

# The State of STEM Research in Sub-Saharan Africa

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**Research output and impact are important indicators of the strength of a region's research enterprise, which is related to its long-term economic development.** The World Bank and Elsevier are partnering to examine Africa's past and current research enterprise in order to find ways to help the continent assimilate, develop, and apply knowledge to improve living standards. This first brief summarizes key preliminary findings from a forthcoming report on published research by countries in Sub-Saharan Africa over the last decade, with a specific focus on the research within Science, Technology, Engineering, and Mathematics fields.

## Research Outputs and Impacts vary across Africa

Past studies examine the relationship between the investments in, the outputs of, and even the knowledge exchange fostered by a country's research. This brief examines the research activity of different regions in Africa: Western and Central Africa, East Africa, Southern Africa, and South Africa.

For each of these regions, the report will analyze:

- Research output/impact
- Different types of research collaboration (e.g., the share of Southern African research that has an international co-author)
- Researcher mobility (e.g., the number of published scholars who move from one region to another)

## KEY MESSAGES

- Science, Technology, Engineering and Mathematics (STEM)-related research output and impact are related to a region's long-run economic development.
- The overall publication output by Sub-Saharan Africa has increased over the past ten years, but not all subregions have grown at the same pace.
- While relative output in the Health Sciences has increased, relative output in the Physical Sciences/STEM has been stagnant.
- The impact of research in the Health Sciences is much greater than that in Physical Sciences/STEM, even after controlling for differences in citation norms.
- Science is an international enterprise, and research collaboration is an important driver of success.

### ■ Research consumption

The overall publication output by African researchers has increased over the past ten years, but not all regions have grown at the same pace.

- East African researchers published 5,249 total articles in 2012, or about 0.2 percent of the world's total output. Since 2003, total research output from East Africa has grown 12 percent annually. For more information on past research on the growth of Africa's overall research output and article share, please see Research Trends under More on the Topic.

While relative output in Health Sciences has increased, relative output in the Physical Sciences/STEM has stagnated or even declined.

- The absolute numbers of Southern African publications in Health Sciences and Physical

Sciences/STEM has grown over the past ten years.

However, the relative share of the region's output in the Physical Sciences/STEM has declined over time.

The impact of research in Health Sciences is much higher than that of Physical Sciences/STEM.

A normalized measure called field-weighted citation impact (FWCI) is used to control for inter-disciplinary differences in citation norms and hence allow for comparisons across subject areas.

The world average is pegged to 1.0, so values above 1.0 indicate that the impact of a region's output is above the world average and vice versa (Figure 4).

The FWCI of Western and Central Africa's output in Health Sciences in 2012 is 0.77 compared to 0.56 for Physical Sciences/STEM.



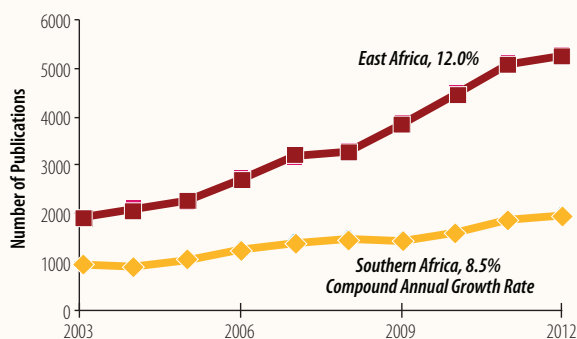
## International Collaboration

Science is an international enterprise, and research collaboration is an important driver of success.

Researchers in Africa are linked together through international, inter- and intra-regional collaborations, though the relative proportions of such collaborations vary.

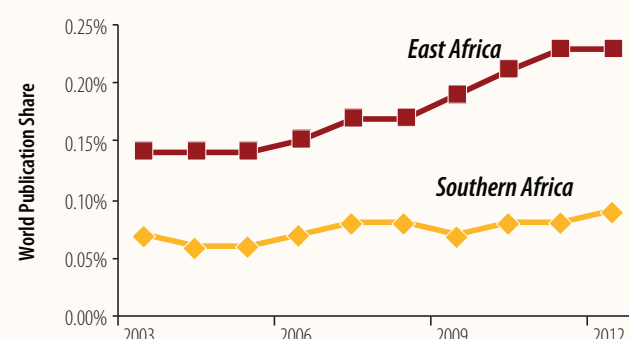
Past studies suggest that nations benefit from collaborative research, particularly international collaborations, as they typically result in higher citation impacts.

**Figure 1. Growth in the overall number of publications for East and Southern Africa, 2003-2012**



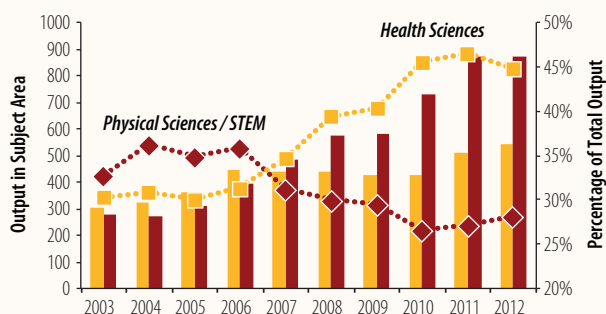
Source: Scopus

**Figure 2. Growth in East and Southern Africa's world publication share, 2003-2012**



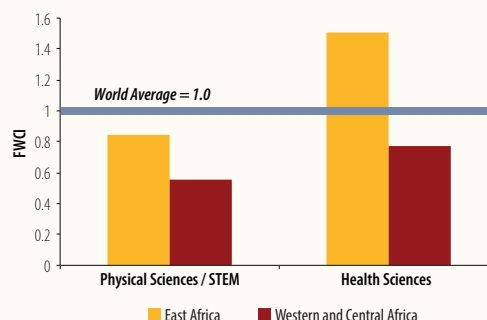
Source: Scopus

**Figure 3. Trends in percentage of Southern Africa's output in Health Sciences versus Physical Sciences/STEM, 2003-2012**



Source: Scopus

**Figure 4. Field-weighted citation impact for East Africa and Western and Central Africa in Health Sciences versus Physical Sciences/STEM, 2012**



Source: Scopus

## MORE ON THE TOPIC

- International Comparative Performance of the UK Research Base - 2013  
<http://info.scival.com/research-initiatives/BIS2013>
- Comparative Benchmarking of European and US Research Collaboration and Researcher Mobility (2013)  
<http://info.scival.com/research-initiatives/science-europe>
- Research Trends – Issue 35, December 2013  
<http://www.researchtrends.com/category/issue-35-december-2013/>  
In "The bibliometrics of the developing world," Sarah Huggett touches upon the difficulty of defining 'developing countries' and then discusses their development in bibliometric terms. For example, has research output from developing countries changed in different subject fields in recent years?  
In "Africa doubles research output over past decade, moves towards a knowledge-based economy," Yann Schemm discusses some of the factors contributing to the increase in research output from sub-Saharan Africa, including increased funding, the rise of open access and Research4Life.
- *Attracting talent in a global academic world: How emerging research universities can benefit from brain circulation* (The Academic Executive Brief – Volume 2, Issue 1, 2012)  
[http://academicexecutives.elsevier.com/sites/default/files/AEB\\_2.1\\_Salmi.pdf](http://academicexecutives.elsevier.com/sites/default/files/AEB_2.1_Salmi.pdf)  
Jamil Salmi, a global tertiary education expert and former World Bank Tertiary Education Coordinator, discusses the benefits to and need for increased academic mobility.
- Knowledge, Networks, and Nations (2011)  
<http://royalsociety.org/policy/projects/knowledge-networks-nations/report/>  
This report reviews the changing patterns of science and scientific collaboration, aiming to identify the opportunities and benefits of international collaboration, to consider how they can best be realized, and to initiate a debate on how international scientific collaboration can be harnessed to tackle global problems more effectively.

