

# Insight into Collaboration in Global Warming Research in Africa, 1990–2008: An Informetric Analysis

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## Introduction

Quite rightly, global warming (GW) is becoming a major area of multidisciplinary research, propelled (in part) by growing public interest in its causes and consequences, and numerous scholarly publications that express (or announce) the need for proactive intervention before it is too late (Walther et al. 2002; Mathews 2007; Robick et al. 2003; Berger et al. 2005; IPCC, 2007). A recent study by Ocholla and Ocholla (2008) notes that research publications in the domain since 1990 have increased by over 300% - in the year 2007, a total of 116 countries produced one or more publications on global warming, with the USA (2572; 35.7%), England (834; 11.6%) and Japan (546; 7.6%) leading with 3952 (54.85%) publications. Although statistically insignificant, the contribution of African countries to global warming research exists, as noted by the participation of 18 (of the 53) countries on the continent; South Africa (46), Kenya (14) and Egypt (7) are among the top contributors. Research collaboration between individuals, institutions and countries is increasingly becoming beneficial (Katz & Martin, 1997) and inevitable (Rao and Raghavan, 2003:230). This paper presents a few preliminary findings from an ongoing study on the trends and patterns of collaboration in global warming research in Africa. Thus far, the study has explored: countries collaborating with African countries in global warming research; the contribution of each collaborating country in terms of the number of co-authored papers from 1990-2008; regional and international collaboration in global warming research in Africa; and the degree and strength of collaboration of each country.

## Methods and materials

The study used the widely accepted indicator of research collaboration - the co-authorship of papers - to measure country-wise trends and patterns of global warming (GW) research partnerships in selected African countries from 1990 to 2008. Data was extracted from the Thomson Scientific's Science Citation Index (SCI®) and Social Sciences Citation Index (SSCI®) by using 'global warming' as the main keyword and the names of the countries

as supplementaries. The counting of country-wise co-authorships considered the co-occurrence of an African country with another country in the address field of each record. A country was counted only once, irrespective of how many times it appeared with an African country in the address field of the same record. Relevant data was downloaded and recorded in Microsoft Excel spreadsheets. Data analysis was conducted using the TextSTAT, TI and UCINET software for Windows. The normalized count of co-authored publications indicated the strength of association between collaborating countries. PAJEK software was used to draw the social networks illustrated in Figs 1 and 2.

## Results

### *Domestic vs cross-border collaboration*

Domestic collaboration refers to the partnership of two or more authors from two or more institutions situated within the same country, while cross-border collaboration is a partnership between two or more authors whose institutions are located in different countries. Of the 117 co-authored articles, 67 were internationally co-authored while 50 were co-authored by authors from the same country. The USA yielded the largest number of domestically co-authored papers (17), followed by France (8), South Africa (6), England (4), and the Peoples Republic of China (3). Argentina, Mozambique and Portugal produced 2 domestically co-authored articles each. One paper each was produced by Chile, Italy and Japan. Table 1 shows the number of documents per *n* number of authors. Single-author documents formed the bulk (64; 23.6%) of the 271 documents that provided the names of authors.

### *Degree of collaboration*

The collaboration co-efficient was used as an indicator of the degree of collaboration (Table 2) The number of hits recorded for each country represents the number of times a given name of a country appears in the address field of a given record. The highest number of hits was recorded by the USA (i.e. 119), followed by France (54), South Africa (48), England (37), Germany (34), Kenya (23), Japan (17), the Netherlands (16), China (14),

and Australia (10). A similar trend was witnessed in the publication pattern of co-authored papers. The measurement of the degree of collaboration (i.e. the collaboration co-efficient) revealed that the countries that were most productive in terms of multiple-author publications were poorer than less productive countries. For example, the highest *cc* scores were recorded by China, Argentina, Brazil, Italy, Botswana, Chile, Denmark, Jordan, Madagascar, Sweden, Portugal, and Mali. The last category of countries plays host to those that recorded collaboration co-efficient of zero, namely Eritrea, Israel, Cameroon, Colombia, Senegal, New Zealand, Tunisia, Wales, and Zimbabwe. This implies that they did not collaborate with any other country in global warming research (GWR) in Africa.

#### ***Number of co-authored documents by a pair of countries***

The raw frequency counts in Tables 3a and Table 3b reveal that the largest number of co-authored documents (23) was jointly published by the USA and France, followed by partnerships between France and Morocco, and Kenya and the USA, with 16 publications each. It was noted that 29 of the 67 (i.e. 43.3%) cross-border collaborations contained at least one name of an African country. Most publications (38) on global warming were co-authored among non African countries.

#### ***Strength of collaboration among the countries***

The strengths of collaboration between and among different countries – as indicated by the normalized frequency counts – are illustrated in Tables 4a and 4b. The highest score (indicating the strongest association or partnership in GWR) was recorded by Niger and Mali (i.e. 0.8). Evidently, again, most collaborative research was conducted among foreign countries.

#### ***Social networks of GWR collaborating countries***

Figs 1 and 2 demonstrate the social networks of countries collaborating with African countries in GWR. Fig 1 illustrates an ego network of selected nodes (i.e. nodes representing African countries only), while Fig 2 is a social network of the entire group of countries engaged in GWR. The large

cluster situated on the left hand side of the illustration consists of both domestic collaboration (i.e. collaboration between African countries) and international collaboration (i.e. collaboration between an African country and a foreign country and/or collaboration among foreign countries). Countries that did not exhibit any collaborative links include Israel, Tunisia, New Zealand, Portugal, Chile, Colombia and Mozambique. Others were: Nigeria, Cameroon, Zimbabwe, Eritrea, Wales, and Senegal.

#### **Conclusion**

Notably, internal/domestically co-authored papers were generally slightly (47.7%) less than internationally oriented papers, with a heightened difference in Africa, where only South Africa (6) and Mozambique (2) produced domestically co-authored papers. Further, the degree of collaboration and the co-authorship pattern were observed to be closely tied. Among African countries, South Africa (48) and Kenya (23) produced the highest collaboration co-efficient. It was observed that at least 29 (43.3%) cross-border collaborations sported at least one name of an African country in their publications. However, most publications (38 of 67) on GW were co-authored by non African countries from USA and Europe, thereby implying minimal African collaboration. Regarding social networks on GW, there were 10 countries (Botswana, Gambia, Ghana, Kenya, Madagascar, Mali, Mauritania, South Africa and Tanzania) that recorded at least one link with another country, showing some collaboration. We noted that collaboration within and between countries were loose and sporadic, and did not appear to form any logical pattern. For example, it was not possible to link the nature of France's collaboration with the country's colonial past, despite frequent collaboration between France and African countries. Other graphics will be provided in the poster.

#### **References**

**[shortened by the Program Chairs because of excessive length]**