The European Commission's research on Africa

A bibliometric analysis of Africa-focused research by the Joint Research Centre to support science diplomacy

"The Joint Research Centre (JRC) is the European Commission's science and knowledge service. JRC scientists create, manage, and make sense of scientific knowledge to support the whole European policy cycle. But how does this process work when it comes to Africa? This story presents a retrospective look at the JRC's research on Africa and shows how scientific productivity, collaboration, and thematic focus have evolved over recent decades."

Science diplomacy with Africa

Research plays a vital role in Europe-African relations as a key ingredient in science diplomacy. However, Africa has 90% fewer researchers than the global average (100 vs 1100 researchers per million people) and only spends 0.4% of its GDP on research, compared to 2.4% in Europe.

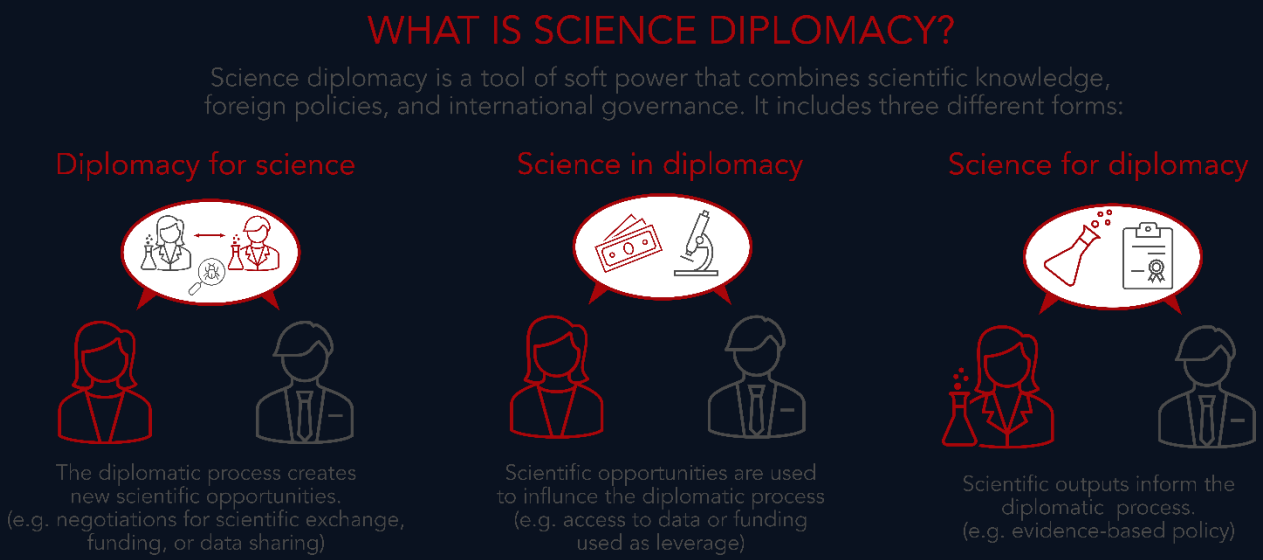
The European Commission plays a significant role in filling this gap in African research. It does this both as a funder of research through its Framework Programmes for Research and Innovation and as a producer of research through the Joint Research Centre (JRC).

This story explores **trends in the JRC's African-focused research** as an important first step to guiding future science diplomacy between the two continents.

Science Diplomacy

Science diplomacy is a mechanism to improve, maintain or develop international relations that, in turn, facilitate effective cooperation in research and innovation.

To support science diplomacy processes between European and African stakeholders, the JRC developed the **African Knowledge Platform**. This platform is an entry-point for recent scientific knowledge on Africa as produced or compiled by the JRC. Its purpose is to encourage an open dialogue with European and African stakeholders to further the mutual ambitions of the European Commission's *Comprehensive Strategy with Africa*:



The African Knowledge Platform needs a historical perspective to understand the JRC's existing scientific work on Africa. We carried out a detailed analysis of JRC's Africa-focused research over recent decades by answering three fundamental questions:

1. **Has the JRC increased its research focus on Africa?** Increased research output with an African focus would indicate that the JRC has a growing interest in science diplomacy with Africa.
2. **Have partnerships and collaboration structures for African-focused research changed through time**? Co-authorship networks shed light on the dynamics of the scientific process. For instance, network analysis can identify the geographical extent of collaboration and to infer whether collaboration is used to establish new ties between stakeholders or as a tool to entrench old scientific networks.
3. **How has the thematic focus of African-focused research changed through time?** If scientific diplomacy is indeed a tool for advancing shared local interests in the face of global problems, then we would expect the thematic focus of research to shift towards international societal challenges.

Read the full report here.

Capturing research trends

We analysed every peer-reviewed scientific publication by the JRC between 1990 and 2020 that referred to an African country in the title or abstract.

After searching for all records from the Scopus abstract and citation database, we obtained a dataset of 768 scientific articles. We analysed this dataset using the latest tools in bibliometric analysis and natural language processing.

Bibliometrics is the statistical analysis of research outputs commonly used in information science. It puts tangible numbers to the scientific process by counting things like the number of research papers or the number of times scientists have collaborated.

Natural language processing combines linguistics, computer science, and artificial intelligence to statistically compare written texts. It can be used to quantify the thematic focus of research using automated methods.

Scientific production

The first question we needed to answer was whether the JRC's focus on Africa has changed through time. While this might seem like a simple question, larger global trends in science make it more complex than it might appear.

Geopolitical and technological trends have meant that global scientific production has exploded in recent decades. International development has allowed countries outside traditional research-powerhouses to enter the arena of global science. The internet has also revolutionised global science by removing barriers to collaboration and scientific publishing.

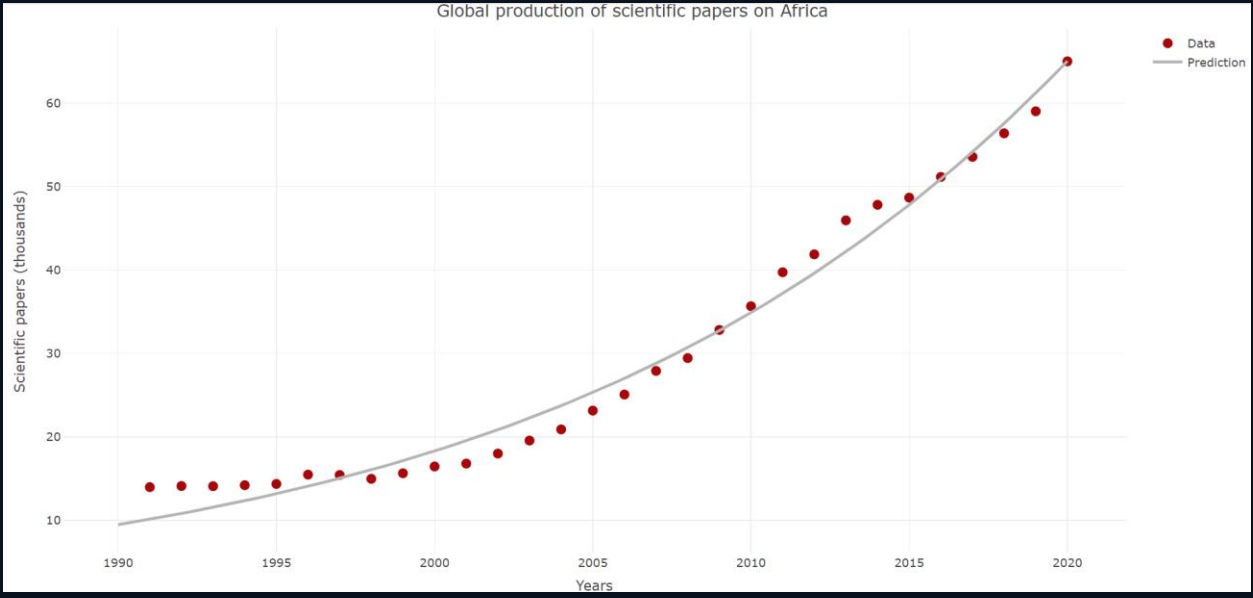
This has led to the rapid growth of global scientific output. Any efforts to evaluate the research focus of the JRC would have to control for these larger global trends

Global production of African-focused research

Th below graph shows the annual total output of research with a focus on Africa, regardless of authorship. Using our search criteria, we found that a total of 910,891 scientific articles were written about Africa between 1990 and 2020.

There were 64,986 new scientific articles written about Africa in 2020 alone. **That's roughly 1 new paper published every 8 minutes!**

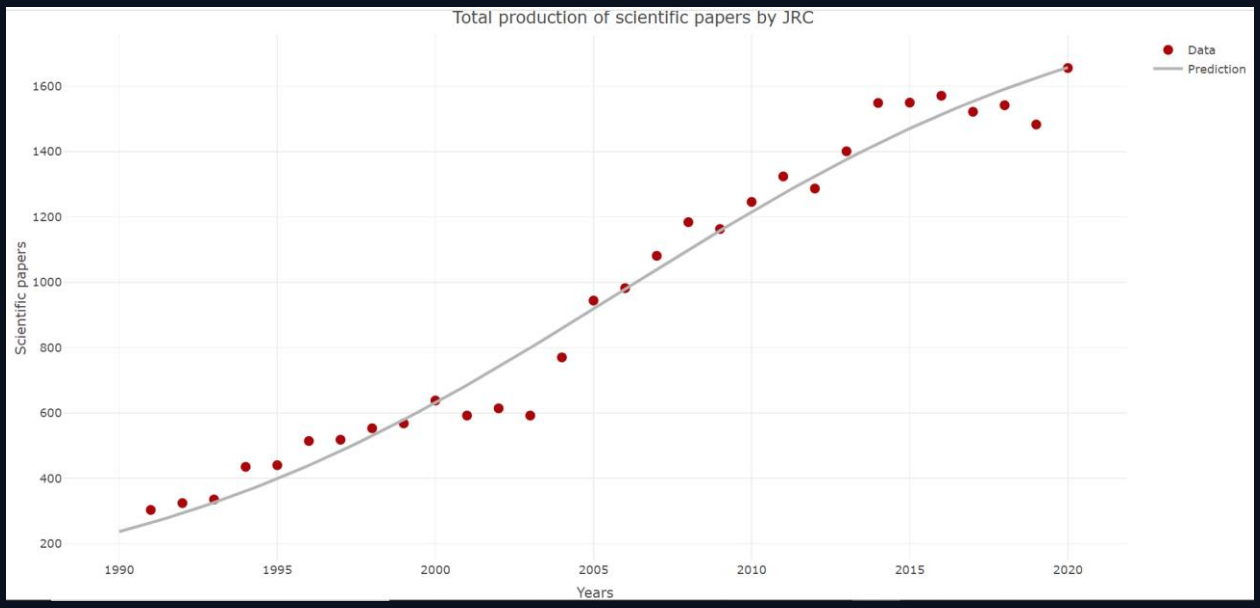
The grey curve in this figure is a statistical prediction of the global research output on Africa. As you can see, it is rising exponentially without any signs of slowing down.



JRC's research productivity

The below figure shows the total number of scientific papers produced by the JRC, irrespective of the topic or geographic focus. Although research has also increased considerably in recent decades, there are signs that productivity has slowed down in the last few years. **For the last 5 years, output has hovered around 1500 new papers per year**.

The current number of staff at the JRC is around 2800 people, of which 70% are scientific staff. So this graph suggests that research productivity at the JRC might be reaching a limit of 0.75 research articles per scientific staff member per year.

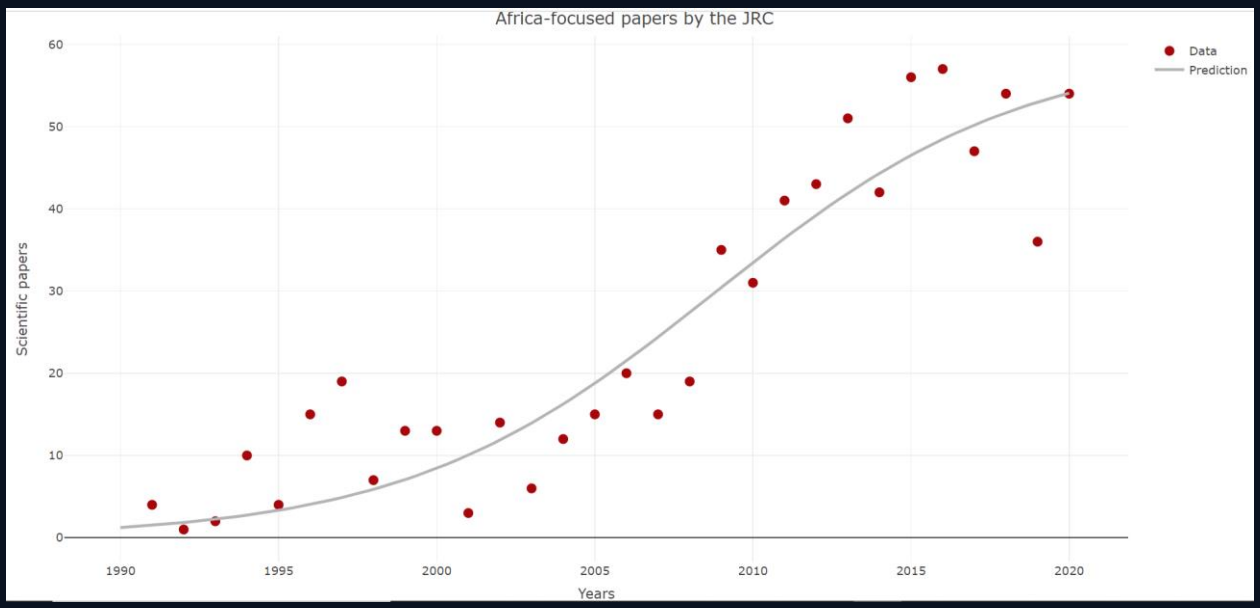


JRC's African research

The production of JRC's papers with an African-focus also seems to be stabilising. Even though there is more variation in annual output, production seems to be levelling off at around 50 new papers on Africa per year. **That's nearly one new scientific article per week.**

Another interesting feature of the below graph is that there was a jump in African-focused research between 2007 and 2009. This period coincides with the transition between the **European Commission's 6th and 7th Framework Programmes** (Europe's vehicles for funding scientific research).

Not only did the 7th Framework Programme see major growth in research spending (from €16 billion to €50 billion in total), it specifically **encouraged participation by researchers across the world**. This may explain the JRC's renewed focus on Africa during this period.

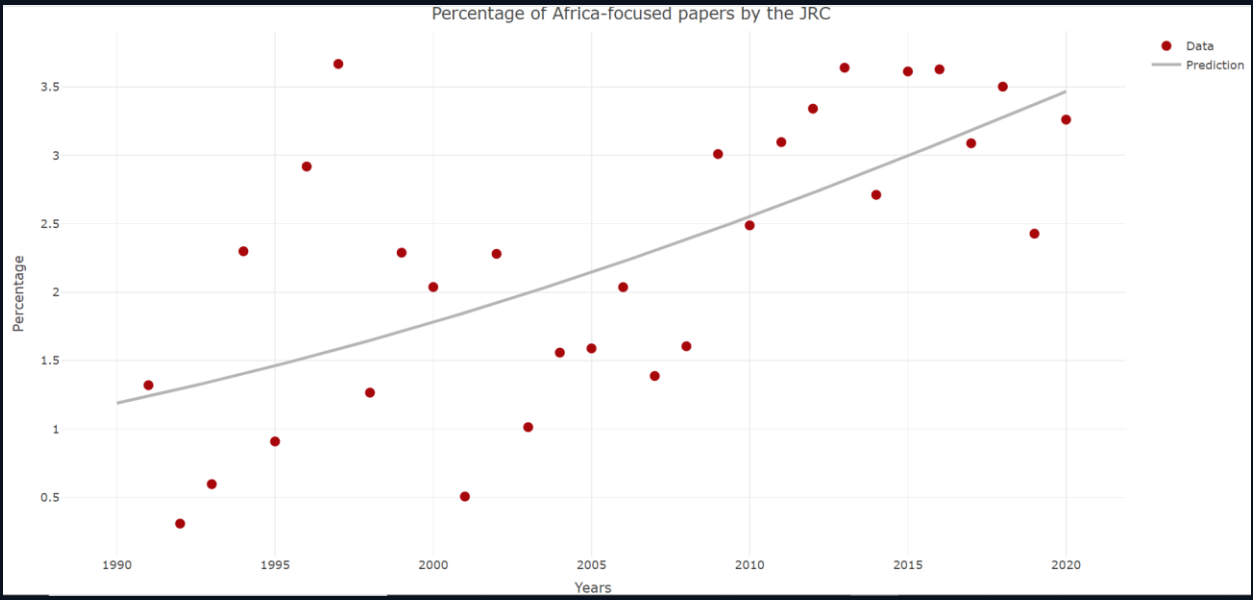


JRC's growing Africa-focus

This final figure shows the percentage of papers produced by the JRC with a focus on Africa. At first blush, it doesn't seem as if the JRC has a major focus on Africa because only about 3.5% of all the JRC's research output is on Africa.

However, once we compare present day output to what is was back in the 1990s, we see that the percentage of African papers has increased from approximately 1.5% to 3.5%. While the absolute rate of increase of two points might seem small, it is more than double what it was back in 1995.

Therefore, **the JRC has more than doubled its research focus on Africa in the last 25 years**. There is, however, a lot of variation in this trend, so we should be cautious of drawing more specific conclusions from these data.



Research collaboration

Science is a social process. Who you choose to work with says nearly as much as what you choose to work on. The JRC has built a diverse collaborative network that spans the planet, so we sought to answer how this network has changed through time.

JRC scientists play different roles in the research process. Sometimes they lead projects as the principle investigators, at other times they support the process as project partners. Of the 768 African-focused research papers written by the JRC, **less than 20% acknowledge funding from the European Commission**. This suggests that the JRC plays a supportive role in 4 out of every 5 of their research papers. In total, 159 different funding sources were acknowledged in the JRC's research papers.

JRC Strategy 2030 recognises **'sharing' as one of the core criteria of research excellence** given its emphasis of multidisciplinary research with multiple partners. This highlights the importance of evaluating research excellence using criteria beyond simply counting research outputs.

The JRC is not an island of knowledge, but a **central hub in a global network**. Understanding how this network has developed over time provides unique insights into the social aspects of the research process.

2004 - 2008

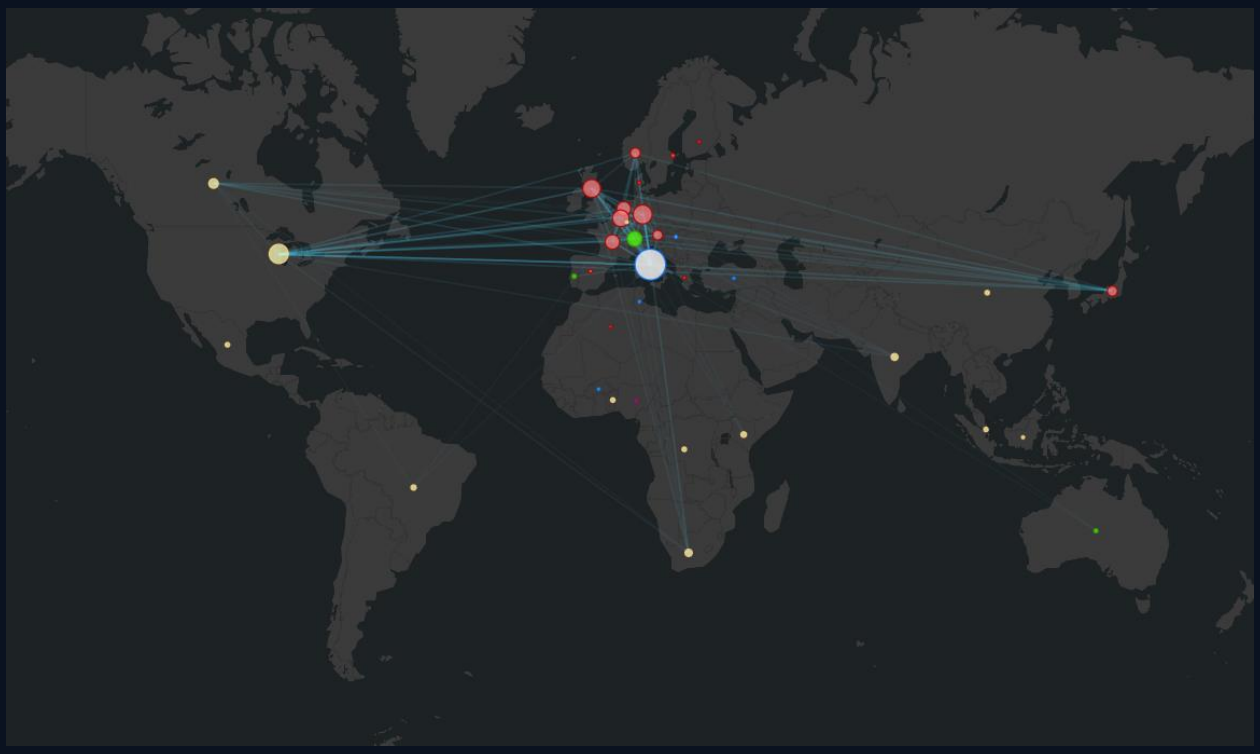
The following map shows the collaborative network of JRC's African-focused research for the period 2004 to 2008 (the period that coincides with the European Commission's 6th Framework Programme, but offset by two years to account for delays in the research process, peer-review, and publication).

The sizes of circles denote the number of co-authorship links to a country. The colours represent sub-clusters of collaboration within the broader network.

We can see that back in 2004-08, **most of the JRC's African-focused research was produced with countries in western Europe** (red circles).

Italy - the location of the JRC's largest site in Ispra - played a central role in most of the JRC's African research (white circle).

Few African countries, like South Africa, DRC, Kenya, and Benin, formed part of a larger international sub-network (yellow circles). This sub-network included non-African partners in the USA, Canada, China and India.



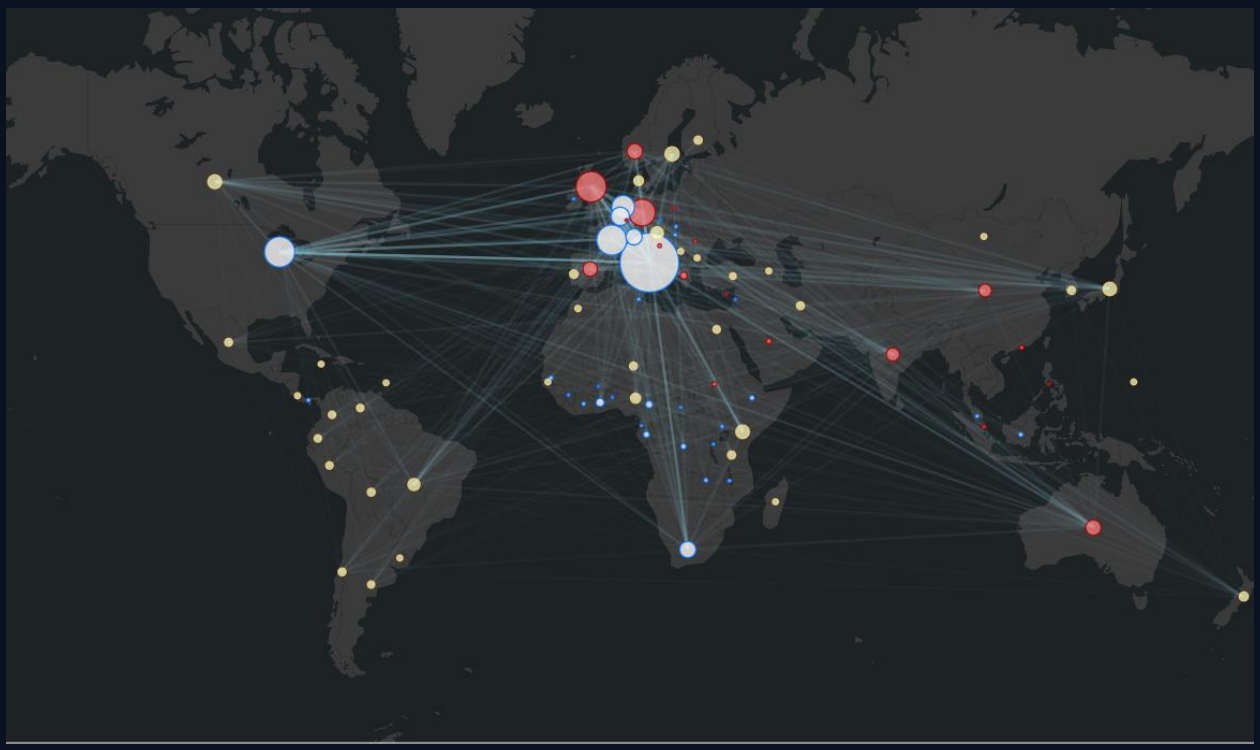
2009 – 2015

The period from 2009 to 2015 coincided with a the 7th Framework Programme (also offset by two years), which increased research funding and encouraged international participation.

This period was associated with substantial growth in the JRC's collaborative network.

Although Italy was still a central hub of this network, it grew its sub-cluster to include other western European countries, and several countries in Africa (especially equatorial countries, and South Africa).

This period also showed strong international collaboration between South American countries and Africa (notably Tanzania, Kenya, Nigeria and The Gambia); shown here as yellow circles.



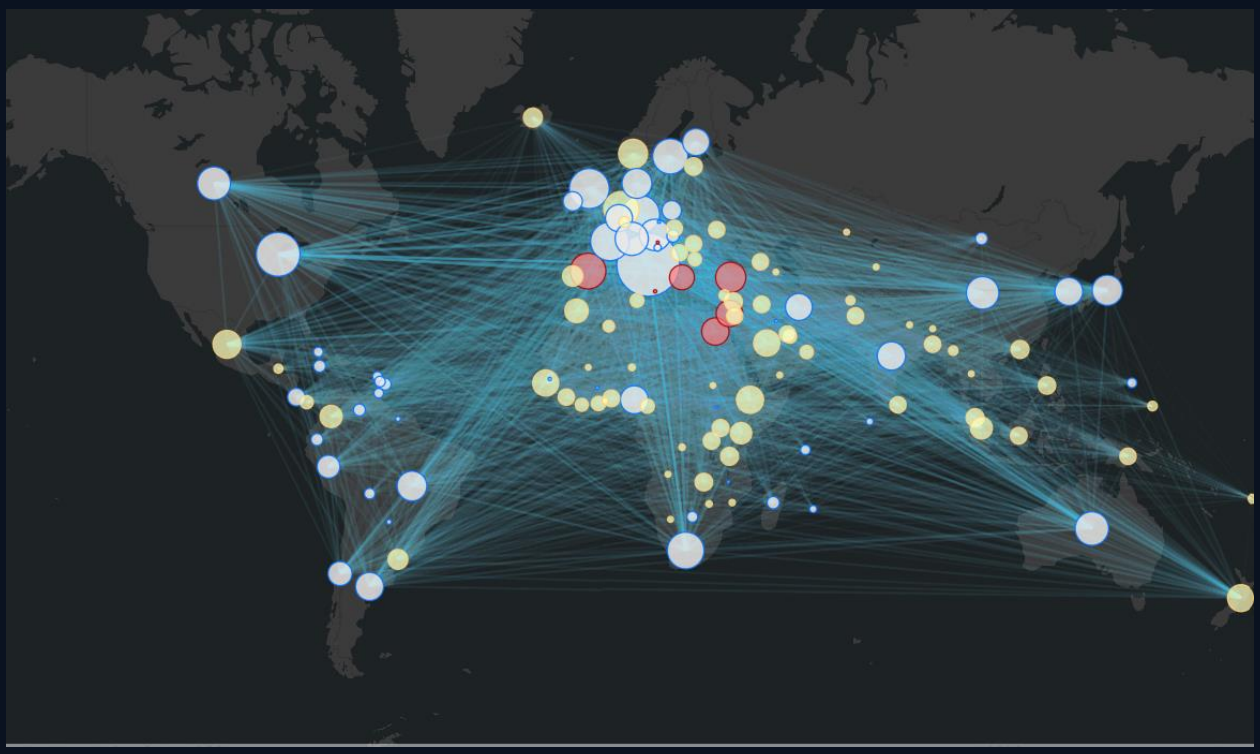
2016 – 2020

The trend of expanding international collaborating continued throughout Horizon 2020 (offset by two years). **There is hardly a country in the world that is not scientifically connected to the JRC.**

During this period, African countries seemed to partner with the JRC as part of much wider international collaborations (yellow circles).

Only a few African countries, like South Africa, Nigeria, Madagascar and Botswana, are part of the same predominant sub-clusters as the JRC's largest site in Italy.

A Mediterranean collaborative sub-cluster (red circles) also emerged during this period, which included Egypt, Turkey, Greece, Israel, and Spain (home of the JRC's Seville site). This suggests that new collaborations can also germinate from shared regional priorities.



Global research collaboration – particularly with African countries – follows the **path of least resistance**. Collaboration is favoured with countries that share languages, cultures, or histories.

Our results showed that even though the JRC might favour collaboration with certain countries, that **does not mean that they only collaborate with the same set of institutions within those countries**.

Only one African institution, the University of Cape Town, was within the Top 20 collaborators with the JRC. Other research partners included some of the leading universities in the world (e.g. University of California, University of Oxford) and leading non-academic research institutes (e.g. NOAA, NASA, and the UK Meteorological Office).

This suggests that research innovation relies on **coalitions of the willing**, rather than international policy and coordination alone. Multinational programmes will only create research excellence if individual universities and research institutions have adequate resources.

Thematic focus

Our third question was to quantify whether the thematic focus of the JRC's research on Africa has changed through time. For this we used **natural language processing** to identify thematic areas of research focus. A computer algorithm grouped research papers into common themes based on statistical patterns in the words they used.

Using this algorithm, we identified 7 thematic areas in the JRC's research on Africa.

On the below link, the changing of the thematic focus of research between 1980 and 2020 are shown. Here, each point is a single research paper. Points that are closer together are thematically more similar, and their colours represent the predominant research theme. We can draw some clear conclusions from these results:

- **Earliest papers were positioned in the centre of the thematic landscape**. This indicates that early work laid the foundation for the subsequent growth in different research themes (rather than there being a linear progression from one theme to the next).
- **There has been a steady growth in the variety of research themes through time**. As the animation progresses, new points are added with different colours.
- **Although the points are clustered in common themes, there is substantial overlap between themes**. This suggests that the JRC regularly performs cross-disciplinary research.

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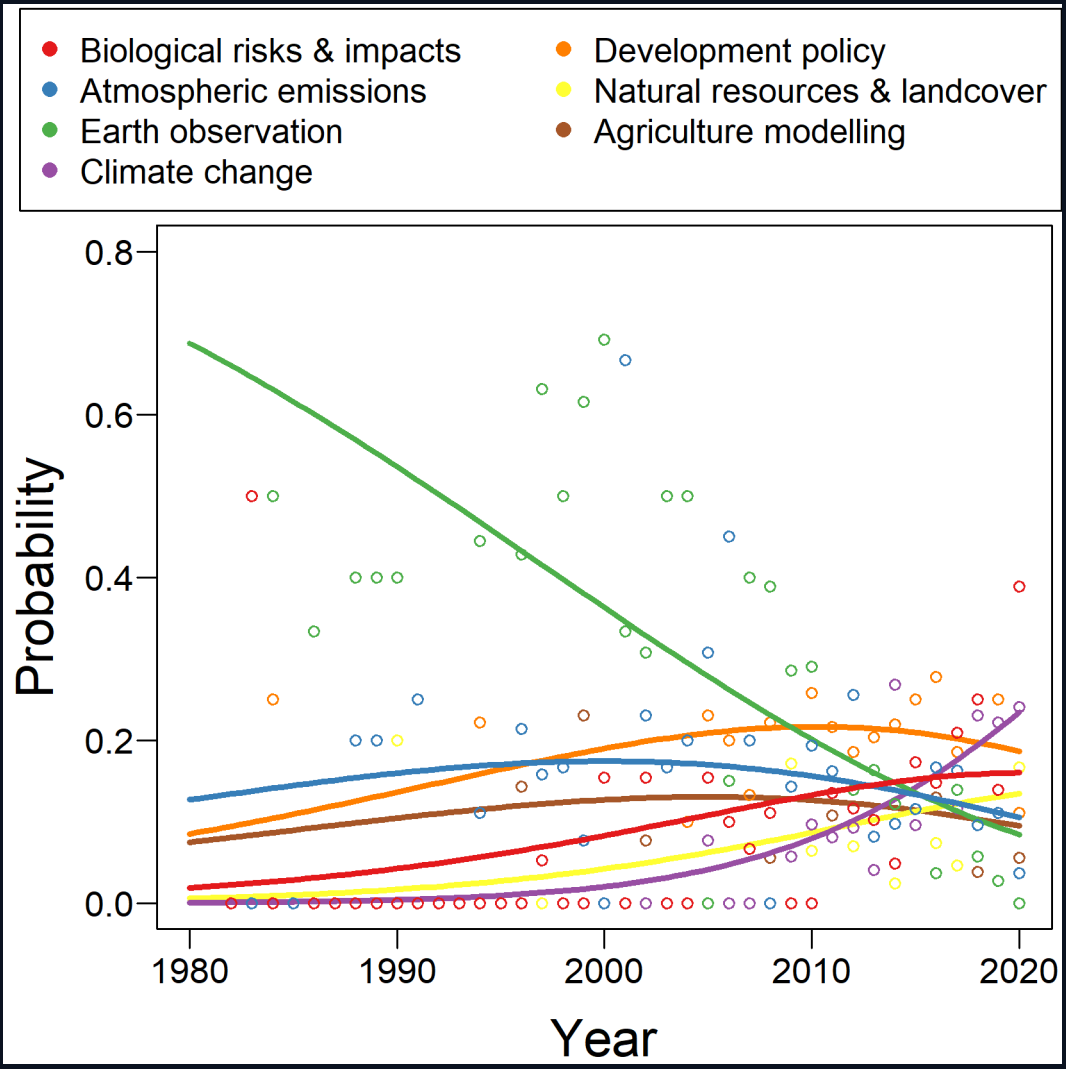
We built a statistical model to track how research themes have grown and shrunk through time. This model showed how earth observation research has declined in prominence since the 1990s (green line in the figure)



Early JRC research (1980-2000) was dominated by studies of remote sensing and earth observation. In the late 1980s, the JRC started the MARS project (Monitoring Agriculture with Remote Sensing) to evaluate agricultural policies using satellite technologies. The TREES project (TRopical Ecosystem Environment observation by Satellite) followed in the early 1990s to create a global inventory of tropical forests to detect and quantify deforestation and assess its impact in the context of climate change.

These two projects typify the focus on earth observation in during the 1980s and 1990s.

The reduced prominence of earth observation does not mean that JRC researchers are no longer working with satellite technology. Instead, they are now using satellite data to answer applied questions.

Research on **climate change and natural resource and landuse change** has increased in the last 10 years. These themes also rely on earth observation technology. So, rather than abandoning research using earth observation, it seems that JRC scientists have adapted their foundational expertise on remote sensing to tackle pressing global challenges.

The JRC's ability to evolve its thematic focus from a strong technical background illustrates the long-term multiplier effects of investments in basic scientific expertise. This justifies **JRC's commitment to ensuring that 5% of its research remains exploratory**.

European-funded research

We used the same approach to quantify trends in research funded by the European Commission through its Framework Programmes. Here we only present the summarised results.

The 6th Framework Programme had a relatively small focus on Africa. Although there were many collaborative partners that studied a variety of themes, scientific production remained modest (only 265 articles).

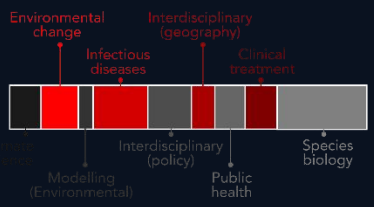
6th Framework Programme

Budget: €16.3 billion

265 articles on Africa

11,919 Total

Research themes



42 Countries

African countries in Top 20

5. South Africa
10. Uganda
15. Egypt
17. Tunisia
18. Botswana
19. Niger

1,930 Institutions

African institutions in Top 20

3. University of Cape Town

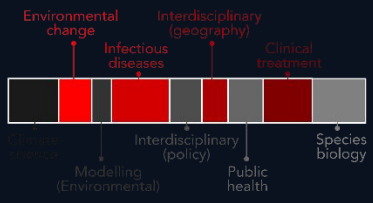
A lot changed during the 7th Framework Programme. A substantive increase in budget increased research production and grew international collaboration networks considerably.

7th Framework Programme

Budget: €50.5 billion

4,202 Articles on Africa

Research themes



85 Countries

African countries in Top 20

8. South Africa
14. Sengal
15. Tunisia
19. Ethiopia
20. Kenya

8,542 Institutions

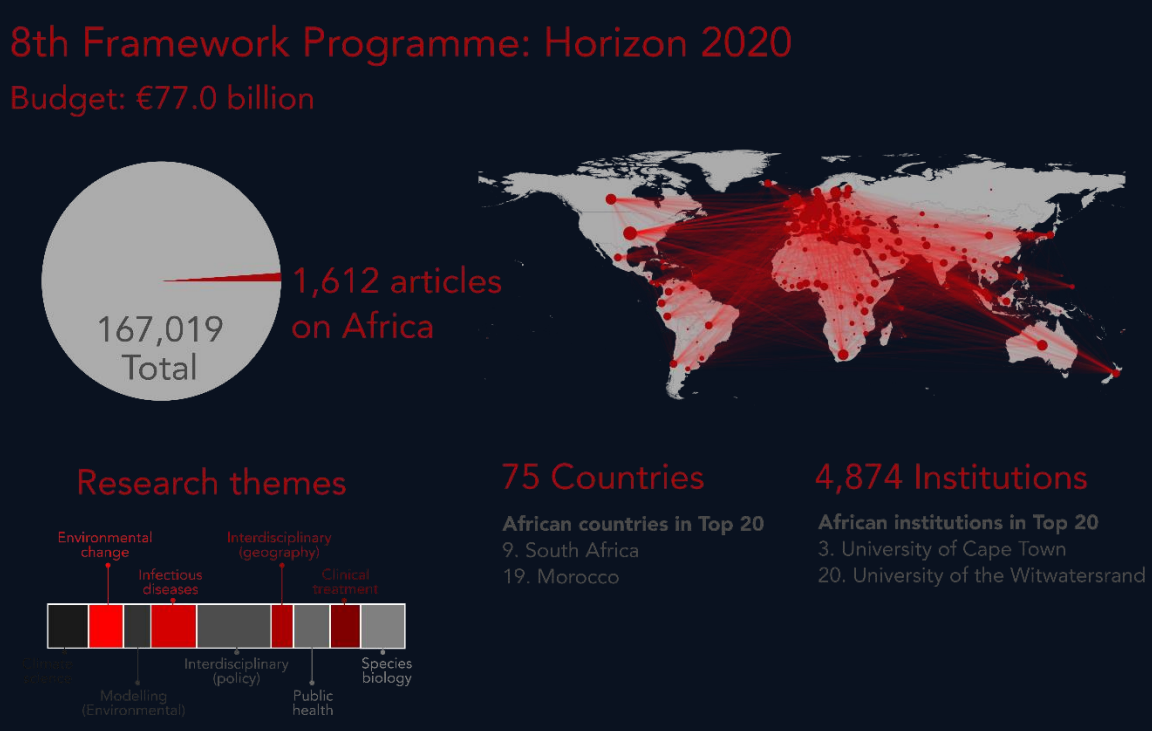
African institutions in Top 20

2. University of Cape Town
4. University of the Witwatersrand
13. Stellenbosch University
17. University of Kwazulu-Natal

These trends continued into Horizon 2020.

Interdisciplinary research with a policy focus has increased in prominence, suggesting that researchers are tacking global challenges.

Outputs from Horizon 2020 will still accumulate over the next few years and will likely surpass those of the 7th Framework Programme.



Europe-Africa science's future

Our study shows the dynamic relationship between the JRC and Africa and shines a light on the science diplomacy between the two continents. Growing scientific production, widespread collaboration, and an evolving thematic focus all suggest that Europe aims to draw African scientists into solving global problems. The European Commission sees science as an important lever in its relationship with Africa.

Supporting equal partnership

Even though Europe has historically dominated the scientific relations with Africa, this is due to change. The new EU-Africa strategy emphasizes moving away from a Eurocentric vision and a donor-recipient relationship of the past, to build shared responsibilities towards solving global challenges.

To this end, the European Commission has **prioritised Africa** as part of Horizon Europe, launched in June 2021. This initiative focuses on building capacity for science and mainstreaming innovation in the cooperation between Europe and Africa.

Horizon Europe is a massive science funding programme with a total budget of €95.5 billion. Of this, €350 million is earmarked in 2021-22 for African research with the express goal to:

> *"Enhance cooperation with Africa to promote actions targeted to finding locally adapted solutions to challenges that are global in nature"*

Horizon Europe's focus for the Africa Initiative is on global challenges around:

- **Public health**: protecting people's health, tacking underlying health conditions, investing in strong health systems, and training the healthcare workforce.
- **The green transition**: health tackling climate change and environmental degradation, developing sustainable energy, finding transport solutions, growing agriculture, and enhancing the circular and blue economies.
- **Innovation and technology**: Establishing innovation incubators and accelerators, strengthening local innovation capacities, improving digitalisation and connectivity for the Fourth Industrial Revolution.
- **Building capacities for science**: developing human capital development, advising policy using science, supporting open science, and improving gender representation.

Moving forward

While the future is bright for the scientific relationship between Europe and Africa, this potential will not be unlocked automatically. European researchers and funders should ensure that their effort dedicated to producing scientific research on Africa is matched by equal effort to manage and mobilise this scientific information to serve policy priorities more effectively.

Knowledge management and knowledge sharing are crucial drivers in this process and will become more important as research becomes more collaborative and transdisciplinary. Effective knowledge management and sharing also facilitate cross-fertilisation from different domains of expertise.

In this context, the JRC's efforts to institutionalise knowledge brokering through its **African Knowledge Platform**, which aims to synthesis and present policy-relevant scientific information on Africa, is a significant milestone in science diplomacy between Europe and Africa.

https://africa-knowledge-platform.ec.europa.eu/

This document has been originated from a StoryMap compiled in the context of the European Commission's Africa Knowledge Platform.

Authors

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Sources

Estreguil, C. and Buschke, F., The evolving role of the European Commission in research on Africa , EUR 31195 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-56184-2, doi:10.2760/38335, JRC127569.

Images

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