

MALI

Agrifood System Change and PARI Research on Innovations

INTRODUCTION

Over the past two decades, Mali has maintained relatively high government expenditure on agriculture despite slight fluctuations. On average, Mali allocated 9% of its annual national budget to the agriculture sector between 2017 and 2022. Lowest budget allocations were in 2022 (4%), possibly due to economic challenges arising from the global COVID pandemic. Meanwhile, the agriculture value added growth rate has been erratic (see Figure 1) over the past three decades - an indication that agriculture in Mali is more prone to external factors (such as weather, market shocks, etc.). It is therefore important to develop and implement innovative initiatives to boost the resilience and promote sustainable agricultural growth and development in the country. This brief revisits various initiatives in

Mali and draws lessons based on studies done under PARI to guide future strategies.

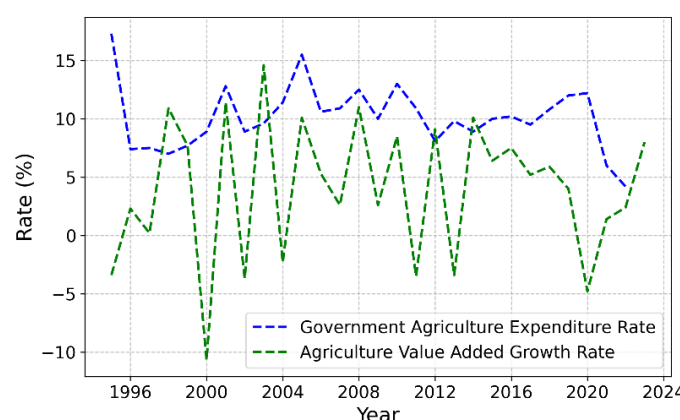


Figure 1: Trend of government agriculture expenditure and value added growth rate in Mali¹

PARI CONTRIBUTIONS

The PARI research in Mali relates to priorities as indicated by PARI Partners, and took note of initiatives of the Green Innovation Centers.

Innovations in value chains

Innovations to improve rice productivity, quality and cost-effectiveness in Mali present significant growth opportunities for the sector (IER et al., 2017). These include the development of disease-resistant rice varieties and technologies for efficient crop management, such as soil preparation, fertility enhancement and pest control:

- One notable initiative by Africa Rice repurposes broken rice—traditionally considered low-value—into a flour substitute for pastries, blending rice and wheat flour to create a competitive product. Advances in processing technologies have further increased the commercial value of broken rice.
- The “Crédit stockage villageois” scheme is another important innovation, offering a credit and storage

system for rice farmers. This enables them to store crops post-harvest and benefit from higher market prices, with strong participation from women farmers.

- Ridge tillage has proven effective, increasing water infiltration by 10% of annual rainfall (around 800 mm) and boosting cereal yields (including millet, sorghum and maize) by 30% on average, with over 50% gains in dry years.

Biofortification enhances nutrition by increasing essential nutrients like iron and zinc in crops (IER et al., 2017). The McKnight Foundation, in collaboration with national institutes like IER, has supported research to improve nutrition through biofortification of locally diverse crops. One key initiative was the International Sorghum and Millet Collaborative Research Support Program (INTSORMIL CRSP), funded by USAID, which aimed to improve food security in Mali. The program focused on seed multiplication, on-farm testing and variety exchange for sorghum and millet, identifying

¹ Source: Authors' illustration using data from <https://www.resakss.org/node/3>, accessed on 26 May 2025



optimal cultivars while promoting fertilizer use and best agricultural practices. This multidisciplinary effort involved scientists, educators and organizations from Burkina Faso, Mali, Niger, Nigeria, Senegal and the USA, addressing the entire value chain. The project provided training, improved seeds, fertilizers and resource management techniques. It also supported technology transfer to entrepreneurs and processors, enabling the production of diverse products such as sorghum flour, couscous, biscuits and poultry feed.

Small-scale irrigation systems have significant potential in Mali, offering greater water efficiency and improved land productivity compared to traditional methods (Kergna et al., 2018a). With agriculture heavily reliant on rainfall, better water management could transform the sector. Mali's water resources are considerable, with the Senegal and Niger rivers providing 70 billion cubic meters annually and groundwater reserves estimated at 2,700 billion cubic meters, of which 66 billion cubic meters are renewable each year. However, these resources remain underutilized. In urban areas, the Californian irrigation system is common for vegetable production, using surface or groundwater distributed through furrows. Sprinkler irrigation, typically employed on commercial farms for high-value crops like fruit trees, maximizes water efficiency. Drip irrigation, delivering water directly to crops at low pressure, is primarily used by wealthier farmers growing fruits and vegetables. These small-scale systems are cost-effective and greatly enhance agricultural productivity.

Livestock

Livestock, particularly small ruminants, play a critical role in Mali's rural economies. Investments in infrastructure, feed, breeds, veterinary services and market information are needed to boost the sector (Dembele et al., 2022; Kergna and Niallibouly, 2020). Over 90% of households engage in livestock keeping. To assist them, innovative technologies such as improved feed rations, pastoral perimeters and genetic enhancements have been introduced. The Livestock Market Information System also provides valuable market insights. However, these innovations must be supported by high-quality veterinary services, which research shows are essential for boosting livestock productivity. Policies should prioritize subsidizing animal feed, improving water supply and encouraging the establishment of small processing units in key livestock zones to increase access and efficiency.

Strengthening livestock keepers' capacity through vocational training and networking is equally important. Investments in infrastructure, market creation and capacity building are crucial for enhancing the sector's economic potential, reducing poverty, improving food security and promoting nutrition.

Seed systems

Irish potato production in Mali is hampered by limited access to improved seeds, inadequate seed storage and conservation infrastructure and shortages of labour and credit. Investing in local infrastructure could help address these challenges (Kergna and Dembélé, 2017). Mali heavily relies on seed imports, making it difficult for farmers to afford the quantities needed for optimal productivity, with average yields estimated at 20–25 tons per hectare. Most potatoes are sold in domestic markets, with the remainder exported to countries like Côte d'Ivoire, Burkina Faso, Ghana, Togo and Senegal. To improve pest and disease resilience—particularly against bacterial wilt (*Ralstonia solanacearum*) and scab threadworm (*Meloidogyne* sp.)—increased investment in the seed sector is essential. Developing local seed supply infrastructure and establishing common ECOWAS legislation on seed production, multiplication and certification are also critical for ensuring highquality, high-yield potato production.

Decentralized seed production and distribution systems with shorter delivery chains have the potential to strengthen seed systems in Mali (Christinck et al., 2018). Although Mali operates within a weak regulatory framework, its short seed supply chains contribute to ensuring both seed availability and quality. This system also allows seed-producer cooperatives to sell leftover stocks as grain, reducing waste and improving efficiency. To further enhance these seed systems, research and investment should focus on two critical areas: (a) treating seeds closer to the time of sale to preserve their quality and (b) developing decentralized seed production and distribution networks with shorter delivery chains.

Herbicides

The use of herbicides for weed control has increased in Mali in recent years, driven by lower prices and improved availability. While the chemicals have decreased labour demand, they have also raised environmental and health concerns (Kergna et al., 2018b). Herbicides have reduced the need for hand



weeding—freeing up time for women, who traditionally perform this task—and cutting weeding labour costs by up to 50%. To address potential environmental and health concerns, policies should focus on monitoring the herbicide supply to ensure the quality and safety of both registered and unregistered products on the market. Additionally, improving knowledge and training on the proper use and application of herbicides is essential to mitigate their negative impacts.

Mechanization

Agricultural mechanization is growing in Mali, with tractor numbers nearly doubling between 2014 and 2021 due to government subsidies, but machinery remains too costly for many smallholders (Kergna, 2018; Kergna et al., 2020). Structural barriers also continue to hinder the scaling up of mechanization. The “Stratégie de mécanisation agricole au Mali,” introduced in 2008, identified persistent challenges faced by local manufacturers, including low productivity, difficulty competing for public contracts and high raw material costs, worsened by steep customs duties (Daum, Adegbola, Kamau, et al., 2022). To promote agricultural growth and strengthen the mechanization sector, the government must establish policies and create an enabling environment that improves smallholders’ access to machinery and inputs. Supporting local manufacturers by enhancing their capacity and skills in machinery use and repair, improving access to finance and implementing fairer tax regimes is also critical.

Since the 1980s, local agricultural machinery manufacturing has been growing in Mali to provide farmers with affordable, high-quality tools, but improved access to production equipment, financing, reliable electricity and skilled labour is required for scaling (Kergna et al., 2022). Policy initiatives, such as the Agricultural Orientation Law and the Agricultural Sector Investment Plan, have supported this growth by promoting traditional and industrial manufacturing for family farmers. A survey of machinery manufacturers shows most companies are privately owned, with over 60% inherited and others established as personal ventures. Manufacturers primarily produce machines for crop production and processing, including ploughs, direct seeders, harrows, milling machines and trailers, while larger equipment like tractors is mostly imported. However, the sector faces significant challenges, including limited access to capital, machines and land,

as well as unreliable electricity and high energy costs, which vary by location. Additionally, a shortage of skilled artisans and reliance on rudimentary tools hinder progress. Addressing these obstacles is essential for the sector’s growth.

Digitalization

Digital technologies are widely used by extension agents, input suppliers and output dealers in Mali to support their professional activities (Baumüller et al., 2023). A study shows that mobile phones are the most commonly used tools, particularly smartphones which are used by 71% of respondents, in particular extension agents, but also dealers. Extension agents employ the widest range of digital technologies, utilizing diverse mobile phone functions to interact with a broad network of value chain actors and share a variety of information. Input and output dealers primarily use digital tools to reduce transaction costs and improve networking and information exchange. However, intermediaries still prefer face-to-face interactions for certain tasks, such as training and price discussions. Digital marketing platforms could capitalize on the digital skills and networks of intermediaries to improve service delivery and enhance access to smallholder farmers in remote areas.

Skill development

While students are generally satisfied with the quality of ATVET in Mali, investments in practical training, digital skills, school facilities and women’s participation are needed (Kergna and Nientao, 2024). Mali is advancing agricultural skills through its National Policy for Vocational Training. A survey of students in agricultural training programs shows that over half come from rural, farming backgrounds. Many aim to become agripreneurs, work in extension services, or join agricultural research organizations, with fewer aspiring to government jobs. Most students feel the courses meet their needs, cover relevant topics and are taught by qualified, approachable teachers. However, they highlighted gaps in digital skills training, insufficient time and resources for practical work and poor access to facilities such as internet, computers and literature. Women remain underrepresented, accounting for only 35% of students and 8% of teachers in ATVET programs. Addressing these gaps will require additional public investment in infrastructure, teaching materials and targeted efforts to engage women.



KEY TAKE AWAYS FROM PARI RESEARCH IN MALI

Rice sector innovations: Advances in disease-resistant varieties, crop management and processing techniques, such as turning broken rice into flour, have boosted Mali's rice productivity and market access, benefiting farmers, especially women.

Irrigation systems: Drip, sprinkler and Californian irrigation systems improve water efficiency and productivity in Mali, offering significant growth potential for high-value crops like fruits and vegetables.

Livestock challenges: Livestock productivity in Mali is hindered by limited feed availability, poor veterinary services and market gaps. Improved feeds, veterinary systems and vocational training are key to enhancing the sector.

Seed systems: Strengthening local seed production, storage and ECOWAS regulations can reduce Mali's reliance on imported seeds and improve access to high-quality varieties to enhance agricultural productivity and resilience.

Mechanization: Government subsidies and local manufacturers are driving the expansion of mechanization in Mali. However, high costs, limited capital and skilled labour shortages must be addressed to scale adoption.

Digital technologies: Mobile technologies are widely adopted by extension agents and dealers in Mali, improving networking, reducing transaction costs and facilitating information exchange across agricultural value chains.

Vocational training: Agricultural training programs in Mali are expanding but require greater investment in digital skills, practical learning opportunities and efforts to increase women's participation to meet the sector's needs effectively.

REFERENCES

- Baumüller, H., Ikpi, U., Jumpah, E.T., Kamau, G.M., Kergn, A.O., Mose, L.O., Nientao, A., Omari, R., Phillip, D., Salasya, B.D., 2023. Building digital bridges in African value chains: Exploring linkages between ICT use and social capital in agricultural marketing. *Journal of Rural Studies* 100, 103002.
- Christinck, A., Rattunde, F., Kergna, A.O., Mulinge, W., Weltzien, E., 2018. Identifying Options for the Development of Sustainable Seed Systems – Insights from Kenya and Mali. ZEF, Bonn.
- Dembele, B., Sall, M., Fall, C.S., 2022. Comprehensive Livestock Driven Typology for Food and Nutrition Security in Mali (AKADEMIYA2063 Working Paper No. 001). AKADEMIYA2063, Kigali.
- IER, FARA, ZEF, 2017. Country Dossier: Innovation for Sustainable Agricultural Growth in Mali, Program of Accompanying Research for Agricultural Innovation. Center for Development Research, Forum for Agricultural Research in Africa and Council for Scientific and Industrial Research, Bonn and Accra.
- Kergna, A.O., 2018. Smallholders' Access to Agricultural Equipment and Agro-Inputs in Mali (FARA Research Report No. 3(7)). Forum for Agricultural Research in Africa, Accra.
- Kergna, A.O., Dembélé, D., 2017. Innovation Opportunities in Irish Potato Value Chain in Mali (FARA Research Report No. 1(5)). Forum for Agricultural Research in Africa, Accra.
- Kergna, A.O., Dembélé, D., Fatunbi, O., 2018. Innovation Opportunities in Mango Value Chains in Mali. Forum for Agricultural Research in Africa, Accra.
- Kergna, A.O., Niallibouly, O., 2020. Potential and Drivers of Livestock Production in Mali (FARA Research Report No. 5(7)). Forum for Agricultural Research in Africa, Accra.
- Kergna, A.O., Nientao, A., 2024. Building Skills and Research- Extension Linkages for Sustainable Agricultural Transformation: Insights from Mali (FARA Research Report No. 8(7)). Forum for Agricultural Research in Africa, Accra.



REFERENCES (CONT.)

Kergna, A.O., Nientao, A., Daum, T., 2022. Opportunities and Challenges for Local Agricultural Machinery Manufacturers; Insights from Mali (FARA Research Report No. 6(09)). Forum for Agricultural Research in Africa, Accra.

Kergna, A.O., Nientao, A., Ongoiba, B., Sidibe, 2020. Mechanization and Skills Development for Productivity Growth, Employment and Value Addition: Insights from Mali (FARA Research Report No. 5(19)). Forum for Agricultural Research in Africa, Accra.

Kergna, A.O., Smale, M., Assima, A., 2018. Causes and Consequences of Increasing Herbicides Use in the Cotton Production Zone of Mali Progress Report (FARA Research Report No. 3(2)). Forum for Agricultural Research in Africa, Accra.

All studies are available at www.r4ai.org.

PARI implementing partners: ZEF/University of Bonn, University of Hohenheim, the Forum for Agricultural Research in Africa (FARA) and its national partners, the African Growth and Development Policy Modeling Consortium (AGRODEP) facilitated by AKADEMIYA2063, and research collaborators in India.

PARI is funded by the German Federal Ministry for Economic Cooperation and Development (BMZ).

Brief prepared by: Heike Baumüller, Friederike Schilling, Emmanuel Tolani, and Joachim von Braun

Layout: Yesim Pacal (PR)

IMPRINT

Center for Development Research (ZEF)

Genscherallee 3 | 53113 Bonn | Germany

E-Mail: presse.zef@uni-bonn.de

Phone: +49-(0)228 - 73 18 46



zef
Center for
Development Research
University of Bonn