POLICY BRIEF

Agricultural research in resource-poor settings: towards an ethical approach

Key Messages

- 821 million of the world's population are chronically under-nourished.
- Small-scale farmers are estimated to feed up to 70% of the world's population but their knowledge remains marginalised in modern agricultural research.
- When resource-poor farmers are not included in the research process, the contribution they can make towards agricultural innovations is lost.
- Contemporary agricultural research is directed towards suiting the interests of an industrialised agricultural system rather than those of resource-poor farmers in the global South.

Recommendations

Funders should ensure that agricultural research agendas are inclusive of the views, needs and desires of the intended beneficiaries of the research.

Traditional agricultural knowledge holders should be recognised for their positive contributions to agrobiodiversity and environmental stewardship, including the use of benefit-sharing instruments based on best practice to avoid exploitation.

Tools should be found to stimulate greater investments in public agricultural research in the global South that deliver healthy, nutritious, sustainable and locally appropriate food.

Wynberg, Marshak, Munuo and van Niekerk

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Why it matters

New evidence suggests a rise in world hunger and a reversal of trends after a prolonged decline[1]. In 2017 the number of undernourished people is estimated to have increased to 821 million, largely due to the proliferation of violent conflict and climate-related shocks[2]. Industrial farming has led to increased focus on a small number of energy-rich but micronutrient-poor staple crops, and the incidence of non-communicable diseases such as diabetes, caused through increased consumption of these so-called "empty calories", has become a leading cause of global mortality[3]. Moreover, the environmental cost of industrial agriculture has been considerable[4]. Agrobiodiversity is a critical contributor for healthy people and ecosystems, but has been eroded while the innovative potential of underutilised species has been largely ignored[5].

Small-scale farmers' knowledge remains marginalised in modern agricultural research, despite the fact that these farmers are estimated to feed up to 70% of the world's population[6]. The important roles played by farmers, as innovators and custodians of genetic resources for food and agriculture were not recognised internationally until the *International Treaty on Plant Genetic Resources for Food and Agriculture* (ITPGRFA) was adopted in 2001. This legally binding instrument requires governments to realise Farmers' Rights by measures including the protection of traditional and local knowledge and enabling farmers to participate equitably in the sharing of benefits derived from the use of plant genetic resources for food and agriculture. This is especially relevant given that there is growing interest and investment in developing neglected and under-utilised crops as high-value niche products and for their suitability in changing climates[7].

Unprecedented innovations in the scientific and technological landscape have had profound effects on the manner in which agricultural research and development (R&D) is conducted. These have included developments in molecular biology, the significant consolidation of the commercial seed, agrochemical and food industries since the 1990s and the rapid advancement of available communication and information technologies. Technological change and patents have been major drivers of industry consolidation, enabling greater ownership and control by fewer companies of key technologies and processes[8].

A striking and continuing global trend has been the escalation of private sector interest in agricultural research (see Figure 1) and a relative decline in public sector research, alongside a greater emphasis on the commercialisation of science[9]. This focus on wealth creation may be at the expense of broader issues of environmental sustainability, fundamental science or non-profitable agricultural innovations and may

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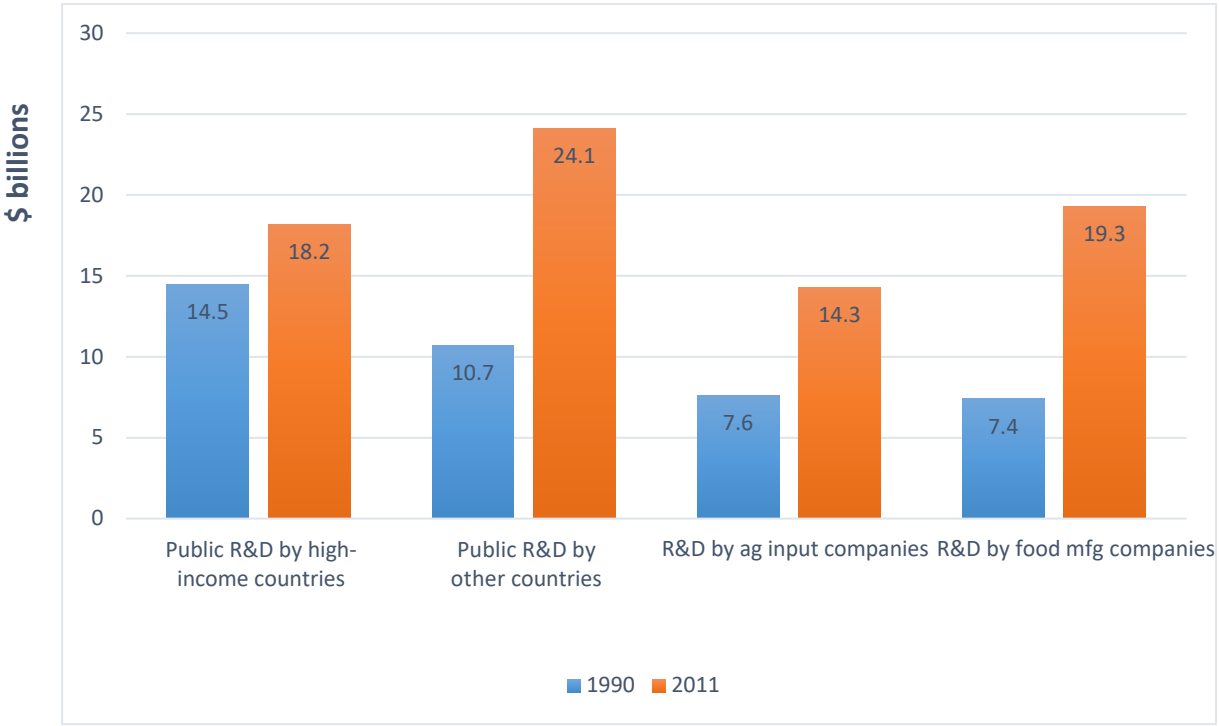
also act against the needs of small-scale farmers. In addition, it may have negative implications for human health and safety, and contribute towards the loss of agrobiodiversity and the deterioration of traditional knowledge systems connected to this diversity.

FIGURE 1 Global Funding on Food and Agricultural R&D 1990 and 2011



Source: Heisey and Fuglie 2018[10]

Historical Trends in Agricultural Research

History underpins the shape and form of contemporary agricultural research and explains some of the ethical challenges we face today in the sector. The evolution and development of agricultural research in Northern, industrialised countries during the 20th century was primarily driven by a need for these countries to become self-sufficient in food production. There was a strong link between researchers and farmers, with wealthy farmers paying for the research required to provide the solutions they needed. Subsequently, farmers were involved in the establishment and running of many of the research stations[11].

In contrast, research in the global South was often driven by colonial needs, with a focus on export crops that were not relevant for the majority of farmers in these countries. Government officials, plantation owners and commercial companies were the main players, and farmers' participation in decision-making was minimal. Agricultural research was formal in style, and based on the model of industrialised countries, with local, non-Western knowledge systems rarely included in problem solving. A strong focus was placed on producing maximum yields, with little attention to nutritional needs, local preferences or indigenous crops. The establishment of agricultural research stations in colonised countries of the global South was therefore not shaped by local farmers or priorities, but was imposed in a top-down fashion by a foreign presence that also had a political imperative to maintain control over these states[12].

As industrialised countries became food secure, policy shifted away from improved yields towards environmental issues, supermarket quality demands and cutting costs[13]. The number of farms in industrialised countries became fewer and their size increased, largely to realise economies of scale. At the same time, the number of people directly involved in farming in industrialised countries decreased. With this shift, the power of consumers and supermarkets began to show as farmers became relatively small players in relation to the overall food system. By the end of the 1970s, agriculture had transformed into agribusiness, and processors and retailers had become dominant forces. In parallel, the research process became increasingly specialised and top-down, with diminished input from farmers. Gradually, decision-making and funding for agricultural research moved from the public to the private sector, alongside a substantial consolidation of food and seed companies who increasingly owned significant parts of the production chain and research complex[14].

A turning point in agricultural research was the so-called “Green Revolution” in Asia in the 1960s, which spread technologies that already existed, but which had not been widely implemented outside industrialised nations[15]. Such technologies included synthetic nitrogen fertiliser, pesticides and herbicides, modern irrigation, increased mechanisation and proprietary crop varieties. These were seen as a 'package of practices' to supersede 'traditional' agriculture and to be adopted as a whole[16]. Although production levels of grain increased significantly, the reliance on just a few high-yielding varieties of a small number of crops (see Figure 2) meant that the Green Revolution also led to a dramatic reduction of agrobiodiversity. Moreover, the benefits were uneven. For example, it has been shown that those best placed to benefit were the richer farmers with access to irrigation, machinery and financial support. With the switch from on-farm to purchased inputs, poorer farmers could not afford the seed and associated inputs and became increasingly indebted, sometimes losing access to their farms[17]. In Africa, similar attempts at a “Green Revolution” have been largely unsuccessful, due in part to a focus on improving single

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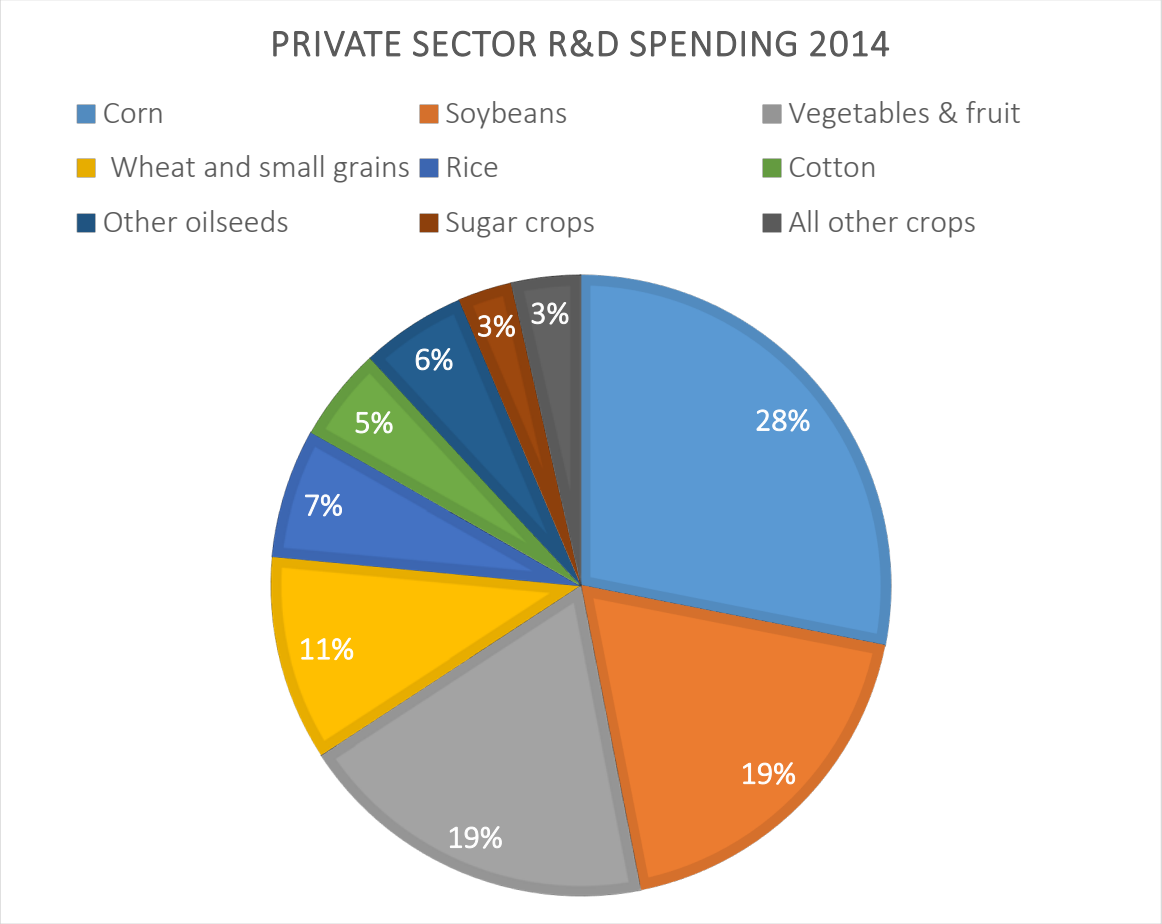
crops, an over-emphasis on production and a lack of appreciation of the context and characteristics of African agricultural systems[18].

FIGURE 2. Private sector R&D spending by crop, 2014



Source: Fuglie, 2016[19].

Key Policy Issues

1. Fair research for farmers in resource-poor settings through participation and respect for local knowledge

The dominant agricultural innovation system is technology-centred rather than needs-centred, and works to suit the interests of an industrial agricultural system tailored towards meeting shareholder needs rather than those of resource-poor farmers in the global South.

For example, nearly all R&D by the private sector has been based on crops and traits important to large-scale commercial farmers, with little attention paid to crops important to small-scale farmers, who often represent poorer farming communities[20]. There has also been an upward trend of patents or plant breeder's rights, restricting access to new varieties by emerging or poor farmers. So-called informal seed systems, in contrast, have been neglected in formal innovation systems.

Another concern centres on the fact that technology is often inappropriately developed, applied and transferred[21]. Knowledge that is generated by the formal research community for a particular context may be passed on to subsistence farmers who have little use for it. A classic example is genetically modified seed, developed primarily for industrialised farming situations where farmers are able to purchase seed and associated inputs from year to year. Rolled out in the global South, such technologies have often had negative consequences for small-scale farmers including increased debt, the disruption of existing farming practices, and the erosion of local agricultural knowledge systems[22]. Such research typically imposes burdens without benefits and therefore violates the value of fairness.

Recommendation 1 - Inclusion

In order to avoid the potentially negative impacts of disruptive technologies, researchers need to work towards being participatory in ways that are contextually relevant. Those funding or doing research should aim to ensure that agricultural research agendas are inclusive of the views, needs and desires of the beneficiaries of the research, thus empowering people in the development and implementation of new approaches, projects or technologies. For instance, funding applications for agricultural research conducted in resource-poor settings should demonstrate farmers' participation in the research agenda, and ways in which agrobiodiversity and environmental stewardship are incorporated.

2. Valuing different knowledge systems and recognising and rewarding the contributions of farmers in agricultural research

When resource-poor farmers are not included in the research process, the contributions they can make towards agricultural innovations are lost. Around the globe, the genetic diversity developed by farmers provides the foundation of food and agriculture. By utilising local knowledge passed on for generations, farmers have selectively bred plants and animals that not only meet their needs and preferences, but are also adapted to ecological conditions and local climates. Through age-old customs such as saving and exchanging seed, farmers have contributed, and continue to do so in many parts of the world, to the spread and diversification of germplasm[23]. Such biodiversity is intimately bound to traditional farming practices and ways of life[24].

There is now increasing recognition that traditional agricultural knowledge and seed systems are critical for food security, enabling adaptation in a world faced with rapid environmental change, conflicts over dwindling natural resources, and crises of economic, social and ecological sustainability[25]. At the same time, there is also growing interest and investment in developing crop wild relatives and so-called orphan crop species[26]. This is due in part to the fact that they contain important genes for stress resistance, adaptability, and improved productivity, and are therefore of interest in the context of climate change, population growth, shrinking areas of arable land and the rapid erosion of agrobiodiversity[27]. Although considerable effort is required to develop these wild relatives into modern varieties, new molecular genetic techniques are making this process much easier[28].

Recommendation 2 - Recognition

The value of fairness requires that those funding and pursuing research based on existing knowledge should ensure that recognition is given to the customary rights that farming communities have over plant varieties, along with the relational and contextual knowledge that they hold. For example, farmers may have selected seed over generations for traits related to climate hardiness. If this genetic material is then used in R&D programmes appropriate benefit-sharing instruments need to be developed. In addition to monetary benefits, this could include requirements to make patented material more freely available for small farmers. Such arrangements could also lead to the development of varieties without intellectual property rights. Although there is no formulaic approach for developing such arrangements, multiple legal tools exist to guide such deliberations[29].

3. Funding agricultural research to address hunger and malnutrition

Hunger, malnutrition and the universal need for healthy food make agricultural research a public interest issue that is distinct from other forms of research, especially in the context of rapidly changing climates and global environmental change. The funding of such research therefore needs careful scrutiny to ensure that people's rights to safe, healthy and sufficient food are upheld and that there is not "lock-in" to particular technologies[30]. As explained above, funding sources for agricultural research have changed over time with industry-funded research largely overtaking the role of publicly-funded research.

The type of research that is carried out is clearly influenced by the sources and availability of funding as well as by the constraints of funders. For example, private sector funding might restrict the distribution of research results, impede technology transfer, or restrict the application of new technologies due to confidentiality requirements or intellectual property rights[31]. This has direct implications for farmers and researchers in resource-poor settings as well as consumers.

Although the rise in philanthropy for agricultural research can help to subsidise technology development and transfer, there are also questions about the role played by philanthropists, as they are not publicly accountable and may self-determine research priorities[32]. At the same time, investing significant public resources in agriculture is challenging for governments of the global South, many of whom have lost domestic autonomy over public spending in agriculture due to the introduction of structural adjustment programmes imposed by the World Bank and International Monetary Fund, aimed at making the public sector more efficient. There are no quick-fix solutions to this situation, especially as concerns are linked to broader structural issues associated with industrial agriculture[33].

Recommendation 3 - Tools

In the short-term, donors should be urged to invest in agricultural research projects that have a clear public benefit. Within agribusiness, mechanisms for public reporting, accountability and transparency should be strengthened, along with a clear focus on the wider environmental and social impacts of research. Above all, tools should be found to stimulate greater investments in public agricultural research in the global South, and the allocation of greater proportions of public budgets for agricultural research directed towards producing healthy, nutritious, sustainable and locally appropriate food.

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Reviewers and Editorial Support

Thanks to Doris Schroeder and Julie Cook for comments on earlier versions and editorial support.

Citing Suggestion

Wynberg, R., Marshak, M., Munuo, N. and van Niekerk, J. 2018. Policy Brief. Agricultural research in resource-poor settings: Towards an ethical approach. A report for TRUST, available: http://trustproject.eu/deliverables-and-tools/

This Brief was provided as part of the TRUST Project, as Deliverable 6.1, grant agreement 664771.

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