# BUILDING PARTNERSHIPS WITH AFRICA: A CNRS MULTI-YEAR COOPERATION ROADMAP

# INTRODUCTION

*The CNRS multi-year cooperation roadmap with Africa is a declaration of intent by the CNRS to develop its already important relations with its scientific partners on the African continent. It is meant to grow and include new developments over the coming months and years, as actions are intended to reflect projects and ideas that will have been discussed and developed jointly and will further evolve. This roadmap is a first milestone for the CNRS to increase and nourish its activities with Africa, with a view to associating key players in France, Europe and internationally. Its main objective is to develop cooperation that meets the dual aim of scientific excellence and equitable and sustainable partnerships.*

*The elaboration of this multi-year roadmap with Africa was made possible thanks to the involvement of many people within the CNRS (scientific departments, administrative departments, researchers) in consultation with scientific and university cooperation attachés in various embassies, and players in higher education, research and innovation establishments as well as public institutions, who were able to contribute their expertise and knowledge.*

*The CNRS therefore initiated this reflection based on the observation that Africa is an essential continent whose many countries rely on research and innovation to transform their societies on several fronts (food security, economy, environment, etc.), but which still remains too little represented in our institutionalized cooperation or is off the radar. Although some forms of cooperation already exist through long-standing and structured cooperation tools throughout the African continent, and particularly with the North African countries and with South Africa, there is certainly room for improvement.*

*In addition, we carried out a bibliometric analysis in order to have an overview and examine the global context of scientific production in Africa, as well as compare the working strategy of European and worldwide research institutions with African counterparts.*

*Although our objective is to reflect on our partnerships with Africa as a whole, we have decided to approach links with sub-Saharan Africa in a different way from those with North Africa and South Africa. In the latter two, cooperation is a result of a very different rationale: older research structures, numerous institutionalized cooperations, a strong presence of doctoral students and researchers in our laboratories, historical links, etc. We will present a specific agenda for these zones in the future.*

*The CNRS therefore wishes in the first instance to implement appropriate tools to establish and strengthen cooperation with sub-Saharan African countries. In 2021, a call for proposals entitled "Support Action for Collaborations with sub-Saharan Africa" was successfully launched with the aims to initiate, strengthen and perpetuate cooperation. In addition to this call, which made it possible to map existing collaborations, the CNRS is planning a series of actions to consolidate existing collaborations and initiate a new cooperation dynamic.*

*The objective is to build, together with African institutions and scientists, stronger Training, Research and Innovation schemes and deepen our relations with the most dynamic universities and research centres on the African continent. The CNRS will work to strengthen its partnerships with key regional institutions and to develop cooperative ventures involving industrial partners and civil society.*

*Last but not least, we aim to use strategic steering based on expertise from outside the CNRS. To that end, we will set up an Africa-CNRS Advisory Board, work on identifying the complementarity of players in Higher education, Research and Innovation in the French system as well as in Europe and further, and will promote a three-player cooperation paradigm.*

*Implementation mechanisms and concrete actions are detailed in this ''CNRS multi-year cooperation map''.*

Spectrocolorimetric analysis of a painted wall fragment from previous excavations at the Pomongwe shelter in the Matobo Hills of Zimbabwe held at the Zimbabwe Museum of Humanities in Harare. © Nicolas BAKER/TRACES/ARSCAN/CNRS Photothèque

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# 1 I SCIENCE AT THE HEART OF THE NEW AFRICAN DYNAMIC

Aerial view of car traffic in Cairo, Egypt. © AdobeStock

## 1.1. GETTING INVOLVED IN AFRICA, A PRIORITY FOR THE CNRS

Adopted in 2015, **the African Union's (AU)[1] Agenda 2063** reflects the pan-African commitment to prioritize inclusive and sustainable social and economic development. African societies, their Heads of State and their governments have become aware of the undeniable role of science and innovation as a driver of complex transformation, requiring multilateral change at the economic, social and environmental levels. These are all challenges that must be urgently addressed for the well-being of humanity and for Nature in general.

Enshrined in Agenda 2063[1], the overarching aspiration to build "a prosperous Africa based on inclusive growth and sustainable development", requires **long-term action in education, teaching, research and innovation** in key sectors such as agriculture, food, energy, the environment, health, infrastructure development, the digital world, security and water.

African Heads of State have committed to devoting more resources to the development of knowledge. Since the 2000s, regional and continental strategies and initiatives from well-established **pan-African institutions** have been multiplied for the massive development of science and technology, but also for innovation and entrepreneurship. Given the current fragility of African research, these strategies share the common objective to coordinate and facilitate advances and capacity building in the sciences, at a regional and continental level, thus respecting the diversities of a united Africa. This intention is naturally reflected in **national development plans to be implemented by 2030**, with the adoption of policy frameworks for education, science and innovation and, for some countries, the creation of dedicated funding agencies. Illustrating this dynamic, Kenya has launched its flagship development programme "Vision 2030"[2] (2008 to 2030), with the aim of becoming a "newly industrialized, middle-income country" and offering high quality of life to all its citizens. Convinced that science and technology are an engine for growth, Kenya has devoted 2% of its GDP to investment in these fields, particularly in R&D. The Nigerian government is also committed to advancing science and technology in order to diversify its economy, thus reducing its dependence on fluctuations in the price of raw materials such as oil, and positioning itself sustainably in strategic sectors such as space, with the launch in 2011 of NigeriaSat-X, the first satellite designed and built by Africans.

Even if different parts of the African continent are not making progress at the same rate, **the increase in financial commitment to R&D** has been very marked in some African countries in recent years. This has happened through technology incubation centres, dedicated funding or technology parks (e.g. the IHub in Nairobi, which has created nearly three hundred start-ups; Kampala in Uganda, which is home to more than six technology centres and incubators, or the Yabacon Valley in Nigeria, which is the country's main technology cluster and start-up ecosystem).

Science, technology and innovation are therefore perceived as key factors of transformation and progress by African countries, which consequently seek to develop new or strengthened partnerships with the academic, socio-economic and cultural sectors both on the continent and internationally. The complexity of the issues, and the need to understand them through plural, systemic and multidisciplinary approaches make the CNRS a leading partner for equitable and sustainable cooperation, with due respect for the diversity of sciences. Being involved with the new African dynamic is fully in line with the missions of the CNRS, which are to advance knowledge and share learning with society and societies throughout the world. Our commitment will necessarily be differentiated, because even if the strategy of African countries is part of a pan-African vision, it naturally displays priorities specific to each country.

The scientific themes to be developed together are therefore country-dependent, with disciplinary fields ranging from fundamental research to applications. They are also highly interdisciplinary, involving the major challenges faced by African countries – echoing issues raised by the Contract of Objectives and Performance (2019-2023)[3] concluded between the CNRS and the French State. The COP prioritizes six major societal challenges: climate change; educational inequalities; artificial intelligence; health and the environment; territories of the future; and energy transition. The Sustainable Development Goals (SDGs) set out by the United Nations in

1 Agenda 2063: https://au.int/en/agenda2063/overview
2 Kenya vision 2030: https://vision2030.go.ke
3 Contract of objectives and performance (COP) (in French): https://www.cnrs.fr/sites/default/files/news/2020-02/COP_V9_3101_web.pdf

its Agenda 2030, which address the challenges of poverty, inequality, climate, environmental degradation, prosperity, peace and justice, also intersect with the CNRS's commitment[4] to the SDGs outlined in a previous roadmap in 2020.

The desire to give new impetus to our commitment in Africa in this present moment comes at the right time.

## 1.2. INTERNATIONAL MOMENTUM

In recent years, momentum towards and from Africa has been international, generating new or strengthened links with many institutions at all levels of involvement in Higher Education, Research and Innovation worldwide. These include state ministries and national research funding agencies (Germany Bundesministerium für Bildung und Forschung, Japan Science and Technology Agency, etc.), universities (Oxford, Cambridge, Massachusetts Institute of Technology, etc.), research organizations (CNRS, Max Planck, CSIC, CAS, etc.), and foundations (Bill and Melinda Gates Foundation, Alexander von Humboldt Foundation, etc.). Political speeches regularly echo this message, as shown by President Emmanuel Macron's address to the University of Ouagadougou in Burkina Faso in November 2017. Here he presented his vision for a new relationship between Africa and France: "I consider Africa to be quite simply the central, global, unavoidable continent, because it is here that all contemporary challenges coincide. It is in Africa that part of the world's changeover will take place." In the same year, Angela Merkel proposed a Marshall Plan for Africa focusing on private investment with financial leverage from Compact with Africa[5], in partnership with the African Development Bank. Since then, many initiatives have been launched, through the development of centres of excellence in Africa, such as Digital Africa[6], a platform for innovation in Africa, or Saison Africa 2020[7], a pan-African and multidisciplinary project, supported by the Institut français and centering on innovation in the arts, sciences, technologies, entrepreneurship and the economy, and aiming to create a global emancipation movement.

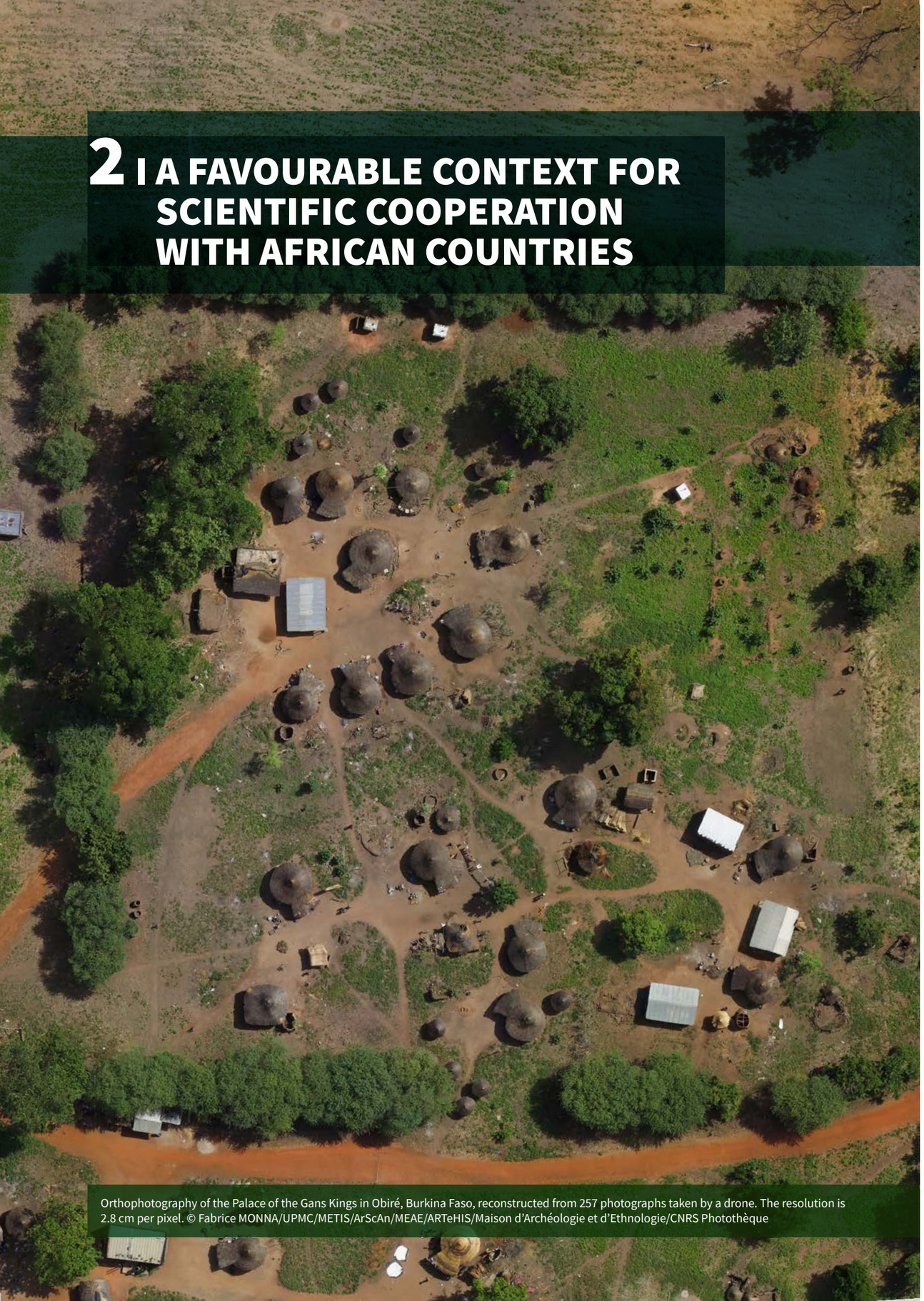
As for the European Union, its political commitment was clearly outlined in 2020 in the joint communication[8] of the European Commission and European Parliament, entitled **"Towards a comprehensive strategy with Africa"** to intensify cooperation with partnerships in five key areas (green transition, digital transformation, sustainable growth and jobs, peace and governance, migration and mobility). This commitment is reflected in the Horizon Europe Framework Programme (2021-2027), which includes in its first programming period a total of 36 topics funded with a budget of around EUR 350 million, and particularly relevant for cooperation with Africa. This strengthened strategy with Africa also reached a milestone in late 2020 with the launch of the **African Research Initiative for Scientific Excellence (ARISE)[9]** pilot programme implemented by the African Academy of Sciences (AAS). ARISE enables early-career African scientists to conduct cutting-edge research across Africa and promotes research in different areas of scientific activity, taking into account the common priorities of the European Union and the African Union.

**International donors** are not left out either, as we will see in section 2.2. For example, the World Bank's 2012 report on areas of research that received funding showed that these had diversified: while in the 1960s and 1980s supported areas mainly dealt with agriculture, by the 1990s there was more research on infectious diseases (HIV, malaria) and the economy. From the year 2000 onwards, the themes that received funding extended to physics, humanities, biotechnology, material sciences and the Internet of things.

Another sign of change has been the return of investments in African science. For example, since 2014, the World Bank has been providing loans to countries under the **African Centres of Excellence in Higher Education (ACE)[10]** programme, with beneficiaries being universities in seven Western and Central African countries. The objectives have been to strengthen higher education in Africa and to enable African students to acquire advanced scientific and technical skills. The success of this programme is an essential element in strengthening the productivity of key sectors, increasing employability and developing deep and long-term structural reforms.

4 CNRS and SGDs (in French): https://www.cnrs.fr/en/cnrs-committed-promoting-sustainable-development
5 G20 Compact with Africa: https://www.compactwithafrica.org/content/compactwithafrica/home.html
6 Digital Africa: https://digital-africa.co/
7 Saison Africa 2020: https://www.saisonafrica2020.com/en
8 https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020JC0004&from=FR
9 African initiative for scientific excellence (ARISE) https://ec.europa.eu/commission/presscorner/detail/en/ip_20_2324
10 World Bank Group ACE Programme: https://ace.aau.org

# 2 I A FAVOURABLE CONTEXT FOR SCIENTIFIC COOPERATION WITH AFRICAN COUNTRIES



Orthophotography of the Palace of the Gans Kings in Obiré, Burkina Faso, reconstructed from 257 photographs taken by a drone. The resolution is 2.8 cm per pixel. © Fabrice MONNA/UPMC/METIS/ArScAn/MEAE/ARTeHIS/Maison d'Archéologie et d'Ethnologie/CNRS Photothèque

***With more than a billion people, thousands of languages, dozens of countries and an average age under 20, Africa is a young and dynamic continent that abounds with opportunities for productive research collaborations and transformative educational experiences. This young population, which will make up a quarter of the world's population by 2050, is at the heart of governments' concerns seeking to improve training, pathways to and within the world of research, to promote knowledge transfer, to increase the employability of graduates, and to ensure that the UN's Sustainable Development Goals are implemented in terms of research collaborations.***

## 2.1. AFRICAN SCIENTIFIC OUTPUT

Typically, Africans involved in research (representing 2.4% of researchers worldwide) are young, and interested in transdisciplinary and international scientific opportunities. Although their scientific production[11] may still seem modest, their scientific publications are increasing dramatically. Annual output has increased from 43,500 publications in 2005 to almost 100,200 in 2018. Over this period, the annual growth rate of African publications has outpaced the rest of the world, so that Africa's share of global publication output has increased by a multiple of 2.3 (from 1.8% in 2009 to 3.1% in 2018), compared to 1.3 for the rest of the world. The geographic origins of African publications show that 90% are produced by just 12 countries, with South Africa alone accounting for a quarter of the 2018 publications (25,150).

Production by scientific field[12] shows, not surprisingly, that a majority corresponds to the challenges of development for African societies (health, immunology, water, agriculture) but that there is also an appetite for more fundamental research such as mathematics. Tropical medicine, parasitology, infectious diseases, public health, environmental sciences, ecology, zoology and plant sciences are highly specialized areas of research undertaken in Africa and made available to the international community, with the same aim of responding to the challenges of development in African societies.

The open nature of African science is reflected in the high number of international co-publications. A bibliometric study shows that there are two types of cooperation profiles: countries with an international co-publication rate of around 50% (Morocco, Algeria, Tunisia, Egypt, South Africa, Nigeria) and countries with a co-publication rate of over 70% (Ethiopia, Ghana, Uganda, Kenya). It should also be noted that co-publications involve international and non-African authors, but also that a large number of sub-Saharan African countries have South African authors as one of their top 5 partners.

African research systems, particularly in sub-Saharan Africa, may suffer from a lack of equipment and resources that hinders more dynamic and sustainable scientific production.

There are many consequences: a lack of experience in applying for competitive calls for projects, a brain drain to countries with more funding, higher prestige or international recognition, insufficient replacement of the scientific and academic workforce, dependence on international R&D funding and, ultimately, unattractive scientific careers and fragile links between the economic and academic sectors.

However, pan-African networks of excellence demonstrate a willingness to build the groundwork for scientific exchanges and partnerships on a continental scale. These include the African Research Universities Alliance (ARUA), which brings together 16 universities emphasizing academic research and academic excellence (with the creation of ACE centres of excellence), or the African Institute for Mathematical Sciences (AIMS), in mathematical sciences.

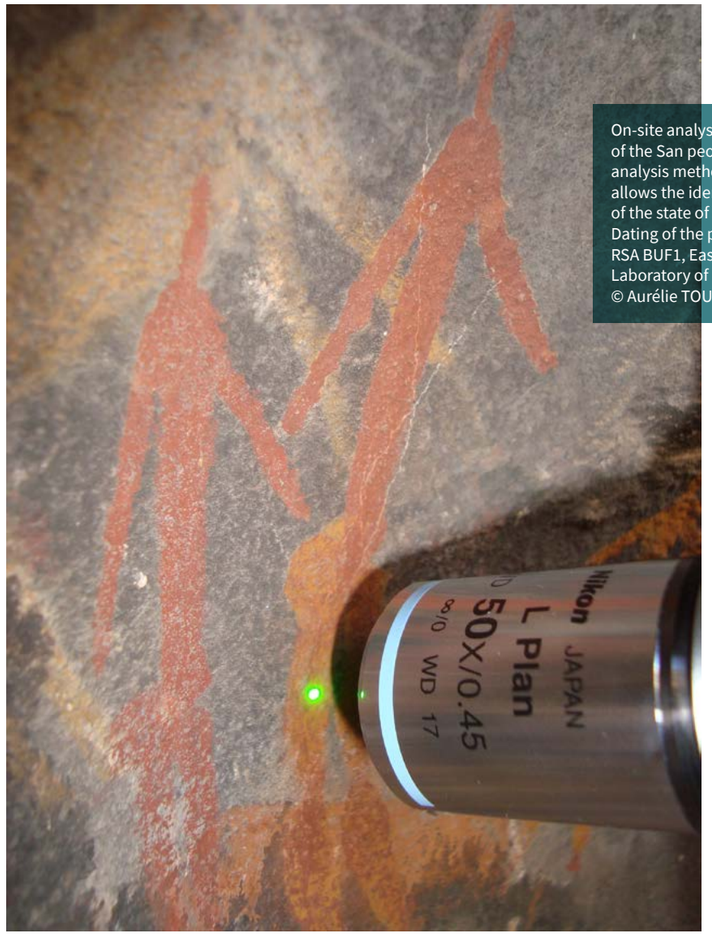
## 2.2. INTERNATIONAL FUNDING FOR AFRICAN RESEARCH

As elsewhere, African researchers have learned to match their research interests with those of funding bodies. When asked, African scientists point to the influence of donor research programmes in the development of their scientific work[13].

11 Due to incomplete data related to scientific output, only publications are considered.
12 Source WoS.
13 Ebadi & Schiffauerova, 2016 ; Li *et al.*, 2017.

Collaborations with certain countries rather than others are also structured by donors, according to political, economic and security considerations, rather than strictly scientific ones. This funding employs many local scientists and provides the means for infrastructure, but is not linked to national research systems. The countries with the highest reported sources of foreign funding are South Africa, Egypt, Tunisia, Nigeria, Algeria, Morocco, Kenya, Ethiopia, Uganda and Tanzania[14].

The South African National Research Foundation (NRF) is one of the biggest donors. Other big donors include the European Union, followed by the US National Institutes of Health (NIH), the UK Wellcome Trust Foundation and the German Deutsche Forschungsgemeinschaft (DFG).Others include the Bill & Melinda Gates Foundation, the Government of Spain, the National Natural Science Foundation of China, the Ministry of Higher Education and Scientific Research of Tunisia and the National Institute of Allergy and Infectious Diseases (part of the NIH).




On-site analysis of pigments from a sandstone rock painting of the San people. The non-destructive and portable Raman analysis method (here, the spectrometer measuring head) allows the identification of pigments and the evaluation of the state of conservation of these paintings.
Dating of the paintings: from 100 to 3,000 years.
RSA BUF1, Eastern Cape, South Africa. LADIR Laboratory of Dynamics, Interactions and Reactivity.
© Aurélie TOURNIE/CNRS Photothèque

14 C. Beaudry, J. Mouton and H. Prosesky (2018).

# 3 I THE CNRS COOPERATION WITH ITS AFRICAN PARTNERS

Three of the five telescopes of the HESS-II (High Energy Stereoscopic System) experiment in Namibia: on the right, two 13-metre diameter telescopes and, on the left, a more recent 28-metre diameter telescope. © Bruno LIEUNARD/Jean-Marc DUBOIS/Collaboration HESS/LAPP/CNRS Photothèque

## 3.1. COPUBLICATIONS

It is possible to reveal real links between the CNRS and African countries by looking at the number of CNRS-Africa co-publications for the period 2014-2019, as well as indicators related to incoming and outgoing mobility or institutionalized cooperation[15]. Looking at publications, those dealing with African themes are the majority, especially in French-speaking African countries that are very oriented towards France. These countries, however, publish very little, even when compared with the rest of sub-Saharan Africa, with the exception of Senegal and Cameroon. Conversely, the main countries publishing outside South Africa are English-speaking (Nigeria, Ghana, Kenya, Uganda). These countries, however, do not work very closely with France or with the CNRS. Still, looking at the general trend for African publications, there has been an increase in the number of CNRS-Africa co-publications and in their quality over the last 10 years, especially in physics and in environment-ecology. In absolute numbers, physics and chemistry are far ahead of the rest of other scientific fields with almost 2,500 and 2,000 publications respectively[16].

Finally, it is interesting to note that many of these CNRS-Africa co-publications involve our main national partners (Université Paris Saclay with nearly 20%, Sorbonne Université, Université Grenoble Alpes, Aix-Marseille Université, CEA and IRD) and European partners (CSIC, Helmholtz, INFN, Russian Academy of Sciences, Sapienza University of Rome and University of Bologna). All of this must give us food for thought to further consolidate our partnerships and thus more generally, consolidate higher education, research and innovation in Africa.

## 3.2. COOPERATION MECHANISMS

In terms of institutionalized cooperation, the CNRS, like many other French and European research bodies, universities and funding agencies, has put in place schemes to structure projects with foreign partners in an institutional setting, giving them a formal existence and dedicating targeted funding, and generally making it possible to encourage their long-term involvement.

The CNRS offers these researchers several schemes to structure cooperation with their foreign colleagues, which they can choose according to the degree of maturity of their project. These range from preliminary International Emerging Actions (IEAs)[17] to programmes for more mature projects, such as International Research Projects (IRPs), International Research Networks (IRNs) or International Research Laboratories (IRLs), which give strategic visibility to a group of collaborations at a given location. At the highest level, the International Research Centers (IRC) system makes it possible to group together all existing cooperative projects between the CNRS and a preferred partner, including PhD Joint Programs (PJP), and to define future joint schemes following a strategic dialogue between the CNRS and the given partner.

In Africa, institutionalized cooperation using these mechanisms is more intense in French-speaking countries (North and West Africa) as well as in South Africa, but less in the case of the sub-Saharan zone and East Africa. In 2021, 48 projects[18] have been organized by the CNRS with African countries, mainly in North Africa and South Africa, and concentrating particularly on ecology and the environment but also on the humanities and social sciences. This is particularly true in Joint units with French Research Institutes Abroad (UMIFRE) established in 8 countries[19]. In addition to these 48 institutionalized cooperative projects, 38 projects have been financed since June 2021 in response to the CNRS call for partnerships with sub-Saharan Africa.

In addition, depending on their discipline, researchers have other tools at their disposal to strengthen links with their African colleagues. These include support grants for humanities and social sciences (international mobility and exchanges). Mechanisms such as Zones-Ateliers (ZA), Sites d'Etude en Ecologie Globale (SEEG), Observatoires Homme-Milieux (OHM) provide funding for the development of partnerships and field studies in ecology and the environment. Services Nationaux d'Observation (SNO) are another source of funding dedicated to natural environments, the observation of astronomical systems or layers of the earth system. Other schemes exist for computer sciences, mathematics and physics with a particular focus on training.

15 See section 3.2
16 Followed by engineering (1116), geosciences (1084), materials science (982), environment-ecology (955), Earth and space sciences (691), biology-biochemistry (360), mathematics (317) and computer sciences (280). NB:The InCites database references significantly more documents in the fields of exact sciences, medicine and engineering than in the humanities.
17 In 2021: 396 IEAs, 210 IRPs, 110 IRNs and 77 IRLs were operational. Also 152 PJPs with 14 partners.
18 CNRS-Africa cooperations: 8 IEAs, 6 IRPs, 12 IRNs, 12 IRLs (11 in Humanities INSHS and 1 in ecology and the environment) and 10 formerly-named PICS (international programmes) ending in 2022.
19 Among the 27 UMIFREs under the dual supervision of the CNRS and the MEAE (Foreign Affairs Ministry), 8 are located on the African continent in 8 countries (Egypt, Ethiopia, Kenya, Morocco, Nigeria, South Africa, Tunisia and the Sudan).

## SUPPORT ACTION FOR COLLABORATIONS WITH SUB-SAHARAN AFRICA

**In order to identify the needs for collaborative projects within an institutionalized setting, the CNRS research communities were asked about their interest in working with their counterparts in sub-Saharan Africa through a Call for proposals entitled "Support Action for Collaboration with sub-Saharan Africa." The objective is to support existing or forthcoming collaborative projects with ten priority countries (Benin, Burkina Faso, Cameroon, Ethiopia, Ghana, Kenya, Nigeria, Senegal, Tanzania and Uganda) selected for their publication dynamics and the proactive stance adopted by their leaders on science and innovation.**

**Dedicated funding, over the period ranging from June 2021 to December 2022, will cover individual exchanges between scientists based in a CNRS unit and in an African university, support for students, or the organisation of seminars or research schools.This call for projects demonstrated real and tangible interest from the CNRS researchers in collaborating with sub-Saharan African countries. Over 220 proposals were received. 70% of the submissions included partners in the target countries (see above). 30% involved a Senegalese partner. A total of 38 projects were selected for their scientific excellence by the CNRS institutes and Interdisciplinary Selection Committee, for a total budget of approximately EUR 600,000.**

**Unsurprisingly, while a certain number of projects are linked with societal challenges (climate change, water treatment, energy, health), other projects corresponded very closely to the CNRS COP's challenge on "Territories of the Future", relating to the technologies to be developed, the identification and management of risks related to urbanization, or the measurement of urban impact on biodiversity. These are of course indicators to be taken into account when developing our strategy on future collaborations. Particular attention should also be paid to what is known as "adapted or frugal innovation", a revolutionary approach that originates from the countries of the South (Africa, Brazil, etc.). This offers a profitable and sustainable alternative to the innovation model developed in the countries of the North.**

Another indicator quantifying the intensity of cooperation is the number of missions undertaken by staff from the CNRS-affiliated units, to Africa, both on field missions and exchanges. Over the period 2008-2018, 28, 000 missions were carried out, more than half of which were in the human and social sciences, sciences of the universe, ecology and the environment, with a majority involving scientific field missions.

Furthermore, the presence of nationals from African countries in the CNRS laboratories is another illustration of the CNRS-Africa links. Nationals from sub-Saharan African countries are poorly represented among the CNRS permanent researchers (17 in total) and the CNRS post-docs (34 in total). These figures, which represent the total for 50 countries, are comparable to the number of Tunisians in our laboratories. The number of doctoral students, on the other hand, is much higher, mainly from French-speaking countries. In total, France[20] welcomes nearly 3,500 doctoral students from sub-Saharan Africa[21], i.e. 14% of the total number of foreign doctoral students (compared to 4,200 doctoral students from North Africa or 2,000 from China).

At a time when the strategies of the European Union and the African Union are converging, it is interesting to assess the opportunities provided by European funding for the implementation of structured projects. The Horizon2020 framework programme has funded 474 projects, 34 of which involve the CNRS in Africa. The majority of these projects come from the three pillars "Excellent Science ", "Industrial Leadership" and "Societal Challenges" but also from the transversal programme "Science with and for Society". The work programmes "Health, Demography and Welfare" as well as "Climate Change and Resources" and "Infrastructure" obtained the highest number of African partners in the final selection (South Africa, Morocco and Senegal in the lead). With a strengthened EU-AU dialogue under the new Horizon Europe framework programme (2021-2027), the participation of our African colleagues can only be increased. Moreover, there are more opportunities offered by Pillar 2 of the Framework Programme with its clusters and missions dedicated to "global issues" with regard to the themes targeted on major global issues. The international partnerships selected by the European Commission are taken into account when responding to calls for projects.

However, African scientists suffer from a lack of expertise in project engineering when responding to European calls for projects, which consequently limits their success rate. While in France, as in other European countries, the difficulties experienced by researchers are the same, research organizations and universities have set up support and assistance mechanisms (European project engineers, tutorials, orals etc.) to help them. It should be possible to set up or strengthen project engineering for African academics and here too, the CNRS could contribute to this effort (see section 4.3).

### 3.3. THE CNRS OFFICE IN AFRICA

Created in 1995 and based at the Innovation Hub in Pretoria, close to the Department of Science and Innovation (DSI), the National Research Foundation (NRF) and the Council for Scientific and Industrial Research (CSIR), the CNRS Office in South Africa is shared with IRD (French National Research Institute for Sustainable Development), since 2011 and CIRAD (French agricultural research and cooperation organization working for the sustainable development of tropical and Mediterranean regions), since 2015. The area of competence for the CNRS covers the 12 countries of Southern Africa. For IRD it covers South Africa, Zimbabwe and Mozambique, while CIRAD concentrates on South Africa (in conjunction with the CIRAD regional office based in Madagascar).

The CNRS Office provides expertise, advice and support for scientists who wish to set up collaborative projects between Southern Africa and France. This involves four types of activity. Giving up-to-date information to research operators in France and Southern Africa on the higher education, research and innovation ecosystems – including their priorities and opportunities. Connecting French and Southern African teams looking for partnerships with the most relevant contacts in corresponding research units. Helping and accompanying Southern African and French researchers in their desire to structure and reinforce their collaborations over the long term. Finally, ensuring the promotion of these scientific collaborations.

The CNRS Office in Pretoria therefore represents a key element in the construction of the CNRS strategy and policy in terms of cooperation with Africa, even more so today with the deployment of this multi-year plan. The undeniable benefit of the presence of an office in the field has led the CNRS to consider creating a second office in the short term, or even a third in the medium term.

Coprological analysis, under a binocular microscope, to determine the gastrointestinal parasites present in a sample of mandrill faeces, "Mandrillus sphinx".
© Claude DELHAYE/CNRS Photothèque

20 Source Campus France – Key figures 2021 (in French) (https://ressources.campusfrance.org/publications/chiffres_cles/fr/chiffres_cles_2021_fr.pdf).

21 Among the top 20 countries of doctoral mobility to France, 9 are African, including 5 in sub-Saharan Africa (Cameroon, Congo, the Ivory Coast, Gabon and Senegal). If we limit to exact sciences, Senegal, Cameroon and the Ivory Coast each have more than 400 nationals in French laboratories, followed by Gabon (300 doctoral students).

# 4 I AN AMBITIOUS STRATEGY TO MEET STRONG CHALLENGES

Measuring the temperature of hydrothermal fluids in a fumarole field at the Dallol hydrothermal site, a unique environment on the planet located in the Danakil depression, Ethiopia. © Purificacion LOPEZ GARCIA/ESE/www.deemteam.fr/CNRS Photo library

## 4.1. TOWARDS A MULTI-YEAR COOPERATION ROADMAP

This overview of the CNRS commitments in Africa illustrates the wealth of cooperation in place, both in terms of the diversity of countries involved and the plurality of scientific fields addressed. The research laboratories established on the African continent are our primary ambassadors and reflect our commitment to Africa. They are dynamic, rooted in the scientific communities that run them, and are a gateway for potential partners from the academic and business worlds, as well as for local citizens. The CNRS is convinced of the need for additional institutional investment in order to nurture, promote and organize the needs of researchers, and to provide a response commensurate with the challenges of our African collaborators. The investment must be designed in intimate collaboration with the French ministries (in particular, MESRI and MEAE) and with our French partners in higher education, research and innovation for targeted and shared projects. Investment must be considered at the same time at the European level, in consultation with the members of the G6 from Germany (Max Planck, Leibnitz, Helmholtz), Spain (CSIC) and Italy (CNR).

The CNRS proposes a multi-year roadmap, following a trajectory that is deployed gradually and involving high-level programmes to support and encourage research, training and innovation in and with Africa. The rest of this document describes the key action points that will be implemented in a **targeted campaign**, with an initial investment to attract sustainable external (co)funding.

The CNRS research policy strategy is to establish a new cooperation dynamic, building on the existing one, but also consolidating it. The short-term implementation of this strategy includes initiatives aimed at consolidating synergies between French and African researchers, with other higher education, research and innovation institutions or organizations (academia, ministries, agencies, etc.) involved in the development of African countries. The deployment of cooperation in Africa requires a multi-criteria analysis that is essential to be relevant and in line with the respective expectations of our African partners. The criteria concern existing cooperation, scientific production (publications, start-ups, etc.), incoming/outgoing mobility of scientists and students, the leverage effect for funding (France, Europe, World), partnerships with other players in the ecosystem (NGOs, local authorities, etc.) and the impact of the project on the country's economic and societal development. This is certainly a complex analysis, but one for which we hope to provide appropriate responses by relying on a team of like-minded players who share the same vision.

## 4.2. A DIFFERENTIATED STRATEGY

The CNRS cooperation with Africa is strongly influenced by the researchers who are involved in it and the realities of science, technology and innovation on the continent. The CNRS is proposing a strategy that combines the dual objective of supporting a bottom-up approach and the need to coordinate the various proposals at the institutional level to create and increase synergies. To this end, three geographical areas have been identified.

**The North African countries** are among the closest Euro-Mediterranean partners of the CNRS: co-publications, structured cooperation, mobility and PhD training are the priorities of the CNRS in this area. Participation in European capacity-building projects such as Euromed could be envisaged.

**South Africa** occupies a privileged and special place. Its scientific quality is widely recognized and it has long been the leading producer of science in Africa (although in terms of number of publications it was overtaken by Egypt in 2021). Institutionalized cooperation between the CNRS and South Africa exist, the objective of the CNRS being to strengthen links in physics and chemistry, but also in sciences of the universe, ecology, the environment, biology and mathematics. This desire to strengthen cooperation was the motivation for initiating a strategic partnership with the University of Witwatersrand through a "PhD joint programme" and the signing of a framework agreement granting CNRS researchers "associate researcher" status during their stays. The reinforced dialogues started with the South African higher education, research and innovation operators will continue in order to increase cooperation. The latter have also shown a strong interest in participating in collaborations with French-speaking Africa via French operators.

**In sub-Saharan Africa**, our desire is to strengthen and update fieldwork to ensure equitable and fair partnerships. The challenge is to propose new modes of collaboration based on co-constructing issues simultaneously in terms of training, research and innovation. The partnerships that will be formed should respond to the double need to deal with societal challenges at the same time as ensuring that knowledge is advanced within these societies. Regional approaches, rather than the multiplication of bilateral cooperation agreements, are a way of creating strong dynamics that will help avoid shortcomings such as brain drain or dependence on external funding.

While this vision reflects our thinking now in 2021, it will require rethinking as the projects' scientific developments

and their impact on the understanding of global issues and societies evolve. It will also take into account new perspectives shared with our partners, both African and French, with the constant aim of doing better, together.

## 4.3. WORKING TOGETHER WITH AFRICAN INSTITUTIONS AND SCIENTISTS ON THE PARAMETERS OF RESEARCH, INNOVATION AND TRAINING THROUGH RESEARCH

**Deepening our relations with the most dynamic universities and research centres on the African continent.** Since knowledge is also transmitted through training in research and by research, the mobility of researchers and students is a key factor in the success of cooperation. Perhaps even more so for students who, by immersing themselves in another country, can benefit from the right training conditions, gain a vision other than that of their country of origin and, in turn, become the teachers of tomorrow. Since 2020, a convergent dialogue between the CNRS and the University of Witwatersrand, ranked as the number one African university, has led to the launching of a CNRS-Wits doctoral programme in order to give doctoral students the opportunity to carry out their research both in South Africa and in France. In addition to the virtuous effect of attracting high-level research staff, this collaboration gives the CNRS greater visibility and influence within the African network of the University of Witwatersrand and thus provides a better vision of potential, further cooperation, particularly in West Africa.

We intend to extend this collaborative construction approach to other partners of excellence on the continent. Institutionalized dialogues, which we will personalize according to the partners we are talking to, will make it possible to define together the nature of the different initiatives to be encouraged and promoted, as well as the means to be deployed for their implementation.

**Encouraging cooperation approaches based on strengthened partnerships with key regional institutions.** This intra-regional dynamic will make it possible to multiply potential funding sources but not be dependent on foreign institutions, avoid the brain drain, and enable the co-construction of scientific priorities, as well as the setting up of international thematic networks. Working with networks of universities such as ARUA, or research centres such as AIMS, will facilitate this regional and pan-African dynamic.

**Strengthening upcoming or more established collaborative projects that are not on the radar of institutionalized cooperation.** Through a competitive call for proposals open to all disciplines (see insert), we identified the different scientific communities and their needs in cooperation terms. These researchers, who declare an interest in Africa, will contribute to focus groups to determine the more suitable modes of cooperation and themes of interest for both the CNRS and its partners. Initiated in the autumn 2021, this data collection process of the various needs that are to be met will be carried out with principal investigators, the CNRS governance and members of the CNRS-Africa Advisory Council, and will be renewed regularly to take into account scientific and political dynamics.

**Combining international cooperation with open science[22].** The CNRS will develop a methodology to make scientific information and research data available to the CNRS teams and their African partners.

**Setting up reserved time on national platforms and TGIR (very large-scale research facilities)** for collaborations with African teams. The CNRS could be leader in initiating a methodology to enable African researchers to access these facilities by making the connection with its international partners.

**Consolidating our links with businesses,** which are essential partners of the CNRS, and with whom it collaborates through joint research units in France and abroad (China, Japan, Singapore and the US). The CNRS will join forces with industrial partners to explore new avenues of collaboration in Africa and respond to the need for innovation towards sustainable solutions. Companies such as Cémoi or Suez have successfully adopted renewed public-private partnerships, where fundamental research is the breeding ground for the successful co-construction of projects, serving as a safety net for the anticipation of risks and for the remediation of damaged ecosystems.

Two approaches will be set up to kick-start a virtuous circle: the first concerns partnerships with French companies in order to identify R&D offset opportunities together but also onsite training and research issues at stake; the second consists in a response to the expectations expressed by African companies in terms of research collaborations. The latter, which is more ambitious but also more difficult to implement, for it presupposes a pre-existing level of relations with African companies, is more promising in terms of development potential for the African continent.

**Helping to train the next generation of African researchers** is an important component in our partnership. The CNRS's collaboration between French and African universities should make it possible to establish intimate links between training and research for students (and staff) from both sides. As already mentioned, exchange programmes for doctoral students, post-doctoral students and young researchers are powerful tools for sharing knowledge and scientific culture. This will be achieved by reinforcing the CNRS's role in the training of students (particularly at the master's and doctoral levels) within summer schools, for example, but also in the training of staff already in post. Short-term proposals for reflection include initiatives to encourage more North-South and South-North researcher mobility and exchanges to join international scientific networks, and on another front, to encourage the creation of start-ups.

## 4.4. DEVELOPING STRATEGIC MANAGEMENT BASED ON EXPERTISE FROM OUTSIDE THE CNRS

The CNRS calls on its national and international partners (research organizations, universities, academies, funding agencies, consortia, alliances, etc.) to favour a concerted approach based on cooperation, the implementation of complementary actions, recognition of each other's strengths and equity.

**Establishing an Africa-CNRS Advisory Board for an in-depth, mutually beneficial scientific and strategic dialogue.** This board, composed of African, French and European personalities, will be placed alongside the governance of the CNRS. It will provide insight into the challenges of science in Africa and facilitate exchanges with the various pan-African science networks. The Board will also provide input to identify common research and innovation themes, exchanges to be pursued with industry, and the development of new modes of governance and collaboration. It will be consulted on the implementation of ambitious strategies and efficient action plans to further develop our scientific cooperation with Africa.

**Enhancing the complementarity of players in higher education, research and innovation in France, Europe and abroad.** As previously pointed out, many stakeholders have already demonstrated their interest in cooperating with African countries. Taking into account the mechanisms already set up or existing networks of reflection is an essential step in our strategic planning to coordinate and optimize the CNRS's future commitments on the African continent. Enriching the Africa-CNRS cooperation requires, of course, that we consider and build on what some of our partners are already doing in a very successful way. The establishment of a regular and trusting dialogue with our current and future partners is the key to building synergies. At the national level, the CNRS knows how to work with research institutions already heavily involved in Africa. These include CIRAD (French agricultural research and cooperation organization working for the sustainable development of tropical and Mediterranean regions), IRD (French National Research Institute for Sustainable Development), INRAE (French National Research Institute for Agriculture, Food and Environment) and INSERM (National Institute of Health and Medical Research). These also include many universities among which the universities of Aix-Marseille, Côte d'Azur, Montpellier, Bordeaux or Sorbonne Université. We will endeavour to participate in initiatives set up its French partners or propose new ones.

Likewise, the aim will be to work closely with our international academic partners. At the European level, the G6 informal information-sharing group should be consulted to take a concerted position regarding the EU strategy for Africa and to obtain funding in order to strengthen existing partnerships and develop others. This is true particularly within the framework of Horizon Europe, whose desire to open up to the international community, and to Africa in particular, corresponds to the multidisciplinary vision the CNRS proposes. The CNRS will also pay particular attention to including, as part of its discussions and cooperation, the network of scientific and university attachés in French embassies, as well as its partners in the socio-economic world, particularly small and medium-sized companies.

**Encouraging the support of African partners in the framework of collaborative projects.** This will involve encouraging our joint research laboratories to involve African partners in response to the French National Agency's (ANR) calls for projects. The CNRS will initiate a global discussion with ANR on the subject of funding participation in these calls for projects. In terms of our stance towards the European Union, the aim will be to use the "Mirror Groups" and ensure they take account of the need to highlight cooperation with Africa so that they can be more widely funded by Horizon Europe.

**Promoting a tripartite cooperation paradigm** involving the CNRS, African partners and partners from other continents. With a view to building responses to global issues by combining expertise across the globe, the aim here is to combine approaches that feed on ecosystems that share similar issues. For example, the issue of the oceans and marine biology is of interest to our Brazilian, South African and Indian partners, and it is in our interest to pool our efforts to build multi-continental consortia. The UMIFRE (Joint units with French Research institutes Abroad), which are embedded in local scientific communities, are also an excellent promoter of exchanges. Tripartite cooperation should make it possible to attract new sources of funding, while broadening the spectrum of cooperation to include innovation and the involvement of the industrial sector.

**Promoting and sharing strategies with our partners in terms of technological innovations** (technology transfers, knowledge transfer, patents, start-ups) but also **innovation in the processes** to be implemented to adopt new modes of cooperation. It is important to establish a network of referents or mentors, notably from the African diaspora, or from the alumni community so that their expertise can be shared among the research community.

22 CNRS Roadmap for Open Sciences: https://www.science-ouverte.cnrs.fr/wp-content/uploads/2019/11/CNRS_Roadmap_Open_Science_18nov2019.pdf

## 4.5. IMPLEMENTATION MECHANISMS

**Consolidating our structured collaboration schemes** (International Emerging Actions/International Research Projects/International Research Networks/International Research Laboratories) and the specific schemes deployed by the CNRS Institutes, such as the Zones Ateliers (ZA), Sites d'Études en Écologie Globale (SEEG), Observatoires hommes-milieux (OHM), Services nationaux d'observation (SNO), Groupements d'intérêt scientifique (GIS), etc. The additional resources will be used to strengthen these mechanisms and their respective ecosystems. This will be done for example by linking academic partners and companies who share the same interest, and by creating crossing points between the CNRS activities in Africa and other emerging countries, societal issues being most often at the heart of the concerns of these countries, albeit identified in a way that is specific to their respective societies. Particular attention will be paid to building up common responses to these global challenges, by adopting multidisciplinary and interdisciplinary approaches.

**Opening up international cooperation initiatives (existing IRNs and IRPs)** to teams of potential partners from sub-Saharan Africa, by organizing a call for proposals. This call for proposals could be **oriented towards the establishment of thematic networks**.

**Setting up a CNRS-Africa Steering Committee** bringing together all the internal stakeholders in order to guarantee the implementation of this multi-year roadmap. Its mission will be to take ownership of the work of the CNRS-Africa Advisory Board, then to propose practical implementations that are consistent with the CNRS's scientific priorities, and finally to monitor their development.

**Creating a second representative CNRS Office in Africa in the short term – and perhaps a third one later on – in addition to the office in Southern Africa.** This would help establish privileged links with the various scientific and institutional players present in each region, as well as with funding agencies, and would promote the CNRS locally, with a view to increasing the volume of projects and scientific opportunities. The precise location of these new offices (West Africa and East Africa) has yet to be defined. One of these offices could also house a first science hub dedicated to interdisciplinary scientific research activities, which should be equipped with quality infrastructure (accommodation, catering, IT equipment, etc.).

**Launching a thematic and interdisciplinary call for proposals at the end of 2022.** This institutional approach will be deployed at the same time as high-impact research programmes and will complement the scientific approach promoted by the CNRS institutes. In the first instance, workshops will be organised in order to federate the community of researchers who collaborate with their partners in Africa, and to identify priority themes.

**Organizing regular events related to Africa,** in order to create and federate a research community around common challenges with our African partners, and influence different political organizations and international donors. Thus, in collaboration with the IRD, the CNRS is proposing, within the framework of the French Presidency of the Council of the European Union (PFUE), to organize an event in Brussels on the theme of renewing the scientific partnership with Africa at the European level. The aim is to bring together French research organizations to draw the attention of European decision-makers to this issue.

**Promoting the CNRS-Africa cooperation through a network of CNRS ambassadors by creating a Visiting Fellowship Programme,** awarded to pairs of scientists (1 French and 1 African in each team). This programme will enable African awardees to be hosted at CNRS units, to join a research team for a period of two to four months and thus be able to build an international network. They will also have the opportunity to concentrate on their research or training project, without the administrative constraints and teaching workloads that are sometimes heavy at home, due to the lack of senior staff in their institutions. They will then become ambassadors of the CNRS excellence. In turn, mobility grants will enable the CNRS researchers to visit for two to four months and organize scientific workshops or participate in teaching and training in the hosting African structure.



**Publisher**
Antoine Petit, CEO and President of CNRS

Cover photograph: Artist's view of the Square Kilometer Array (SKA). The SKA is a project for a giant radio telescope with a collecting area equivalent to one square kilometer. It is scheduled to be deployed in South Africa.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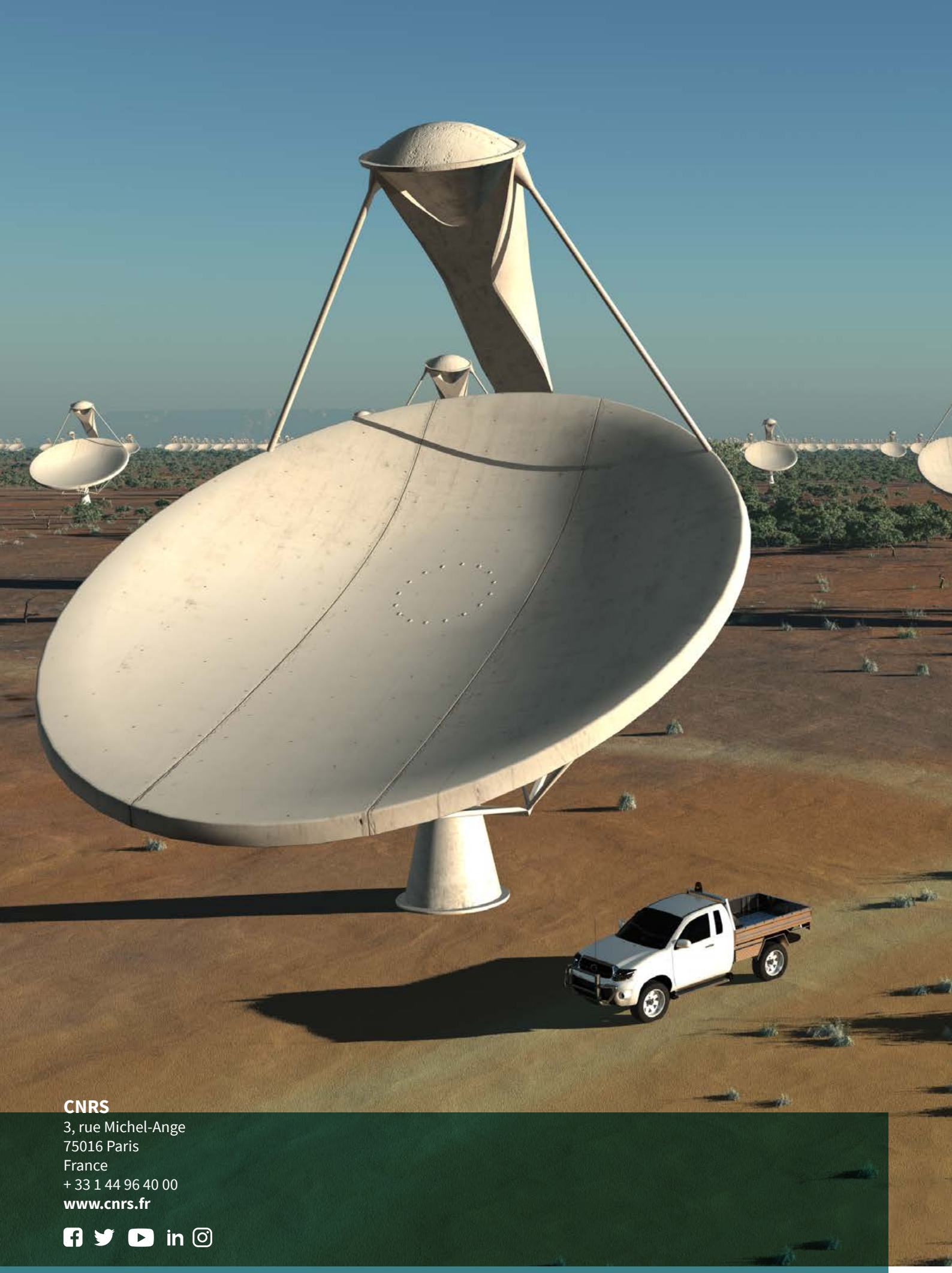

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