

# Building twenty-first century agricultural research and extension capacity in Africa

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## Abstract

This study explores the effectiveness of international efforts to build the capacities of national agricultural research and extension systems (NARES) in Africa and proposes actions to improve the performance of these systems. Analysis draws on agricultural research expenditure data in Africa, Asia and Latin America and key informant interviews of 26 senior representatives of international and African research organisations. We conclude that donors and international partners have increased the supply of professional African scientists while contributing relatively little to the institutional capacities of African NARES. We propose a transition to what we call a twenty-first century African-led agricultural research system and identify actions to manifest it.

**Keywords:** agricultural research and development, technical innovation, research management, national agricultural research systems

**JEL Classification:** O19, O32, Q16

*We cannot in the third world simply borrow or buy science from those ahead of us. Pure science we can take as it comes, but much of applied science we have to make for ourselves.*

—Arthur Lewis, Nobel Banquet address, 1979

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## 1. Introduction

Seventy-four per cent of Africa's crop production growth since 2000 came from the expansion of area under cultivation and only 26 per cent from improvements in crop yield (Jayne and Sanchez, 2021). Continued reliance on area expansion to feed Africa's population is not sustainable. While roughly 60 per cent of the world's remaining potential arable land is in sub-Saharan Africa (SSA), most of this land is concentrated in just eight countries; the potential for area expansion in most of the region's remaining 41 countries is very limited (Lambin *et al.*, 2013; Chamberlin *et al.*, 2014). Even though most of SSA might be considered 'land abundant', a relatively large proportion of rural Africans are unable to expand their area under cultivation and must rely on yield improvement to improve their livelihoods.

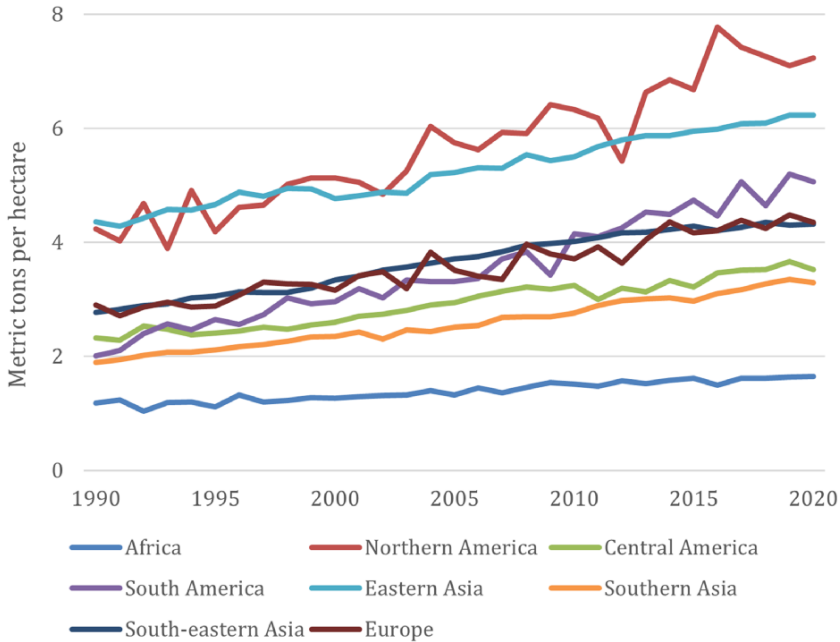
Continued reliance on area expansion as the main source of agricultural growth is also unsustainable on environmental grounds. Agricultural land expansion has accounted for most of Africa's loss of forests, grasslands and biodiversity. The goals of feeding Africa's growing population and conserving the planet's natural resources, diverse ecosystems and the services they provide will be more effectively achieved through productivity improvements on existing farmland instead of area expansion (van Ittersum *et al.*, 2016; Alliance for a Green Revolution, 2022).

For these reasons, sustainable agricultural intensification in Africa increasingly depends on raising yields. Crop yields in SSA are the lowest of all regions of the world and the yield gap continues to widen against other developing areas (Figure 1). The slow rate of crop yield growth in SSA over the past four decades attests to the urgent need to understand how to improve the systems responsible for raising crop yields in the region.

Well-functioning agricultural research, development and extension (R&D&E) systems are obviously not sufficient for achieving these varied objectives, but they are indeed necessary because they are the organisations that generate new technologies and management practices required for technical innovation (Fuglie *et al.*, 2020; von Braun *et al.*, 2023). Farm technical innovation is enabled by favourable sectoral and macroeconomic policies, investments in transport and communications infrastructure, and private investments in agrifood systems; all these encourage farmers to invest in their farms (Barrett *et al.*, 2022). But the generation of improved farm technologies and their adaptation to local biophysical and socioeconomic conditions, which enables farm productivity growth, could not occur without agricultural R&D&E systems.

The international research system (IARS)—defined as the CGIAR<sup>1</sup> together with United Nations organisations and international universities—has by most accounts successfully generated new agricultural technologies, practices and other international public goods that have improved livelihoods around the world (von Braun *et al.*, 2023; Alston *et al.*, 2022). However, the impacts of the

1 The CGIAR website indicates that it currently goes by the acronym but was formerly referred to as the Consultative Group on International Agricultural Research.



**Fig. 1.** Cereal yields by region (metric tons per hectare), 1990 to 2020 notes below table.

Source: FAOSTAT (last accessed May 2022).

IARS have been limited in areas lacking well-functioning national R&D&E systems. It is widely recognised that international research organisations are not well-suited to scale-out technical innovations across highly varied agro-ecological conditions in Africa, nor do they have the resources to do so. Hence strong national and regional partners on the ground are necessary. The fact that much improved genetic materials developed by international research fail to be commercially distributed and adopted by African farmers attests to the need to strengthen African National Agricultural Research and Extension Systems (NARES) to achieve greater impact from funds allocated to international research.

For precisely these reasons, the IARS have attempted to build the capacity of national research systems in developing countries and directly collaborate with them to transfer and adapt internationally generated technologies to farmers. Many organisations within the IARS state that capacity development of African-led agricultural research organisations is among their primary mandates (e.g. CGIAR—IEA (2017)) and they have received substantial international funding for at least four decades to achieve this goal. More and more international donor organisations are explicitly prioritising ‘locally led development’. However, even after decades of capacity development efforts, most African NARES remain weak and dependent on the IARS (Stads *et al.*, 2021).

This study examines the effectiveness of international capacity development efforts to build the capacities of agricultural R&D&E systems in Africa and identifies actions for strengthening the capacities and performance of both African NARES and international research and donor partners. Research on this topic has been impeded by the lack of data on the behaviours of, and interactions between, organisations operating in the agricultural R&D&E space in developing countries. Most available quantitative data lack the depth or nuance to shed light on complex institutional behaviour. Hence, in addition to using secondary data on national R&D expenditures in Africa, Asia and South America, this study derives its findings from key informant (KI) interviews of 26 senior representatives of African and international agricultural R&D&E institutions.

Respondents from both groups highlighted aspects of donor funding and IARS behaviour that have delayed the transition to more effective NARES led and owned by African states and society. Based on the weight of KI perspectives, the study concludes by proposing that African governments and African development organisations proceed to build what we call a twenty-first Century NARES in which research is defined, prioritised and implemented by NARES with the IARS being in service to the NARES. IARS still have a crucial role to play, but that role would be shaped by and in service to the NARES, African governments and African development organisations themselves. Achieving this vision will require that international donors and IARS be willing to relinquish some degree of control over the allocation of funding and embrace a truly African-led system. The study concludes with proposals for consideration by African governments, African R&D&E organisations, international research organisations, donors and the private sector.

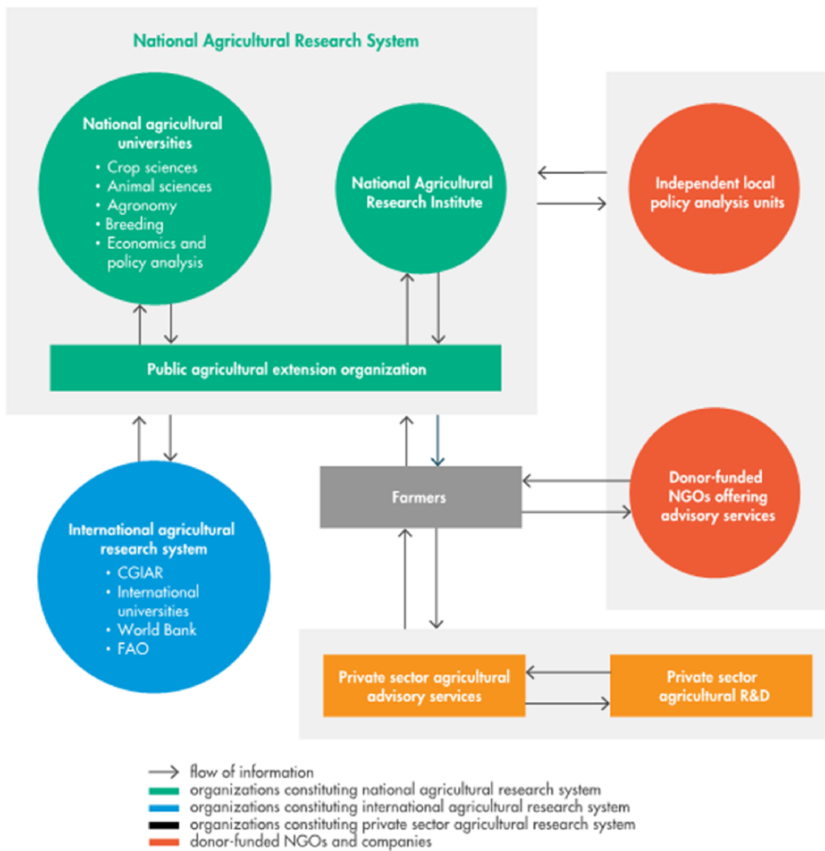
## 2. Methodology and data

### 2.1. Definitions

National Agricultural Research and Extension Systems (NARES) are defined in this study as encompassing all public institutions devoting their activities to agricultural research and advisory services to farmers and committed to a nationally defined research agenda. NARES include at least three types of organisations: (i) national agricultural research institutes (NARI); (ii) national agricultural universities and their affiliated institutes that generate agricultural research on crop science, seed breeding, veterinary sciences, agronomy, economic and policy analysis, *inter alia*, and build the capacities of the national workforce involved in farming and agrifood systems; and (iii) technical departments of public sector ministries involved in agricultural research and advisory services to farmers.<sup>2</sup>

<sup>2</sup> This study distinguishes between NARES, NARI and NARS as follows. National agricultural research systems (NARS) include the organisations within the NARES responsible for research and development and exclude extension organisations. NARES refer to the full set of public agricultural research, development and extension organisations.

The international agricultural research centres of the CGIAR are not part of NARES; they have a global mandate and their activities are not defined by national governments. However, their activities are in principle coordinated with the NARES. The historical division of labour between the CGIAR and NARES has been that the CGIAR is responsible for managing the international gene bank, generating improved technologies and transferring them over to NARES, who are in turn responsible for adapting the technologies to local conditions and ensure farm adoption (Byerlee and Lynam, 2020). Figure 2 shows the various public and private sector organisations operating in agricultural R&D&E systems in a given country.



**Fig. 2.** System of national and international agricultural research, development and extension systems operating in African countries.

Note: The national entities in green are public sector organisations. In some countries, there is more than one NARI and more than one public extension system.

## 2.2. Methods

Findings and conclusions are based on two sources. First, we review existing literature related to agricultural R&D&E systems in SSA and examine trends in R&D expenditure and staffing, utilising data compiled by Agricultural Science and Technology Indicators, FAOSTAT and CGIAR annual reports.

The second source of the study's findings was KI interviews of senior representatives of national, regional and international agricultural research institutions. Because we aim to better understand the behaviours of and interactions between African and international development organisations, we interview roughly equal numbers of KIs from these two groups. We also selected three representatives of international donor organisations that are major funders of agricultural research in Africa. KI selection was necessarily purposive as it was considered infeasible to compile lists of relevant representatives from all national and international organisations involved in agricultural R&D&E in Africa. We adopted Chatham House Rules for these interviews to ensure that respondents could express their views freely without attribution; however, all respondents consented to having their organisational affiliations and positions reported (see [Appendix 1](#)).

The KI approach was considered appropriate for this study for several reasons. The study's objectives require an understanding of priorities, approaches to collaboration and possible strategic interactions between national and international R&D&E organisations. A deep understanding of these issues can be obtained by drawing upon the extensive experience of individuals directly involved in these organisations. The KI approach is especially suitable in contexts where data is unavailable or where issues are too complex to yield insights from quantitative data.

KI interviews followed three steps. First, the team interviewed 26 KIs based on nine open-ended questions shared in advance with each KI. The nine questions explored with experts were designed to shed light on the strengths, weaknesses, opportunities and threats facing NARES in SSA, reasons for varying performance across countries, synergies and coordination challenges between the NARES and organisations in the IARS, impacts on each other's performance and proposed actions for improving the performance and positive impacts of agricultural R&D&E systems (see [Appendix 2](#)). Interviews were conducted individually to avoid the influence of dominant individual(s). Second, written and video transcripts were recorded for each KI. Transcripts were reviewed by the author team and summarised for each question. Third, after all 26 interviews were conducted the author team grouped similar responses into categories and identified key recurrent themes emerging from the nine questions. Five of these themes considered most relevant for this study are summarised in [Section 4](#).

## 3. Trends in agricultural R&D funding in Africa

African governments have historically spent relatively little on agricultural R&D&E compared to other regions of the world. [Table 1](#) reports R&D

**Table 1.** Public agricultural research and development expenditures by region

Region	% increase in public agricultural R&D expenditures (1980–2016)	Public agricultural R&D intensity in 2016			
		R&D/GDP (%)	R&D/cropland (\$)	R&D/farmer (\$)	
Developing Regions					
Central America	44.9	0.75	25.22	62.86	
South America	88.7	1.40	33.04	174.61	
China	1,018.2	0.64	75.20	51.67	
Southeast Asia	229.8	0.35	22.54	27.68	
South Asia	441.4	0.28	22.30	18.63	
West & Central Asia	174.0	0.70	23.40	69.27	
North Africa	164.2	0.40	32.09	79.85	
Sub-Saharan Africa	64.6	0.30	8.31	10.55	
Central Europe	35.6	0.97	23.18	157.78	
Western Europe	61.0	3.03	84.89	1,398.30	
Canada-USA	32.4	2.27	27.78	2,034.01	
Australia-NZ-S Africa	-21.7	1.94	22.59	742.03	
Japan-Korea-Taiwan	94.8	4.61	676.03	1,125.44	
World	130.2	0.93	30.45	55.23	

Source: [Fuglie \(2018\)](#), updated with 2016 data with acknowledgement to K. Fuglie. Notes: public sector allocations to NARS. Figures for sub-Saharan Africa exclude South Africa. The table shows R&D spending in PPP\$ for international comparison purposes.

expenditures in relation to agricultural gross domestic product (GDP), hectares of cropland and the number of agricultural labourers in the country. By most of these measures, funding for NARES has been lower in SSA than in other regions for decades. At least 20 African governments spend so little on their NARES that they are effectively defunct (Africa Union, 2021). National systems in countries, such as Kenya, Ethiopia, Nigeria, Ghana and Rwanda have made important strides, but their capacities are still in great need of improvement.

Table 2 shows the relative contributions of African governments and international donor organisations to agricultural R&D funding per agricultural labourer over the 2010–2019 period. Some African governments, such as Nigeria, Senegal and Kenya, do fund national R&D institutions per agricultural person at levels comparable to many countries in Asia and Latin America. Table 2 also shows that, with a few notable exceptions, African governments account for a substantially greater share of agricultural R&D expenditures than donors do.

The CGIAR is the world's largest publicly funded agricultural research network committed to agriculture innovation for farmers and food systems in the developing world.<sup>3</sup> The CGIAR plays a crucial role in the global agricultural development landscape, providing evidence to policymakers, innovations to partners and new tools to harness the power of agriculture to raise living standards in developing areas. Figure 3 compares total expenditures on the NARS in SSA (mainly funded by national SSA governments) and total international donor spending on the CGIAR in support of agricultural development in SSA.<sup>4</sup> Over the past 3 years for which data is available (2014–2016), the NARS in SSA received USD2.36 billion each year for agricultural R&D, which was five times more than total expenditures by the CGIAR over the same period (USD468 million). Agricultural R&D expenditures account for roughly one-third of the CGIAR's total expenditures in SSA (Fuglie, 2022), meaning that the CGIAR's agricultural R&D activities in SSA is estimated to be roughly \$150 million per year, about one-tenth that of funds allocated to the NARES. In short, the NARES receive the majority of funds expended on agricultural R&D&E in most SSA countries, with the CGIAR playing a vital role but spending only a small proportion of the total funding for agricultural R&D in SSA.

3 The CGIAR currently includes over 9,000 scientists in 15 organisations, including Africa Rice Center, Center for International Forestry Research (CIFOR), International Center for Agricultural Research in the Dry Areas (ICARDA), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), International Food Policy Research Institute (IFPRI), International Institute of Tropical Agriculture (IITA), International Livestock Research Institute (ILRI), International Maize and Wheat Improvement Center (CIMMYT), International Potato Center (CIP), International Rice Research Institute (IRRI), International Water Management Institute (IWMI), The Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT), World Agroforestry (ICRAF) and World Fish.

4 Data are not reported for public extension systems and hence we use the term NARS to denote national agricultural research systems, while NARES is used when public extension services are included.

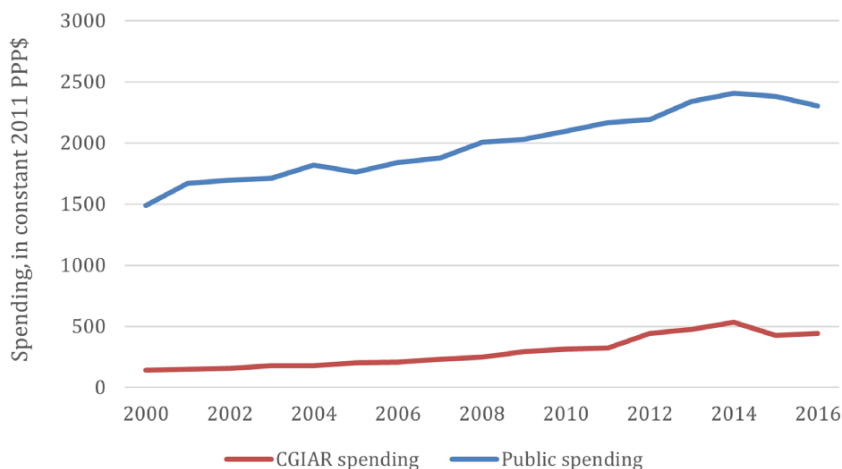


**Table 2.** Public agricultural R&D spending and donor spending per agricultural persons

	Public Ag R&D expenditures, in constant 2020 PPP\$ per agricultural persons			Donor spending on research and extension, \$ per agricultural persons		
	(a) 1990–1999	(b) 2000–2009	(c) 2010–2019	(d) 1990–1999	(e) 2000–2009	(f) 2010–2019
Burkina Faso	7.9	6.6	9.6	0.8	2.0	5.5
Côte d'Ivoire	28.3	6.6	9.6	1.6	0.4	2.5
Ethiopia	4.3	6.6	9.6	0.8	0.5	1.1
Ghana	20.4	6.6	9.6	3.6	2.4	3.0
Kenya	60.9	31.4	24.5	6.3	2.7	2.5
Malawi	9.4	6.0	7.4	0.8	1.0	4.9
Mali	16.7	14.7	12.1	4.2	3.9	2.7
Nigeria	8.5	20.4	23.2	0.8	0.2	0.8
Rwanda	3.5	5.0	8.1	0.2	0.5	1.6
Senegal	39.3	24.5	28.7	3.1	8.2	5.2
Tanzania	5.3	5.5	6.9	1.0	1.1	1.1
Brazil	165.4	152.4	243.4	0.1	1.2	0.7
China	5.5	12.9	32.8	0.2	8.6	2.8
India	5.9	9.4	14.8	0.2	0.2	0.2
Pakistan	13.7	14.0	12.2	0.1	0.1	0.7
Vietnam	1.0	4.2	5.5	0.0	0.5	0.4
Bangladesh	5.5	9.6	9.6	1.3	0.9	2.4

Sources: FAOSTAT, ASTI.

Description: Donor funding includes multilateral, bilateral and private donors including FAO, IFAD, BMGF, etc. Recipients of donor funds are 'bilateral recipients' involved in agricultural research and unfortunately do not specify which organisations receive the funds or whether they are national or international recipients. For additional details, see <https://www.asti.cgiar.org/methodology>. Funding sources include core government allocations from the central government budget, such as through a ministry or the treasury for salaries or operating expenses; other government allocations, such as through competitive funding sources; loans from multilateral or bilateral donors; grants from multilateral or bilateral donors; allocations derived from commodity levies or producer organisations; revenues derived from the sale of goods and services; and any other recorded sources. ASTI's national agricultural research expenditure data is categorised as salary-related expenses, operating and program costs, and capital investments by government, nonprofit and higher education agencies. R&D spending by private entities is excluded, due to lack of available data.

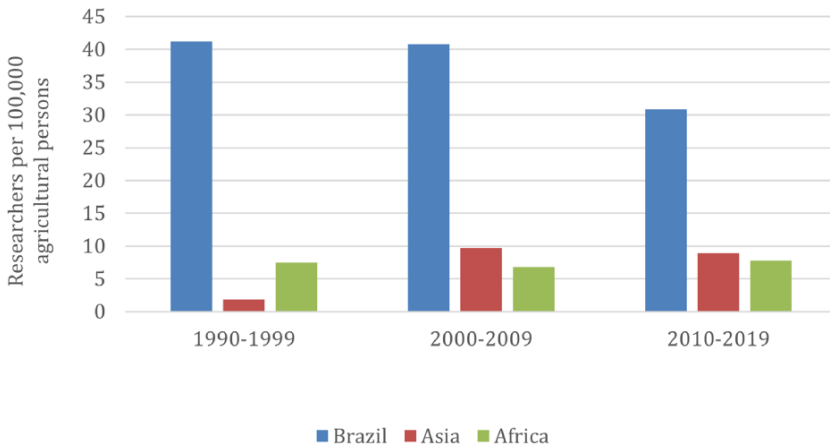


**Fig. 3.** Spending on agricultural R&D organisations by African governments and total CGIAR expenditures on agricultural programs in and/or for sub-Saharan Africa, in millions of constant 2011 PPP\$ notes under figure.

Sources: Agricultural Science and Technology Indicators (ASTI), Fuglie (personal communication) Description: Data on public spending by African governments to African NARS is from ASTI. Data on funding to CGIAR is provided by K. Fuglie and is assembled from annual financial reports of CGIAR organisations; it reports total expenditures in support of agricultural development in SSA and is not specific to agricultural R&D. Fuglie (personal communication) indicates that CGIAR expenditures on agricultural R&D constitute roughly one-third of total CGIAR spending shown in this figure.

During 2009–2016, 57 per cent of the funding to the NARS in SSA (excluding Nigeria, South Africa and several smaller countries) was provided by national governments, and funding from donors and development banks constituted 28 per cent (Stads *et al.*, 2021). Dependency on donor funding is particularly high among francophone West African countries. Many national governments fund little more than the salaries of researchers and staff, leaving budgets for research operations and capital equipment highly dependent on donors and other funding sources. Stads *et al.*, (2021) also found that the amounts disbursed to NARES are routinely lower than—and in some cases only a fraction of—budgeted allocations. These funding discrepancies obviously affect the operations and performance of the NARES; they also make it difficult to analyse whether empirical relationships can be established between the levels of budget allocations and performance.

To examine the robustness of these findings, we constructed alternative indicators of intensity of R&D effort (e.g. the number of researchers in the NARS relative to hectares under cultivation or per agricultural person). These alternative indicators produce results highly consistent with those shown in Tables 1 and 2 and so only report one illustrative example. Figure 4 reports trends in the numbers of researchers in the NARS per 100,000 persons in agriculture over the past three decades. Both Asia and Africa lag far behind Brazil on this indicator but over the 2010–2019 period, in general terms the selected Asian and



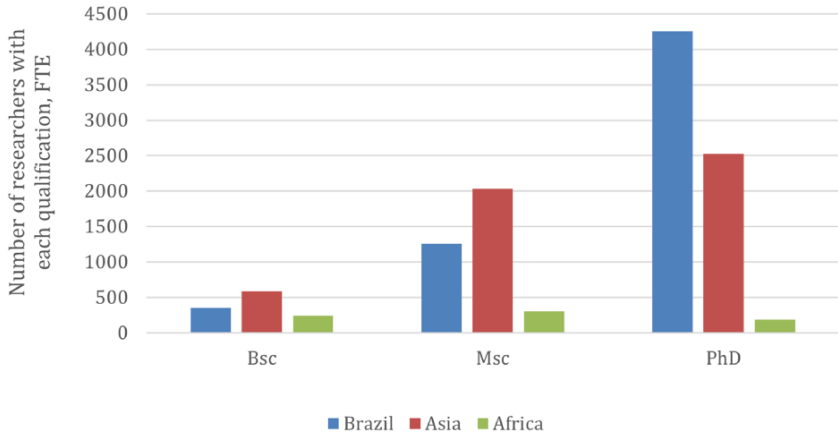
**Fig. 4.** Number of researchers in NARS per 100,000 persons in agriculture notes below figure. Source: ASTI, FAOSTAT. Description: Countries included for Asia are Bangladesh, China, India, Pakistan and Vietnam; countries included in Africa are Burkina Faso, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Malawi, Mali, Nigeria, Rwanda, Senegal and Tanzania.

African countries had roughly similar numbers of agricultural researchers per agricultural person. In all three regions, the numbers of agricultural researchers have increased, almost three times in Africa, but the agricultural population in Africa also grew by a similar magnitude over the same period, such that the ratio of agricultural researchers per person in agriculture barely grew between 2000–2009 and 2010–2019.

Figure 5 reports the composition of degree training of agricultural scientists in various countries and shows important disparities between Brazil, Asia and the 11 African countries for which data are available. The African countries lag far behind Asian comparison countries in terms of the numbers of MSc and PhD level staff in their NARES, highlighting the imperative of capacity building to raise their performance.

#### 4. Main themes from key informant interviews

This study identifies five recurrent themes emerging from the KI interviews: (i) building strong NARES will require a regional approach for many African countries that currently lack functional NARES; (ii) sustained commitment and funding from African governments is a precondition for building strong NARES and regional and continental agricultural R&D&E systems; (iii) IARS often profess to be building the capacities of the NARES but often their overall impact on the NARES is limited; (iv) international donors and research organisations would achieve greater impact themselves by doing more to build the capacity of African NARES and regional R&D organisations; and (v) confront the issue of donors creating new organisations that duplicate activities



**Fig. 5.** Researchers in national agricultural research systems by degree qualification notes below figure. Source: ASTI. Description: Countries included for Asia are Bangladesh, India, Pakistan and Vietnam; countries included in Africa are Burkina Faso, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Malawi, Mali, Nigeria, Rwanda, Senegal and Tanzania.

undertaken by the NARES rather than support them directly.<sup>5</sup> These five themes are elaborated below.

#### 4.1. Building strong NARES will require a regional approach at first for many countries

Today, only a few African countries have productive NARES; at least 20 countries have historically allocated so little public resources to their NARES that they essentially lack a viable national agricultural R&D program or university system capable of producing a steady supply of qualified national professionals to effectively operate a NARES. Hence delivering sustainable and productive technologies to farmers and analytical guidance to policy makers in many African countries will require starting with a regional approach. *Stads et al., (2021)* propose organising agricultural R&D investment by agro-ecological zones rather than political boundaries, at least for relatively small African countries. Integration of agricultural R&D at the subregional and regional level, through joint research programs and regional centres of excellence, may be the most effective way to allow countries with lagging agricultural

<sup>5</sup> The KI interviews resulted in four other key themes, which, while important, are not highlighted here because they were considered less central to this article's objective of examining IARS capacity development efforts and their impacts on African NARES. These other key themes were: (i) well-functioning national or regional R&D&E systems are essential for accelerating the pace of farm technical innovation in SSA, but current performance is highly variable, generally weak, and influenced by factors beyond funding levels; (ii) the importance of integrating nutritional objectives into NARES priorities; (iii) the need for stronger public agricultural extension systems for agricultural R&D investments to achieve impact; and (iv) the need to improve the capabilities of tertiary education systems to generate a continuous stream of well-trained agricultural scientists needed to strengthen African NARES.

research systems to benefit from the gains made in countries with similar agro-ecological conditions that have more advanced systems. Better coordination and a clear articulation of mandates and responsibilities among national, sub-regional, regional and global R&D players are essential to ensuring that scarce financial, human and infrastructure resources are optimised, duplications minimised and synergies and complementarities enhanced.

#### **4.2. Sustained commitment and funding from African governments is a precondition for building strong NARES and regional and continental agricultural R&D&E systems**

Through their Maputo and Malabo Declaration commitments, African leaders have pledged that agriculture is a critical engine for economic development, job creation and poverty reduction ([Africa Union Development Agency, 2016](#)). Yet by most metrics, SSA governments continue to spend relatively little on agricultural R&D ([Table 1](#)). African leaders must become convinced that greater commitment to their NARES organisations will help them achieve many crucial national policy objectives. African continental development organisations such as the African Development Bank (AfDB) and the Africa Union (AU) are in a unique position to galvanise national government commitment to their NARES and necessary follow-through. The AfDB and AU could also do more to hold governments accountable to their Malabo Declaration commitments, especially given that less than ten African governments have consistently adhered to them ([Africa Union, 2021](#)).

The continental and international development community could also do more to demonstrate to African leaders how and why most of their national policy goals, including the sustainable development goals, depend on improving the capabilities of their own national tertiary education systems to generate a continuous stream of well-trained agricultural scientists needed to effectively operate their NARES and, more generally, to generate a skilled and productive work force.

#### **4.3. International donors and research organisations can be doing more to build the capacity of African NARES and regional R&D organisations**

The fact that the CGIAR continues to dominate the agricultural research landscape in many African countries after decades of capacity building efforts can be interpreted as a failure of international partners to have strengthened the capacities of their national partners to assume the lead in agricultural R&D and policy guidance activities.

There is a crucial distinction between individual and institutional capacity building. Most KIs stressed that the CGIAR and international universities have succeeded admirably in building the capacity of individuals, including through attachments, short- and long-term training, scholarships and research collaboration. After receiving such support, many African researchers are hired into positions within the IARS, building the institutional capacities of the IARS

and potentially widening the capacity gap between organisations in the IARS and the NARES. Several KIs specifically highlighted the 'brain drain' from the NARES to the IARS, consistent with [Seck's \(2005\)](#) observation that expenditures to African NARES often indirectly strengthen the IARS at the expense of the NARES. Other KIs indicated that the CGIAR is moving too far into the territory that national research and extension systems should be covering, with the appropriate division of labour being that IARS should do crop breeding and germplasm development, while NARES should lead selection, adaptation and extension. One KI expressed the majority view as follows: 'CGIAR and NARES should have a more clear division of labour, but because NARES have been weak, the international system has naturally encroached'.

The majority of KIs in international and in national organisations stated that organisations in the IARS often claim that capacity building is among their primary mandates and use that mandate to seek donor funding but often do little after grant funds are received to build institutional capacity within the NARES. Some KIs believe that the overall impact of the CGIAR has been to attenuate the development of the NARES. Most KIs in the African organisations pointed to variable treatment by international partners, with some being sincerely supportive while others take a more patronising attitude, inviting African organisations to engage in proposal development at late stages of the grant development process, allocating to them a small fraction of total grant budgets, and hiring away their most talented staff. One KI stated that 'the CGIAR has still not developed a compelling vision for how to work with the NARES, though there are some notable exceptions like [two specific CGIAR organisations], but in general, the CGIAR is not really helping build capacity of the NARES'. Several KIs referred to a vicious cycle whereby weak NARES provide the rationale for organisations in the IARS to continue being the prime grantees of donor funding; because they prepare the budgets and determine how funds are allocated, organisations in the IARS uses those resources to strengthen their own capacities, while doing relatively little to build the capacity of the NARES, reinforcing the need for organisations in the IARS to continue to lead donor-funded projects in the future.

These views are consistent with the findings of several evaluations of CGIAR capacity development efforts. For example, [Stern et al., \(2006\)](#) state 'When CGIAR centres experienced cuts in core funding, the primary cuts were often made in resources for training, primarily meant to strengthen the NARS' and '*the Centers focus their training efforts globally and regionally depending on the mandate and focus of their research. Centers also emphasise the aim to train within their specific area of competence and often the near-term purpose is to improve capacity in that particular area of research and activity. However, the formal commitments of Center managements were not always so clearcut such that research relevance may not necessarily have led to institutional strengthening. Furthermore, where under-resourced NARS were dependent on Center support there might be a risk of distorting NARS research priorities and associated priorities for training in order to access resources*' (p. 2).

In opposition to this dominant view, about a quarter of the 26 KIs felt that the CGIAR has faithfully worked with NARES to strengthen their capacity and feel that CGIAR is adequately focused on capacity development. They suggested that counterproductive engagements between NARES and IARS is at least partially due to inadequate African government commitments to strengthen their own NARES, which in many cases cannot fulfil their own mandates and hence the CGIAR naturally seeks to fill those gaps. The brain drain could be largely avoided if governments provided sufficient resources to provide salaries closer to international levels and to enable NARES researchers to conduct meaningful programs themselves. Six KIs could point to specific examples of success in improving the capacity of NARES. One KI from an African R&D organisation stated *'In my own experience, "I think individual scientists from the NARES really enjoy working with the CG; it really gives them exposure to new tools, methods"'*. But even here, KIs observed that individuals from the NARES were often pulled away from their own organisational priorities to engage in CGIAR-led research activities.

Slightly less than half the KIs based in the NARES viewed CGIAR impacts on the NARES as generally favourable. By contrast, 82 per cent of the KIs based in international organisations viewed CGIAR impacts on the NARES as either inadequate or adverse. Overall, roughly two-thirds of respondents felt that the CGIAR was insufficiently focused on institutional capacity strengthening of the NARES.

#### **4.4. The effectiveness of donor funding to the IARS depends on strengthening the NARES**

A serious stocktaking by international partners—donors, the CGIAR, and international universities—is warranted to develop a greater appreciation of how their own effectiveness (i.e. impact generated per dollar of donor funds allocated to IARS) depends on the performance of NARES, and that, by extension, efforts to build the capacities of these partner institutions should be prioritised more seriously. The fact that much improved genetic materials developed by international research fail to be commercially distributed and adopted by farmers demonstrates how the impact of the CGIAR and other international partners is constrained by severe weaknesses and challenges faced by NARES. System performance is constrained by its weakest link in the system. Support for building strong NARES needs to be pursued with much greater commitment by international donor organisations; impacts from their own grants and projects in fact depends upon it.

Donor commitment to supporting African agriculture requires direct engagement with the NARES. After African governments, international and African funding organisations hold the key to strengthening African R&D&E systems according to the disbursements and grants that they make. We encourage donors to consider ensuring that grants related to African agricultural technical innovation require including organisations in the NARES at the design stage, supporting nationally led priority setting agendas, and ensuring

that NARES interests and priorities are reflected in proposal and budget development. Grants with co-directors from NARES organisations would enable these organisations to feel greater ownership and commitment to achieving the objectives of the grant. Donor and development bank funding should be consistent with priorities set by national stakeholder processes, which can draw upon the expertise of international, African continental and regional partners.

In many cases, these proposals for consideration may entail (i) putting host-country institutions in the lead, supported by international expertise; (ii) the priority agenda being defined by national governments to build local ownership; and (iii) taking a systems approach to NARES development, which requires socio-economic/policy analysis units to be integrated into the NARES.

#### **4.5. Confront the issue of donor creation of organisations that duplicate activities of the NARES**

Some donor organisations are reluctant to directly partner with public sector entities and tend to create new organisations that at least partially duplicate activities carried out by organisations in the NARES. These organisations are accountable to the donors that fund them rather than African governments. The impacts of these donor-created organisations on the capacity development of organisations in the NARES may well be detrimental, as the hiring practices of donor-created organisations often draw upon the best talent within the NARES, thereby weakening, demoralising and marginalising organisations in the NARES that African governments continue to rely upon to carry out agricultural R&D&E in their countries. Many KIs spoke of resentment, lack of cooperation and adverse impacts on the development of organisations in the NARES that occur after donors create and fund new organisations to carry out tasks that overlap with their mandates. One KI referred to the NARES as *de facto* training centres for international organisations to draw upon for hiring African researchers, after they gain skills and experience in the NARES and thereby at public expense.

These concerns raise issues about the meaning of donor commitments to support ‘locally led development’ when the organisations being developed are created by and accountable to donors and their priorities rather than African governments and where the net impact of the activity might be a relatively greater capacity gap between the donor-funded entities and the public sector organisations in the NARES.

### **5. Priority actions: who must do what?**

Based on the foregoing, we propose that the historical twentieth century model of agricultural R&D&E in SSA needs to fundamentally change in light of changing conditions over the past several decades. Today, there is much greater analytical and management capacity related to agriculture and food systems in Africa compared to three decades ago (Jayne *et al.*, 2021). Yet even today in 2023, organisations in the international agricultural research system (including



organisations that may be led by senior-level Africans but are created by and accountable to donor organisations) receive the majority of funding from international donors and foundations to carry out agricultural research in Africa, pursuing priorities that do not necessarily flow from African continental or regional development or research organisations (e.g. AU, AfDB and Forum for Agricultural Research in Africa) or national governments. Accountability to donors rather than to African governments has contributed to a state of affairs where African public sector officials frequently dismiss as irrelevant the work led by international research organisations and even by African-led but donor-controlled organisations.

The AUC's Agenda 2063 recognises the need for African governments to be at the core of continental programs and an Africa which holds itself accountable for results (Africa Union Commission, 2015). Current conditions warrant a twenty-first century model of agricultural research in which African continental and regional development organisations and national governments take control of and accountability for how agricultural research (including research conducted by the IARS) is prioritised, implemented and evaluated in their countries.

We propose that the leading continental African development organisations—the AU and the AfDB—play the catalytic role. They can first seek greater accountability and commitment from African governments themselves to build their NARES and provide the sustained funding required to do so. Second, the AfDB, using its now considerably expanded capital base (African Development Bank, 2019), can create (with CGIAR support) a new regional architecture for agricultural research, organised by agro-ecologies to serve the immediate needs of African farmers, while simultaneously building the capacities of NARES in countries where they are particularly weak. Third, the AfDB can leverage funding commitments from multilateral and bilateral donors to support its own capacity development investments to regional and national research systems. Fourth, the African continental organisations can also encourage international donors to stop funding donor-created organisations designed to duplicate the activities of the NARES and encourage them to start engaging directly with the organisations of the NARES. Fifth, they could encourage African governments to adopt guidelines that spell out roles for international partners to ensure that their activities build local institutional capacity of the NARES and support nationally defined priorities and processes.

Lastly, the continental African development organizations can work with international funding partners to ensure that their research and capacity development grants promote institutional capacity development of the NARES, not just individual capacity development. It is an issue of aligning incentives with objectives. If the funders of agricultural grants value institutional capacity development of African NARES, they will elevate institutional capacity development to a major objective of their grants and hold grantees accountable for achieving those objectives. The IARS will then have the incentives to prepare grant proposals and budgets that achieve those outcomes. New grantees are also likely to emerge, including the NARES themselves, who can

sub-contract with international partners committed to helping them achieve their institutional capacity development objectives.

## 6. Conclusions

Achieving many of Africa's most important development goals, including most of the sustainable development goals (SDGs), depend on agricultural productivity growth and adaptation to climate change, which in turn requires technical innovation on tens of millions of African farms. The pace of farm technical innovation and productivity growth are greatly influenced by the performance of agricultural research, development and extension services (R&D&E), both international and national (Fuglie *et al.*, 2020).

Each year, African governments and international development partners invest roughly US\$2.5 billion (in constant 2011 PPP) on agricultural R&D activities. The perspectives given by KIs in this study suggest that the payoffs to these considerable investments are attenuated by longstanding weaknesses in African-led agricultural R&D&E systems. These weaknesses also impede the effectiveness of research funding allocated to international research partners, because the CGIAR and other international partners are not structured to, and lack the resources to, scale-out technical innovations on their own; strong national partners on the ground are needed to adapt international germplasm, management practices and policies to the highly varied agroecological conditions and resource constraints faced by smallholder farmers. Strong national partners are also required for effective social science work in support of farmer adoption and tasks related to seed certification, registration and commercial distribution.

We contend that *institutional* capacity development should be seen as the fundamental goal of capacity development efforts and the appropriate litmus test by which international capacity building efforts are evaluated. Building the capacities of individuals is important for achieving institutional capacity development but most KIs interviewed for this study felt that building the capacity of individuals without due focus on institutional capacity development has contributed to the migration of trained individuals from African NARES to international research organisations, widening rather than narrowing the capacity gap between African and international R&D organisations. Hence, individual capacity development is necessary but insufficient for building the capacities of African NARES.

Longstanding weaknesses in the NARES have led donors and international research organisations to adjust and adapt their activities, creating parallel structures to 'work around' the weaknesses of the NARES to make progress. However, donor-created organisations may often generate overlapping agendas and mandates with the NARES organisations, leading to resentment, competition and dysfunctionalities that may impede performance and the long-term benefits from investments to all partners—at international, regional and national levels. The dominant view expressed by KIs is that the natural partner that should be leading and mobilising local support for agricultural R&D&E systems are the organisations within the NARES: NARI, agricultural universities, extension systems and policy analysis units. Countries that

were able to build strong NARES, e.g. Brazil and many Asian countries, were able to mobilise greater and more sustained political support for increased expenditures to agricultural R&D&E and for favourable policies that together create 'virtuous cycle' synergies between private sector investment, improved farmer access to new technologies and management practices, agricultural productivity growth and broader agrifood systems transformation.

What will be needed to strengthen the performance of the NARES? The study identifies three key planks: First, the AU and the AfDB must play the catalytic role in continental leadership and coordination, including seeking greater accountability and commitment from African governments themselves to build their NARES and allocating sustained funding required to do so.

Second, a stocktaking by international partners, including the CGIAR and international universities, may develop a greater appreciation of how their own effectiveness (e.g. impact generated per dollar of donor funds allocated) may be dependent on the performance of local partners working on the ground, and, by extension, that efforts to collaborate with and build the capacities of these partners is a major priority.

Third, donors themselves may consider potential modifications to their priorities and/or procedures. After African development organisations and governments, international donors hold the key to strengthening African R&D&E systems by the grants that they make. We encourage donors to consider ensuring that grants related to African agricultural technical innovation require including organisations in the NARES at the design stage, supporting nationally led priority setting agendas, and ensuring that the priorities of national governments are reflected in proposal and budget development. Mandating that grants have co-directors from NARES organisations would encourage greater ownership and commitment of African organisations to achieving the objectives of the grant.

We acknowledge the considerable heterogeneity in national capacities across African countries. Strategies may differ, especially according to the size and effectiveness of existing NARES programs. Roughly 20 SSA countries spend very little on NARES organisations. For such countries, a regional approach to African-led agricultural R&D may be the most practical and cost-effective approach, whereas direct support for NARES may be the most constructive route for relatively large countries.

African countries can also capitalise on the considerable power of the private sector to provide yield-enhancing technologies to farmers. Longstanding mistrust of the private sector has led to a situation where most African governments and citizens are uncomfortable with entrusting agricultural R&D&E activities and associated influence over national food security to outside private interests. For this reason alone, strong national agricultural R&D&E systems are indeed necessary. However, African farmers and economies stand to greatly benefit if governments can craft *win-win* partnerships with private agribusiness firms (international and national; large and small) and create a policy environment that encourages greater private investment in their food systems. This

challenge, among other reasons, underscores why agricultural policy research institutes are important components of an effective NARES.

This formula for success has already been demonstrated by several African countries. For example, Ethiopia tripled its real expenditure on public agricultural research between 2000 and 2015 and expanded its agricultural extension service to such an extent that in 2018 it possessed half of SSA's agricultural extension workers (Dorosh and Minten, 2020; Fuglie *et al.*, 2020). Not surprisingly, Ethiopia has achieved the highest rate of agricultural growth of any country in SSA since 2000 (FAOSTAT, 2022). Each additional \$1 of agricultural value-added in the Ethiopian economy generated an additional \$0.29 in non-farm GDP and hence contributed powerfully to the country's rapid economic transformation (Dorosh and Minten, 2020). Ethiopia's successes provide a powerful example that by committing greater investment to national and international agricultural R&D&E and focusing on improving the operational performance of these organisations, SSA governments will be taking one of the single most important steps to sustain their countries' economic transformation.

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## Appendix 1: Key informant profile

	<i>Position</i>	<i>Affiliation</i>
1	Senior administrator	Lilongwe University of Agriculture and Natural Resources, Malawi
2	Director	Federal Agricultural Research Institute, Abuja, Nigeria
3	Program Manager	Gates Foundation
4	Dean	Rongo University, Kenya
5	Former Executive Director	CGIAR Organisation
6	Program Director	Islamic Development Bank
7	Head of Department	Sokoine University of Agriculture, Tanzania
8	Deputy Director	ISRA/BAME, Senegal
9	Former Vice President	Alliance for a Green Revolution in Africa (AGRA)
10	Board of Directors	CGIAR
11	Executive Vice President	Private sector agribusiness company
12	Senior economist	United States Department of Agriculture
13	Executive Director	African Network of Agricultural Policy Research Institutes
14	Vice President	African Development Bank
15	Nigeria	African Research Universities Center of Excellence
16	DR Congo	CGIAR
17	Switzerland	CGIAR
18	Nigeria	The Federal University of Agriculture, Abeokuta
19	Senior director	Rockefeller Foundation
20	Chief scientist	Bayer, Inc.
21	Director of R&D	Ministry of Agriculture
22	Ghana	Forum for Agricultural Research in Africa (FARA)
24	Malawi, Africa	LUANAR University
25	Ethiopia	Ethiopia Agricultural Research Institute
26	Ethiopia	National extension service

## Appendix 2: Open-ended questions posed to key informants

1. How does the importance of nutritional security affect how agricultural R&D&E and agricultural policy research should be organised and instituted?
2. What is the required policy and programmatic agenda (re your response to Q1)?
3. To what extent is progress in improving livelihoods, nutrition and food security in Africa dependent on improving the performance of African national agricultural R&D&E systems? On a scale of 1 to 10?
4. What is the agricultural research and extension ‘capacity gap’ between Africa and other developing countries?

How would you define and/or measure the capacity gap?

5. What is the current state of national agricultural R&D&E systems in sub-Saharan Africa? Strengths, weaknesses, opportunities, threats.
- Feel free to identify both relatively successful and less successful examples.

6. How is the CGIAR system affecting the development and capacities of the NARES?
7. Is the contribution of international public and private agricultural R&D (and the CGIAR system in particular) limited by weaknesses in national-level adaptive agricultural R&D&E systems?
8. Is strengthening African R&D&E systems necessary to raise the effectiveness of the CGIAR system in achieving its goals? Scale of 1–10?
9. What is the priority agenda for action? How can African agricultural R&D&E systems be restructured and supported (e.g. funding, capacity strengthening, coordinated with regional and continental and international research institutions) to promote the achievement of resilient, sustainable and productive food systems transformation?