. While all institutions have a research mandate and are expected to produce scholarly output through international and other types of collaboration (DHET, 2013b), it is evident that the production of scholarly output through IRC is dominated by a select few institutions.

Given the differentiation within the system in terms of institutional types, it is expected that research-intensive institutions would produce more research output than comprehensive universities and universities of technology. However, it is evident from Figure 3 that the higher education system remains highly unequal, with only a few institutions having capacity for comprehensively conducting research and collaborating internationally, while many institutions continue to struggle. As we will discuss below in more detail, the inequalities within the system are rooted in the historical differentiation of institutions, with historically

black universities still facing challenges to produce research output through IRC. This is also evident in Figure 3, where the scholarly output through IRC by two research-intensive HBIs (University of Limpopo and University of Fort Hare) represents a small fraction of scholarly output by research-intensive universities in the country.

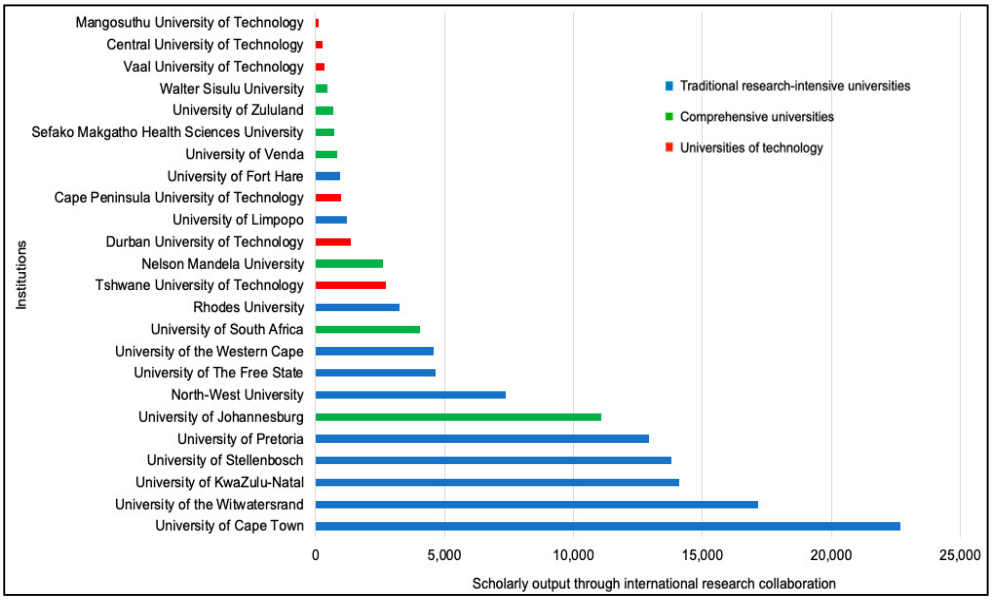

Figure 3: Overall institutional scholarly output through international research collaboration, 2012-2021

Apart from comparing different institutions and their IRC trends, we are also interested in comparing different institutional types in terms of IRC trends during 2012-2021. Figure 4a highlights that eleven traditional universities have participated in and produced the majority of South Africa's scholarly output through IRC, co-authoring 102 657 publications with international counterparts. This is followed by seven comprehensive universities (20 397 co-authored publications), and six universities of technology (5 787). While our focus is on the public higher education sector, it is important to note that other sectors and institutions in South Africa – such as government institutes, research organisations, hospitals and corporates – also participate in IRC and have contributed more to the country's research output (24 811 internationally co-authored publications) than the comprehensive universities or universities of technology during 2012-2021. The South African Medical Research Council, for example, has produced more scholarly output through IRC during this period (4 881) than 17 public universities.

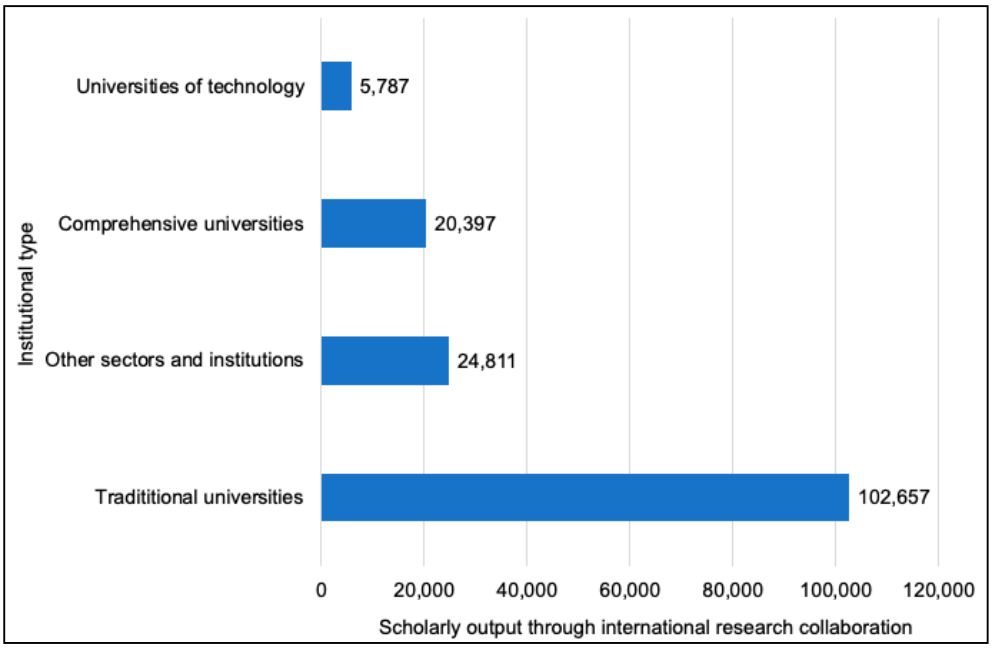

Figure 4a: Scholarly output through international research collaboration by different institutional types, 2012-2021

Figure 4b presents comparisons of public universities and their scholarly output through IRC in terms of their classification as HWIs, HBIs and merged institutions (see footnote 1). Despite all the policies and initiatives since 1994 to bring equity into the system and enable HBIs to strengthen their research capacity and expand international partnerships and collaborations, it is evident that the inequalities and inequities, rooted in colonial and apartheid policies, remain deeply entrenched in the South African higher education system. Between 2012-2021, only 7.40% of South Africa's scholarly output through IRC was produced by HBIs. HWIs produced 57.79% of the scholarly output through IRC, while merged institutions produced 34.81%. It is important to note that similar trends have been observed when it comes to the overall research output in the country. In 2019, 46% of South Africa's research output was produced by six HWIs, while eight HBIs contributed only 9.73% of the overall research output (DHET, 2021).

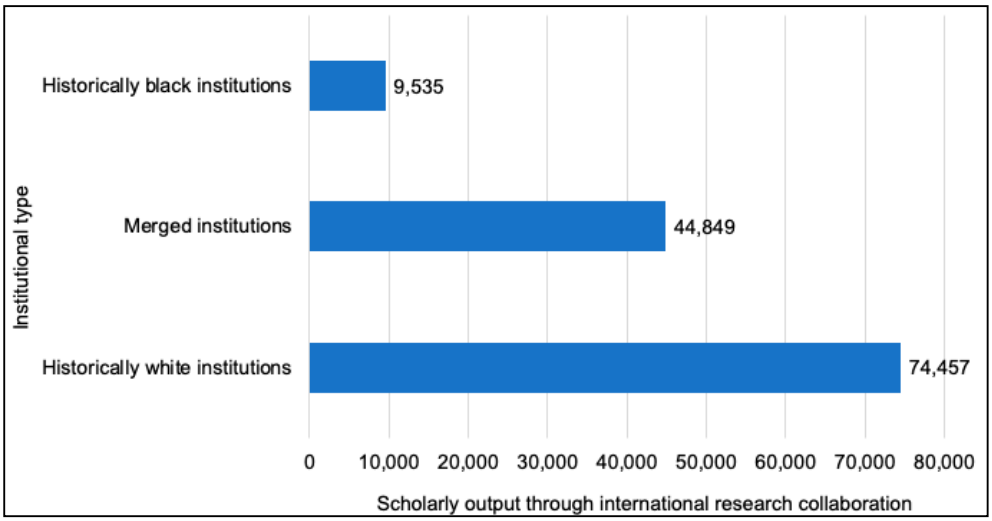

Figure 4b: International research collaboration by different institutional types, 2012-2021

10.2 Trends in institutional international research collaboration by world regions

In this section, we analyse institutional IRC broken down by world regions. This includes regional differentiation between Africa, Middle East, South America, Asia Pacific, Europe and North America based on regional differentiation of bibliometric data by Scopus. Figure 5 presents the breakdown of institutional IRC as a percentage of collaboration by world regions between 2012-2021. This figure presents a striking picture of the South African higher education system and the institutions which prioritise collaboration primarily with Europe, North America and Asia Pacific (top half of Figure 5) and those which prioritise a more balanced collaboration around the globe (the bottom half of Figure 5) (see Appendix 2 for detailed figures of institutional collaboration with different world regions). However, as the data in Figure 5 only presents a partial picture of institutional IRC, we further expand and analyse the data in more detail in Figures 6a and 6b.

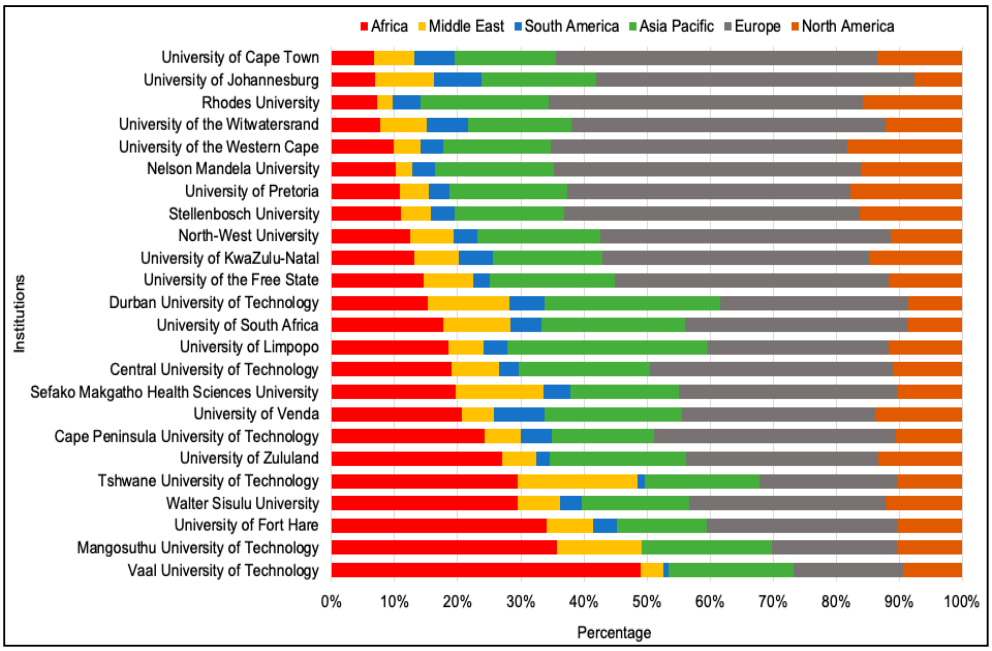

Figure 5: Institutional IRC as a percentage of collaboration by world regions, 2012-2021

Figure 6a presents a detailed breakdown for universities with 5 000 or more international collaborations during the 2012-2021 period that resulted in scholarly output. For these institutions, collaboration with Europe was a priority. For example, collaboration with European institutions made up 50.99% of the University of Cape Town's IRC, followed by Asia Pacific (16.16%) and North America (13.38%). The IRC with institutions on the African continent made up only 6.76% of the University of Cape Town's IRC. Similar trends can be seen in the case of most institutions in Figure 6a. The University of South Africa is the only institution showing different trends when compared to other institutions featured in this figure, with a lower percentage of collaboration with Europe (35.26%) and North America (8.72%), and a higher percentage of collaboration with the African continent (17.77%). It is important to note that while the University of the Western Cape is the only HBI in Figure 6a, its IRC trends do not differ from the trends at HWIs. It is evident from Figure 6a that these institutions have prioritised IRC with Europe, North America and Asia Pacific (primarily Australia), while largely neglecting IRC with the African continent and most other parts of the Global South.

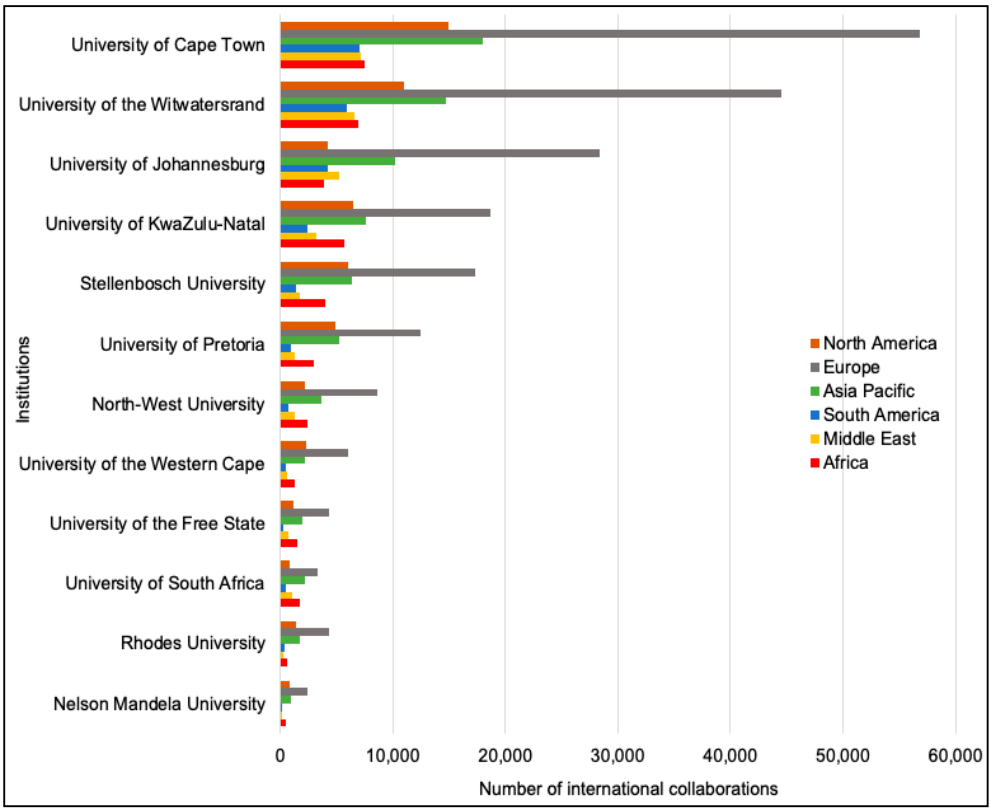

Figure 6a: Trends in institutional international research collaboration by world regions, 2012-2021

Figure 6b[3] presents a detailed breakdown of IRC trends by world regions for universities with less than 5 000 international collaborations during the 2012-2021 period. While the universities highlighted in Figure 6b depict considerably less collaborations than most institutions featured in Figure 6a, their IRC trends present a significantly different picture to the one discussed above. For several institutions in Figure 6b, collaboration with the institutions on the African continent has been a priority – such as Vaal University of Technology (48.94%), Mangosuthu University of Technology (35.71%), University of Fort Hare (34.07%), Walter Sisulu University (29.50%), and Tshwane University of Technology (29.48%). While a number of institutions in Figure 6b continue to prioritise collaboration with Europe, they also engage in a more balanced IRC with other parts of the world. This is in line with the call to South African universities expressed in the *White Paper on Post-School Education and Training* (DHET, 2013b) to prioritise collaboration with the African continent and the Global South, while not neglecting collaboration with other parts of the world. This has not been the case when it comes to most universities featured in Figure 6a above.

3 It is important to note that the x-axis differs in Figures 6a and 6b. This is due to the different international collaboration figures at institutions. Figure 6a presents institutions with more than 5 000 international research collaborations, while Figure 6b presents institutions with less than 5 000 collaborations during the 2012-2021 period.

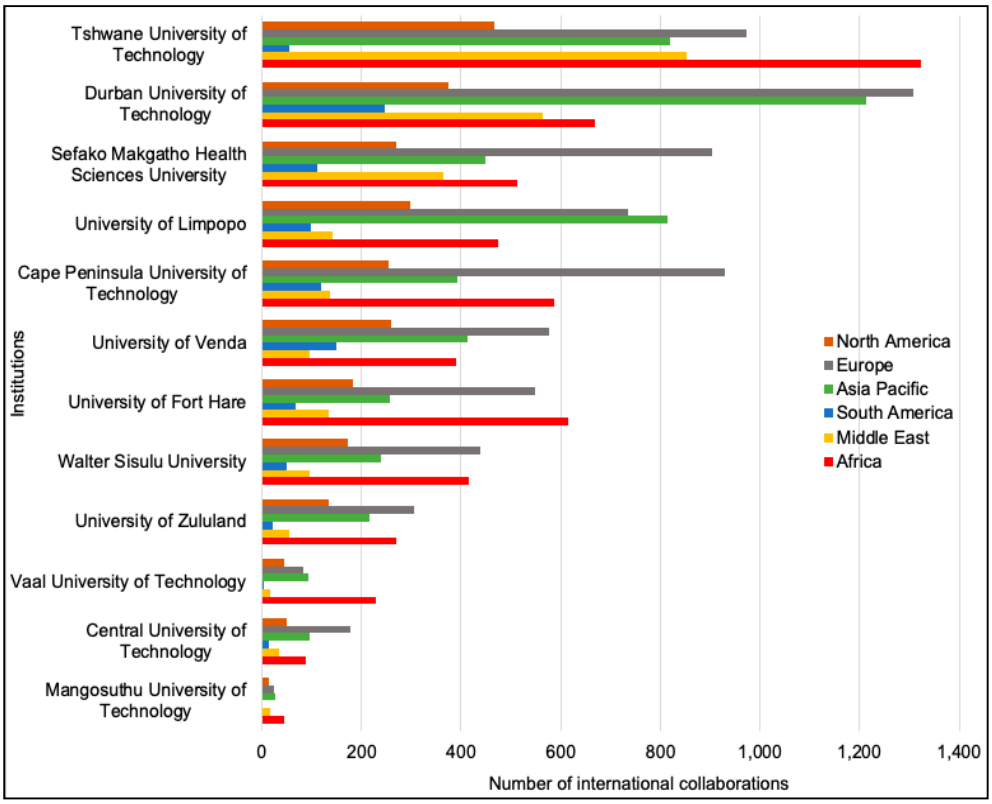

Figure 6b: Trends in institutional international research collaboration by world regions, 2012-2021

Apart from showcasing the world regions with which universities collaborate, Figures 6a and 6b also highlight the complexities and deep inequalities within the South African higher education system. While HWIs and some merged institutions have largely neglected the IRC with the African continent when their overall institutional IRC trends are taken into consideration, they have, at the same time, engaged in more collaborations with their counterparts on the African continent than the HBIs. For example, the University of Cape Town has been involved in 7 533 research collaborations with the institutions on the African continent, and the University of the Witwatersrand has been involved in 6 924 collaborations. While this represents only 6.76% of the overall IRC during 2012-2021 period for the University of Cape Town and 7.72% for the University of the Witwatersrand, the intra-Africa collaboration figures for these two institutions are higher than the overall IRC figures with all world regions for seven out of eight HBIs. Even though the HWIs neglect collaboration with the African continent when looking at their intra-Africa collaboration as a percentage of their overall IRC, at the same time, they are the leading South African institutions that collaborate with the African continent when their intra-Africa collaborations are compared to the overall intra-Africa collaboration figures of the HBIs.

11. Conclusion

International research collaboration is one of the main priorities of the South African public higher education sector and universities (DHET, 2019). IRC contributes to sharing ideas and perspectives across borders, strengthening institutional and research partnerships, improving research performance and visibility, increasing accessibility to research infrastructure and funding, and strengthening research capacity (Kwiek, 2021; Vieira, 2022). While previous bibliometric studies have explored and analysed IRC trends between South Africa and the rest of the world, in this study we have unpacked and analysed institutional IRC trends during the 2012-2021 period. Our focus was on the examination and analysis of scholarly output trends of South African public universities; analysis of annual and overall institutional IRC trends; comparison of IRC trends between different institutional types; and examination and analysis of institutional trends in co-authorship of scholarly output through IRC broken down by world regions.

Our analysis and findings show that despite the government policies and initiatives to bring equity into the higher education system and enable HBIs to develop and strengthen their international partnerships and collaborations after 1994, the inequalities rooted in colonial and apartheid policies and racial segregation continue to be evident in South African higher education. To a large extent, HWIs and HBIs continue to operate as distinct groups of institutions, as they were designed during apartheid, with strikingly different capacities for knowledge production and IRC. As our findings show, during 2012-2021, 57.79% of South Africa's scholarly output through IRC was produced by six HWIs, 34.81% by ten merged institutions, and only 7.40% by eight HBIs. This is similar to the overall inequalities in the production of scholarly output in the country. As noted above, in 2019, 46% of South Africa's research output was produced by HWIs, 9.73% by HBIs, while the rest was produced by merged institutions and two new universities (DHET, 2021). When it comes to IRC, South Africa continues to be largely represented in international collaborations by HWIs. Our findings highlight the need for the DHET to move beyond the policy rhetoric and implement programmes and initiatives that would enable HBIs to develop academic and infrastructural capacity to conduct research and produce new knowledge through institutional, national and international collaboration.

The *White Paper on Post-School Education and Training* (DHET, 2013b) has called on South African universities to prioritise the expansion of research collaboration with the African continent and the Global South, while also maintaining existing and establishing new links and collaborations with other parts of the world. Cross *et al*. (2011) assert that all of the South African universities have had an opportunity since 1994 to transform their priorities and engage in meaningful research collaboration with universities in Africa and elsewhere in the Global South. Our analysis of institutional IRC trends with different parts of the world between 2012-2021 shows that HWIs – while dominating the production of scholarly output through IRC – have continued to prioritise the collaboration and development of new knowledge primarily with their counterparts in the Global North, while largely neglecting the African continent and much of the Global South. On the other hand, while most HBIs have struggled with capacity, infrastructure and funding since the end of apartheid, their prioritisation of intra-Africa and South-South IRC is evident (apart from the University of the Western Cape) despite their research output being much smaller when compared to the HWIs. At the same time, our findings point out that, while the HWIs neglect research collaboration with the African continent when their overall IRC figures are taken into consideration, they are also the leading

institutions in South Africa that collaborate with the African continent when their intra-Africa IRC is compared to the intra-Africa research collaboration figures of HBIs. This highlights the deep inequalities, inequities and complexities within the higher education system.

As noted by Heleta and Jithoo (2023), the Department of Higher Education and Training needs to begin to track institutional IRC trends and patterns and develop incentives for universities which contribute to the prioritisation, expansion and strengthening of IRC with the African continent and Global South. In addition, more research is needed on what influences institutional and academic choices regarding the types of research collaboration (institutional, national or international) in which academics and researchers affiliated with South African universities participate. Future research should examine in more detail the factors that are contributing to inequalities in the production of scholarly output through IRC between HWIs and HBIs, including the academic and research capacity constraints at HBIs. In-depth research is needed on why HWIs continue to prioritise IRC with the Global North, while neglecting collaboration with the African continent and Global South. Future research should explore and analyse the factors that play a role in institutional ability to engage in IRC. More research is also needed on the institutional IRC trends in different academic fields. Finally, research is needed on other sectors and institutions in South Africa, such as government institutes, research organisations, hospitals and corporates, and their role in knowledge production and IRC.

Declaration

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References

Asubiaro, T. 2019. How collaboration type, publication place, funding and author's role affect citations received by publications from Africa: A bibliometric study of LIS research from 1996 to 2015. *Scientometrics,* 120: 1261-1287. https://doi.org/10.1007/s11192-019-03157-1

Baas, J., Schotten, M., Plume, A., Côté, G. & Karimi, R. 2020. Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies. *Quantitative Science Studies,* 1(1): 377-386. https://doi.org/10.1162/qss_a_00019

Badat, S. 2015. Institutional combinations and the creation of a new higher education institutional landscape in post-1994 South Africa. In A. Curaj, L. Georghiou, J. Cassingena Harper & E. Egron-Polak (Eds.), *Mergers and alliances in higher education,* pp. 175-201. New York: Springer. https://doi.org/10.1007/978-3-319-13135-1_9

Bozeman, B. & Boardman, C. 2014. *Research collaboration and team science: A state-of-the-art review and agenda*. New York: Springer. https://doi.org/10.1007/978-3-319-06468-0

Breetzke, G.D. & Hedding, D.W. 2018. The changing demography of academic staff at higher education institutions (HEIs) in South Africa. *Higher Education*, 76: 145-161. https://doi.org/10.1007/s10734-017-0203-4

Bunting, I. 2006. The higher education landscape under apartheid. In N. Cloete, P. Maassen, R. Fehnel, T. Moja, T. Gibbon & H. Perold (Eds.), *Transformation in higher education*, pp. 35-52. New York: Springer. https://doi.org/10.1007/1-4020-4006-7_3

Cross, M., Mhlanga, E. & Ojo, E. 2011. Emerging concept of internationalisation in South African higher education: Conversations on local and global exposure at the university of the Witwatersrand (Wits). *Journal of Studies in International Education*, 15(1): 75-92. https://doi.org/10.1177/1028315309334635

Department of Education [DoE]. 1997. *Education White Paper 3: A programme for the transformation of higher education*. Notice 1196 of 1997. https://www.gov.za/sites/default/files/gcis_document/201409/18207gen11960.pdf [Accessed 15 January 2023].

Department of Higher Education and Training [DHET]. n.d. *University research support and policy development*. https://www.dhet.gov.za/SitePages/University%20Research%20Support%20and%20Policy%20Development.aspx [Accessed 20 February 2023].

Department of Higher Education and Training [DHET]. 2013a. *Report of the ministerial committee for the review of the funding of universities*. https://www.dhet.gov.za/Financial%20and%20Physical%20Planning/Report%20of%20the%20Ministerial%20Committee%20for%20the%20Review%20of%20the%20Funding%20of%20Universities.pdf [Accessed 3 May 2023].

Department of Higher Education and Training [DHET]. 2013b. *White Paper for post-school education and training: Building an expanded, effective and integrated post-school system*. https://www.dhet.gov.za/SiteAssets/Latest%20News/White%20paper%20for%20post-school%20education%20and%20training.pdf [Accessed 19 March 2023].

Department of Higher Education and Training [DHET]. 2019. *Policy framework for internationalisation of higher education in South Africa*. https://www.dhet.gov.za/Policy%20and%20Development%20Support/Policy%20Framework%20for%20Internationalisation%20of%20Higher%20Education%20in%20South%20Africa.p df [Accessed 20 February 2023].

Department of Higher Education and Training [DHET]. 2020. *Strategic plan 2020-2025*. https://www.dhet.gov.za/SiteAssets/DHET%20Strategic%20Plan%202020.pdf [Accessed 20 February 2023].

Department of Higher Education and Training [DHET]. 2021. *Report on the evaluation of the 2019 universities' research output*. https://www.dhet.gov.za/Policy%20and%20Development%20Support/Research%20outputs%20report%202021_final.pdf [Accessed 20 February 2023].

Department of Higher Education and Training (DHET]. 2022. *2020 statistics on post-school education and training in South Africa*. https://www.dhet.gov.za/Information%20Systems%20Coordination/Statistics%20on%20Post-School%20Education%2and%20Training%20in%20South%20Africa%202020.pdf [Accessed 20 February 2023].

Department of Science and Technology [DST]. 2019. *White Paper on science, technology and innovation*. https://www.gov.za/sites/default/files/gcis_document/201912/white-paper-science-technology-and-innovation.pdf [Accessed 20 February 2023].

Essop, A. 2020. *The changing size and shape of the higher education system in South Africa, 2005-2017*. Ali Mazrui Centre for Higher Education Studies. Johannesburg: University of Johannesburg. https://heltasa.org.za/wp-content/uploads/2020/08/Size-and-Shape-of-the-HE-System-2005-2017.pdf [Accessed 10 April 2023].

Hall, M. 2015. Institutional culture of mergers and alliances in South Africa. In A. Curaj, L. Georghiou, J. Cassingena Harper & E. Egron-Polak (Eds.), *Mergers and alliances in higher education,* pp. 145-173. New York: Springer. https://doi.org/10.1007/978-3-319-13135-1_8

Heleta, S. 2022. Eurocentrism, racism and academic freedom in South Africa. In R. Watermeyer, R. Raaper & M. Olssen (Eds.), *Handbook on academic freedom*, 191-205. Cheltenham: Edward Elgar Publishing. https://doi.org/10.4337/9781788975919.00019

Heleta, S. & Jithoo, D. 2023. International research collaboration between South Africa and rest of the world: An analysis of 2012-2021 trends. *Transformation in Higher Education,* 8(0): a246, 1-11. https://doi.org/10.4102/the.v8i0.246

Kamola, I. 2016. Situating the 'global university' in South Africa. In M.H. Meng-Hsuan Chou, I. Kamola & T. Pietsch (Eds.), *The transnational politics of higher education: Contesting the global/ transforming the local,* pp. 42-62. London: Routledge. https://doi.org/10.4324/9781315625379

Kwiek, M. 2018. International research collaboration and international research orientation: Comparative findings about European academics. *Journal of Studies in International Education*, 22(2): 136-160. https://doi.org/10.1177/1028315317747084

Kwiek, M. 2020. Internationalists and locals: International research collaboration in a resource-poor system. *Scientometrics*, 124: 57-105. https://doi.org/10.1007/s11192-020-03460-2

Kwiek, M. 2021. What large-scale publication and citation data tell us about international research collaboration in Europe: Changing national patterns in global contexts. *Studies in Higher Education*, 46(12): 2629-2649. https://doi.org/10.1080/03075079.2020.1749254

Maringe, F. & Ojo, E. 2017. Sustainable transformation in a rapidly globalising and decolonising world: African higher education on the brink. In F. Maringe & E. Ojo (Eds.), *Sustainable transformation in African higher education,* pp. 25-39. Rotterdam: Sense Publishers. https://doi.org/10.1007/978-94-6300-902-7_2

Mouton, J. & Prozesky, H. 2018. Research publications. In C. Beaudry, J. Mouton & H. Prozesky (Eds.), *The next generation of scientists in Africa,* pp. 128-146. Cape Town: African Minds. https://doi.org/10.47622/978-1-928331-93-3

Mouton, J., Basson, I., Blanckenberg, J., Boshoff, N., Prozesky, H., Redelinghuys, H., Treptow, R., Van Lill, M. & Van Niekerk, M. 2019a. *The state of the South African research enterprise*. Stellenbosch: DST-NRF Centre of Excellence in Scientometrics and Science, Technology and Innovation Policy. https://www.sun.ac.za/crest/wp-content/uploads/2019/08/state-of-the-South-African-research-enterprise.pdf [Accessed 10 April 2023].

Mouton, J., Redelinghuys, H., Spies, J., Blanckenberg, J., Lorenzen, L., Ford, K., Visagie, A. & Van Niekerk, M. 2019b. *The quality of South Africa's research publications*. Pretoria: Department of Higher Education and Training, and Stellenbosch: Centre for Research on Evaluation, Science and Technology. https://www0.sun.ac.za/crest/wp-content/uploads/2021/01/quality-of-south-africas-research-publications.pdf [Accessed 10 April 2023].

Ngwenya, S. & Boshoff, N. 2022. Different manifestations of 'context': Examples from a bibliometric study of research in Zimbabwe in Southern Africa. *Scientometrics*, 127: 3911-3933. https://doi.org/10.1007/s11192-022-04435-1

Nordkvelle, Y. 1990. The academic boycott of South Africa debate: Science and social practice. *Studies in Higher Education*, 15(3): 253-275. https://doi.org/10.1080/0307507901 2331377390

Onyancha, O.B. 2011. Research collaborations between South Africa and other countries, 1986-2005: An informetric analysis. *African Journal of Library, Archives and Information Science,* 21(2): 99-112. http://hdl.handle.net/10500/5272

Onyancha, O.B. 2021. Regional and international research collaboration and citation impact in selected sub-Saharan African countries in the period 2000 to 2019. *Global Knowledge, Memory and Communication,* 70(6/7): 577-594. https://doi.org/10.1108/GKMC-04-2020-0039

Pouris, A. 2012. Science in South Africa: The dawn of a renaissance? *South African Journal of Science*, 108(7/8): 1-6. https://sajs.co.za/article/view/9810. https://doi.org/10.4102/sajs.v108i7/8.1018

Sehoole, C. 2006. Internationalisation of higher education in South Africa: A historical review. *Perspectives in Education,* 24(4): 1-13. https://hdl.handle.net/10520/EJC87408

Sooryamoorthy, R. 2009. Collaboration and publication: How collaborative are scientists in South Africa? *Scientometrics*, 80(2): 421-441. https://doi.org/10.1007/s11192-008-2074-z

Sooryamoorthy, R. 2010. Science and scientific collaboration in South Africa: Apartheid and after. *Scientometrics*, 84: 373-390. https://doi.org/10.1007/s11192-009-0106-y

Sooryamoorthy, R. 2019. Scientific knowledge in South Africa: Information trends, patterns and collaboration. *Scientometrics*, 119: 1365-1386. https://doi.org/10.1007/s11192-019-03096-x

Vieira, E.S. 2022. International research collaboration in Africa: A bibliometric and thematic analysis. *Scientometrics*, 127: 2747-2772. https://doi.org/10.1007/s11192-022-04349-y

Appendices

Appendix 1

Institutional international research collaboration trends, 2012-2021. The figures in the table represent the number of international collaborations.

Institution	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cape Peninsula University of Technology	83	72	79	69	80	82	88	117	147	174
Central University of Technology	10	5	10	14	17	17	23	51	55	52
Durban University of Technology	35	43	59	67	107	157	140	209	229	307
Mangosuthu University of Technology	4	5	5	4	8	10	11	8	27	34
Nelson Mandela University	165	174	193	202	248	249	286	357	369	354
North-West University	335	418	469	618	643	796	851	943	1 126	1 184
Rhodes University	213	215	241	303	336	327	369	406	394	456
Sefako Makgatho Health Sciences University	22	19	34	33	23	33	53	75	103	310
Tshwane University of Technology	106	156	175	184	198	270	388	525	423	296
University of Cape Town	1 506	1 635	1 803	1 998	2 250	2 359	2 583	2 622	2 807	3 109
University of Fort Hare	38	60	87	54	69	110	116	133	147	123
University of Johannesburg	437	422	555	641	948	1 115	1 282	1 675	1 774	2 205
University of KwaZulu-Natal	828	1 041	1 217	1 257	1 333	1 346	1 458	1 608	1 907	2 090
University of Limpopo	42	73	98	84	91	127	120	103	240	248
University of Pretoria	734	898	895	1 077	1 255	1 327	1 417	1 592	1 710	2 018
University of South Africa	72	120	175	258	331	449	425	618	768	843
University of Stellenbosch	841	1 009	1 073	1 103	1 282	1 442	1 581	1 632	1 845	1 999
University of the Free State	171	203	249	283	393	447	566	602	755	966
University of the Western Cape	242	340	372	395	388	418	498	544	658	714
University of the Witwatersrand	1 061	1 077	1 281	1 501	1 687	1 801	1 958	1 994	2 304	2 496
University of Venda	35	39	62	41	63	76	104	123	148	139
University of Zululand	23	19	38	49	48	65	95	95	136	125
Vaal University of Technology	18	13	8	13	23	46	52	64	48	67
Walter Sisulu University	37	16	24	24	27	51	38	36	102	104

Appendix 2

Institutional international research collaboration trends by world regions, 2012-2021. The figures in the table represent the number of international collaborations.

	World regions					
Institution	**Africa**	**Middle East**	**South America**	**Asia Pacific**	**Europe**	**North America**
Mangosuthu University of Technology	45	17	0	26	25	13
Central University of Technology	88	35	14	97	178	51
Vaal University of Technology	230	17	4	93	82	44
University of Zululand	271	54	22	216	306	133
Walter Sisulu University	415	95	49	238	438	172
University of Fort Hare	614	133	68	256	548	183
University of Venda	390	95	150	412	576	259
Cape Peninsula University of Technology	587	138	118	393	929	254
University of Limpopo	475	142	99	815	736	299
Sefako Makgatho Health Sciences University	513	364	110	449	903	269
Durban University of Technology	669	563	247	1 214	1 308	374
Tshwane University of Technology	1 324	853	54	820	974	466
Nelson Mandela University	505	131	183	945	2 428	808
Rhodes University	630	210	387	1 762	4 309	1 368
University of South Africa	1 683	998	468	2 157	3 340	826
University of the Free State	1 447	765	270	1 956	4 291	1 150
University of the Western Cape	1 259	557	450	2 203	6 016	2 347
North-West University	2 357	1 292	703	3 663	8 642	2 138
University of Pretoria	3 009	1 248	917	5 186	12 401	4 920
Stellenbosch University	4 035	1 780	1 406	6 403	17 315	6 028
University of KwaZulu-Natal	5 734	3 142	2 368	7 608	18 626	6 487
University of Johannesburg	3 849	5 252	4 255	10 219	28 330	4 238
University of the Witwatersrand	6 924	6 529	5 960	14 702	44 562	10 958
University of Cape Town	7 533	7 101	7 079	18 017	56 858	14 919