Research emphasis and collaboration in Africa

Anastassios Pouris and Yuh-Shan Ho

Researchers contributing to recent scientometric literature regarding scientific co-authorship among African researchers are increasingly investigating the effects, modes and dynamics of, and motives for collaboration. Prof Anastassios Pouris and Prof Yuh-Shan Ho conducted a study to identify co-authorship patterns of research on the African continent through an examination of both the patterns of collaboration at country and continental levels and the scientific disciplines that are emphasised.

Governments utilise research collaboration as a policy instrument for knowledge transfer from abroad and as a means to improve diplomatic relations with other countries by creating goodwill in order to gain political capital (Wagner et al., 2001). Governments allocate substantial resources in support of this objective. Russell (1995) and Wagner et al. (2001) suggest that international collaboration is replacing other models as the preferred method of building scientific capacity in developing countries.

Prof Pouris and Prof Ho approached their research from a policy perspective regarding the importance of assessing the benefits (or otherwise) of international collaboration to the African continent.

Researchers collaborate with each other for various reasons. However, the practice of collaboration is not without debate in terms of its risks and benefits. Arguments against collaboration include the concern that spending on international cooperation is not always beneficial to the paying country and that critical technologies and key knowledge for competitiveness are given away to competitors. An additional concern is the notion that collaborative agreements advocate strategic or political ends rather than the interests of science and technology.

An issue of specific importance in the African context is the dependency on the size of collaboration and the size of the scientific community. Narin et al. (1991) found that the number of international co-authorship projects of scientifically small countries is higher than that of larger scientific countries. Melin (1999) concludes that researchers from scientifically large countries collaborate less internationally than researchers from scientifically small countries, because the first group easily finds partners within its national borders.

Historically, studies on research collaboration focused on data from industrialised countries. More recently, such studies have included developing countries in general and African countries in particular. For this project, co-authorship analyses were used to identify the state of research collaboration on the African continent. The researchers attempted to answer the following questions:

- Which scientific disciplines are emphasised in Africa?
- How did research collaboration evolve in Africa between 2007 and 2011?
- Who are the main research partners of African countries?
- Are the patterns of collaboration (extended and disciplinary) in Africa similar to those in the rest of the world?
- How do the various African countries perform in terms of collaboration?
- Which are the main African institutions that are actively engaged in collaboration?

Data sources and methodology

The data used in this study was retrieved from the Science Citation Index Expanded (SCI-Expanded) of the Thomson Reuters Web of Science. All journal articles that were published in this index by authors on the African continent were selected and analysed to identify publishing institutions and countries, and to classify articles as collaborative or single-authored publications. The researchers limited the analysis to publications between 2007 and 2011, and articles were the only document type considered.

The collaboration type was determined by the affiliation of the authors and is presented in the following way:

- Internationally collaborative publication (ICP) – articles that were co-authored by researchers from at least two countries
- Inter-institutional collaborative publication – articles that were co-authored by researchers from at least two institutions
- Institution-independent article – articles where the researchers' affiliation was from the same institution
- African collaborative publication (ACP) – articles whose authors' affiliations were from different countries on the African continent
- Outside-African continent collaborative publication (OCP) – articles that were co-authored by authors from Africa and from countries outside the African continent

The identified articles were further allocated according to the Web of Science subject categories. The journal citation reports of 2011 indexes 8 336 journals, classified across 176 Web of Science categories. A total of 111 877 articles published by authors in African countries between 2007 and 2011 were analysed.

Output in research areas

The number of world publications in particular fields was compared with the number of African publications in these fields, and the African share and its activity indices in the different fields were determined. The activity index indicates the relative research effort a country or region devotes to a given field. It is defined as the country's share in the world's publication output in that field, divided by the share of the country or region in the world's publication output in all science fields.

It was found that the most emphasised research fields are those of tropical medicine (12.5 times bigger than that expected from the scientific size of Africa), parasitology (6.5 times bigger than that expected from the scientific size of Africa) and infectious diseases (4.6 times bigger than that expected from the scientific size of Africa). The list of emphasised research areas is dominated by medical and natural resources fields (for example, biodiversity, water resources, entomology and mining).

The research areas that are under-emphasised in Africa include those underpinning modern technologies and economies (for example, engineering, physics, chemistry and materials science). This is in contrast to a country like China, which emphasises engineering, physics and chemistry. This raises the following questions: Why does Africa not follow international examples? Are the needs of the African continent served best by its current research emphasis?

These findings lead to arguments that the small research community and research activities on the continent will not be able to resolve current scientific challenges, such as the HIV/AIDS pandemic. If the regional capacity is unable to provide a scientific or technological solution to a challenge, overemphasis on particular disciplines will not be fruitful. Similarly, while international efforts to develop high-technology industries based on brain power are emphasised, these trends are ignored by African countries. For this reason, it may be advisable for African researchers to move away from expensive fields like medicine and focus on wealth-creating disciplines that generally require less investment and may be more easily diffused in African economies and societies.

> This research was approached from a policy perspective regarding the importance of assessing the benefits of international collaboration to the African continent.

Characteristics of collaborative publication outputs

During the five-year period studied, the number of articles from Africa increased by 50%. Single-country articles increased by 35%, while the internationally collaborative articles grew by 66% – almost twice the growth of the single-country articles. It is interesting to compare the share of internationally collaborative articles from Africa (54% of 111 877 articles) with those in other countries between 2007 and 2011.

In the same period, the number of publications and collaborations by the top 20 prolific countries in the world amounted to 5 114 346, as indicated in SCI-Expanded. The Brazil, Russia, India and China (BRIC) members had relatively similar percentages of internationally collaborative articles (26% for Brazil, 33% for Russia, 20% for India and 23% for China). Higher percentages could be found in the Group of Seven (G7) countries (33% for the USA, 51% for Germany, 26% for Japan, 54% for the UK, 52% for France, 44% for Italy and 49% for Canada).

With regard to the collaboration of individual African countries, it was found that these countries exhibit substantially high patterns. Nigeria was the only country with a collaboration rate lower than 50%. Twenty-nine countries published more than 90% of their articles in collaboration with other countries. Although it is possible that the division of the continent into 54 countries may contribute to the

substantial number of collaborative articles, other factors may also affect the apparent pattern.

Internationally collaborative articles grew from 52 to 58% on the African continent between 2007 and 2011. Internationally, articles that list institutions from more than one country (internationally co-authored articles) also grew dramatically, but only from 10 to 24% between 1990 and 2010 (National Science Board, 2012).

From a policy perspective, it is important to identify the benefits or otherwise of international collaboration on the African continent. Does the African agenda direct the collaborative research agenda or is collaboration directed by international imperatives?

Africa's main collaborating partners are the USA, France and the UK. It is important to note that these countries are not only the most collaborative countries in the world (National Science Board, 2012), but also the largest funders of research in the biosciences, with a specific emphasis on medicine and agricultural sciences in Africa.

Single-authored articles in Africa are a matter of concern. The share of single-authored articles in Africa is very small (a single-digit number for most countries). This may raise questions as to whether there is a scarcity of researchers on the continent who are able to undertake research on their own. With the exception of Nigeria (29%) and Egypt (43%), all African countries produce more collaborative articles with co-authors from other countries than with local co-authors.

It is also important to note that the number of OCP articles is much bigger than the number of ACP articles. What drives researchers in Botswana and Zimbabwe, for example, to produce more than 74% of their collaborative publications outside Africa? South African universities are a few hours away by road, while Europe and the USA are a number of hours away by plane.

Similarly, why does Egypt collaborate almost exclusively with non-African countries? Conclusions derived from these examples may argue that African collaboration is not driven by local researchers searching for collaborators, but by the availability of resources and interests outside the continent.

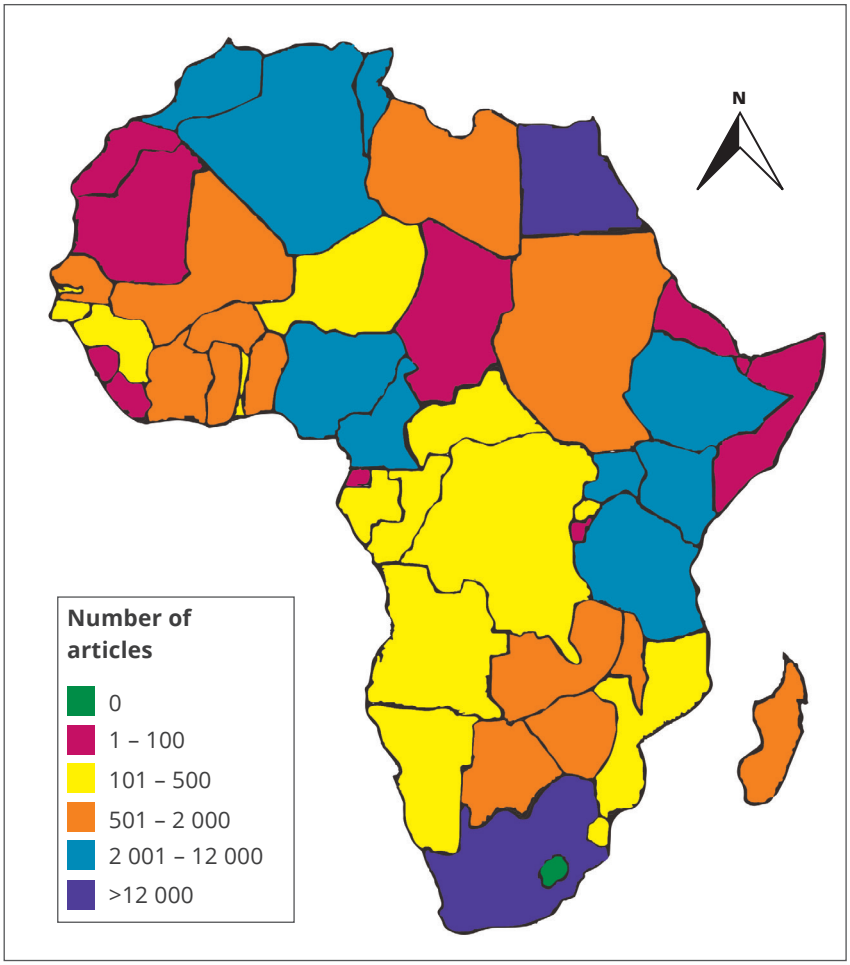
Egyptian (9) and South African (7) institutions dominate the list of the most prolific institutions on the African continent. Ethiopia, Nigeria, Tunisia and Uganda also appear on the list. All institutions have a larger number of inter-institutional collaborative articles than single-institution articles.

An angle to be emphasised in this regard is that South African universities are subsidised by the government according to the number of publications produced by their members of staff (Pouris, 1991). This is a disincentive to inter-institutional collaboration, because collaborating institutions have to share the government subsidy. However, the high share of inter-institutional collaborative articles from South African universities indicates that the forces promoting inter-institutional collaboration are stronger than the adverse impact of the funding mode.

Conclusion

Small scientific countries, because of their scientific limitations, have to be particularly attentive to their research priorities in order to optimise their developmental goals.

The above argument is supported by the identified disciplinary emphasis of Africa's research on natural resources and the medical fields. While it can be argued that this emphasis is underlined by the resources available on the continent and the diseases present, it may be that these priorities are not necessarily the best options for the continent's developmental objectives. It should be mentioned that African



→ *Figure 1: Distribution of articles in African countries.*

prioritisation mechanisms, and any embryonic efforts in this domain are based on the immediate needs of the existing activities, and not on the most achievable and beneficial efforts for the future when the research outputs will materialise.

In the African context, South Africa, for example, spends considerably more research efforts in the field of HIV/AIDS than what is expected from its relative scientific size. It is doubtful that the HIV/AIDS epidemic can be resolved by South African research alone, without the support of the rest of the world. This emphasis may need further assessment (Pouris and Pouris, 2011).

The identification of the research outputs of the African countries and their related collaborative patterns show that the continent suffers from subcritical research systems and collaboration dominance. Single-author articles on the continent appear to be on the verge of extinction. This could be the effect of foreign funding sources that favour groups of researchers and not individual researchers.

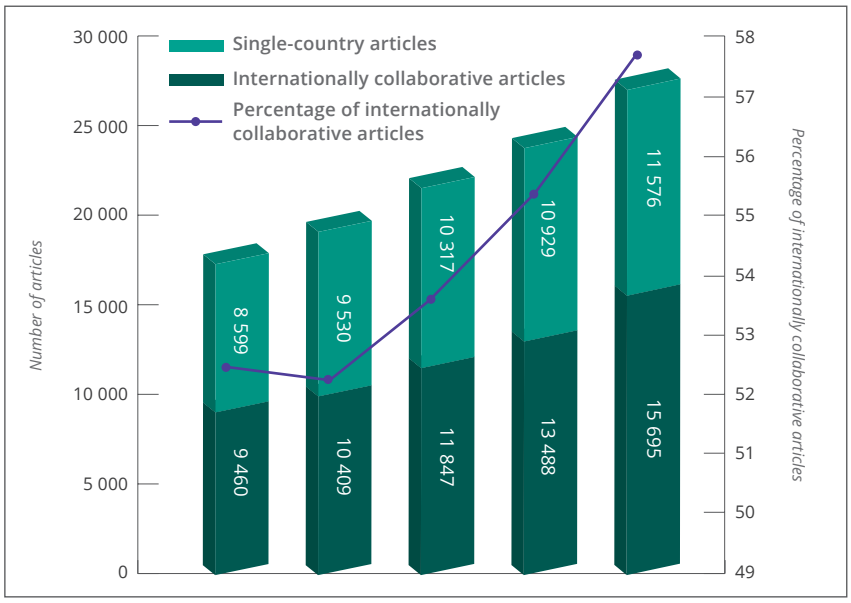


Figure 2: Growth in African collaboration: 2007–2011.

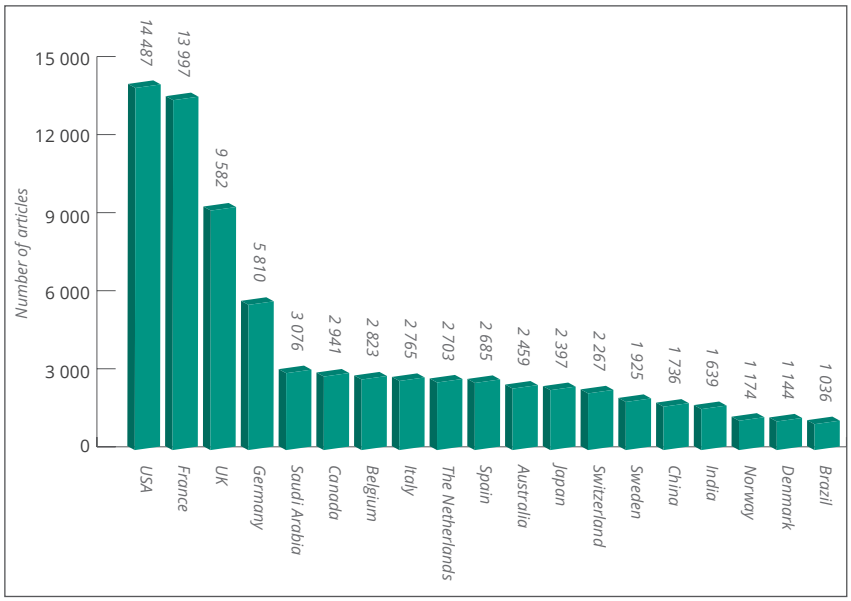


Figure 3: The main collaborating countries with Africa: 2007–2011.

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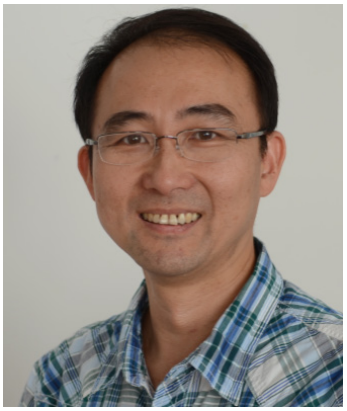

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