

## BENIN

### Agrifood System Change and PARI Research on Innovations

#### INTRODUCTION

For the past two decades, the government of Benin has steadily increased the financial support allocated to the agriculture sector. However, the growth rate of the value added by the agriculture sector has shown significant fluctuations (refer to Figure 1). As such, Benin has resorted to pursue various innovative strategies to transform its food systems sustainably. These innovations range from technological advancements, institutional frameworks to policy reforms (see Table 1). It is important to revisit these and other current initiatives to draw lessons, as provided in this brief based on studies done under PARI, to guide future strategies.

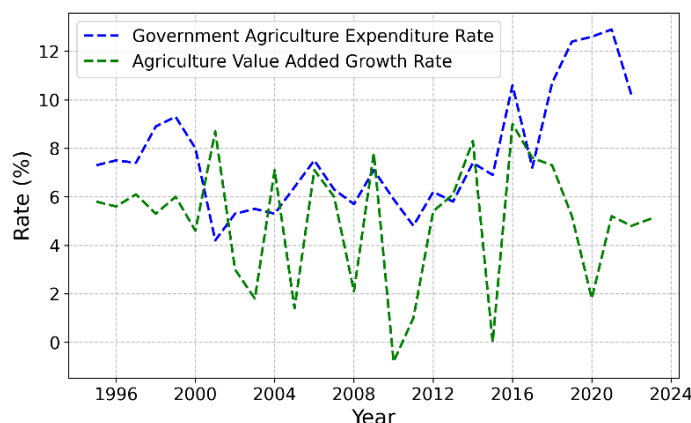


Figure 1: Trend of government agriculture expenditure and value added growth rate in Benin<sup>1</sup>

Table 1: Summary of innovative pathways to sustainable food systems transformation in Benin<sup>2</sup>

| Category                          | Key Innovations                          | Implementation objectives/Strategies                                                                                                                                                |
|-----------------------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Institution and policy frameworks | ▪ Infrastructure improvement             | ▪ Enhance food storage and minimise losses                                                                                                                                          |
|                                   | ▪ Robust supply chains                   | ▪ Enhance food distribution                                                                                                                                                         |
|                                   | ▪ Policy reforms                         | ▪ Promote policies that encourage fair and equal access to essential resources, including land, financial support, and market opportunities, in particular for marginalised groups. |
| Technological innovations         | ▪ Climate-smart agriculture              | ▪ Use of bio-fertilizer to improve yields.                                                                                                                                          |
|                                   | ▪ Improved seed and breeds               | ▪ Promote water management systems                                                                                                                                                  |
|                                   | ▪ Improve post-harvest management losses | ▪ Promote varieties that enhance resilience to climate shocks.                                                                                                                      |
|                                   |                                          | ▪ Promote use of semi-modern equipment in production and processing.                                                                                                                |

#### PARI CONTRIBUTIONS

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

#### Innovations in value chains

**Lack of access to improved seeds is a significant constraint for soybean and rice production in Benin.**

**Similarly, poultry and small ruminant farming face challenges due to limited veterinary services and rudimentary infrastructure** (Adegbola et al., 2018a; INRAB et al., 2017; Mensah et al., 2017). The average quality of rice produced in Benin is low, with 30–35% often consisting of broken grains. Soybean yields remain low at around 1.1 tonnes/hectare in 2022, less

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

<sup>2</sup> Sources: Authors' compilation from <https://www.zero hungercoalition.org/en/food-systems-transformation-back-benins-table> and <https://www.zero hungercoalition.org/en/call-action-delivering-benins-food-systems-pathway>, accessed on 1st April 2025



than half that of the global average of 2.6 tonnes/ha. Rural storage conditions make it difficult to preserve the germination properties of soybean seeds intended for replanting. Farmers also have limited access to fertilizers, pesticides (except for cotton), machinery, credit and modern technology. Additionally, the absence of regulations for water management and the lack of improved water infrastructure in rice valleys negatively affect rice yields and, consequently, farmer incomes. Other challenges include disagreements within farmer associations, lack of trust and unequal access to resources. In small ruminant farming, key constraints are the high prevalence of diseases (e.g., mange and diarrhea), degradation of fodder and shrinking pasture space caused by continuous land reduction.

**To address these challenges, Benin has developed innovations across plant, animal and fish production systems.** These advancements focus on technical improvements, new equipment, better access to inputs, improved seeds and breeds, and knowledge transfer (Adegbola et al., 2016; Mensah et al., 2017). These innovations have positively impacted yields, farmer incomes and resilience to climate change. Some examples of specific value-chain innovations include:

**Rice:** improved seeds, rice threshers, grading machines, and milling machines;

**Soya:** dried soy flour, soya cheese production, and soy yoghurt production;

**Pineapple:** production of pineapple jam, jelly, powder and pineapple-based alcohol, wine, vinegar;

**Cashew:** improved cashew nut peelers, powered cashew nut grinders, cashew fruit harvesting nets, cashew juice with gelatine and cashew nut flour of dried cashew; and

**Small ruminants:** improved feeding techniques based on harvest by-products and agro-food processing by-products, and sharecropping agreements for improved breeds of sheep and goats

**Farmers in Benin generally perceive agricultural technology innovations as beneficial, citing increased yields and income, time savings and— to some extent—improved food security** (Adegbola et al., 2018b). For instance, in soybean production, farmers highlight the advantages of improved varieties, such as shorter cultivation periods (90–100 days), adaptability to local climates, appealing appearance and higher

yields. Similarly, in rice production, farmers consider cultivating improved rice varieties the most profitable innovation compared to other technologies (e.g., improved steaming kits). These varieties are valued for their high yields, drought resistance and adaptability to local climates. Innovations in rice processing, such as steaming kits and threshing machines, have gained recognition for saving time and labour, increasing women's incomes and reducing food losses. In the small ruminant and poultry sectors, several innovations have been well received by farmers. For example, an under-basket breeding system has reduced chick mortality from 79% to 56%, while providing a suitable habitat for small ruminants in flooded areas has decreased mortality to 0%. However, these technologies remain underutilized due to low awareness.

**The engagement and commitment of stakeholders—primarily research institutions, extension services and funding bodies—and the alignment of innovations with the aspirations of end user, are critical to the success of agricultural innovations in Benin** (Kouévi and Fatunbi, 2019). One notable success is the NERICA-L14 rice variety, developed by Benin's National Agricultural Research Institute (INRAB). This variety is pest-resistant and delivers high yields, making it a widely adopted innovation that is now cultivated throughout the country. Another successful innovation is the clean BENTO 01 tomato variety, which provides growers with access to high-quality, disease-free tomato seeds. This initiative was funded by the government and the Mono and Couffo Rural Development Support Project (PADMOC), with research support from the Territorial Agency for Agricultural Development (ATDA) and INRAB. Today, demand for this variety is high, with 90% of vegetable growers using it. In cashew nut processing, a manual sheller has significantly improved efficiency by reducing the rate of broken nuts and enhancing export quality. This sheller allows an individual to process up to 100 kg of cashew nuts per day. Its success stems from effective collaboration between researchers and manufacturers. However, some technologies have failed to gain traction among farmers due to insufficient testing, lack of refinement, or poor commercialization (e.g. the rice-based Pella breakfast and techniques for *Amaranthus* seed production).

## Mechanization

**Farmers in Benin prioritize price and horsepower when buying tractors. Maintenance and access to**



**spare parts remain key challenges for mechanized agriculture** (Adegbola et al., 2020b). A survey revealed that all tractors in Benin are imported, with Mahindra and Massey Ferguson being the most preferred brands due to their quality, durability and availability of spare parts and repair technicians. Tractors are mainly used for plowing and transportation. Few operators benefit from after-sales services; maintenance is typically done at workshops, while repairs are handled by independent technicians, owners, or assistants. Tractor breakdowns are often caused by the lack of spare parts and repair expertise. Building technical skills among stakeholders—such as producers, technicians and drivers—is crucial to improve tractor durability and reduce breakdowns. Collaborating with international companies to support local assembly and fabrication could further boost mechanization and reduce dependency on imports.

**Tractors have increased incomes, productivity and employment among smallholder farmers in Benin** (Adegbola et al., 2020b). Farmers report community-level benefits such as reduced disease, increased wealth, more schooling, higher birth rates and lower death rates. At the household level, mechanization boosts income, food security and access to credit while providing farmers more free time, which they use for other activities, rest, or family engagement, strengthening cohesion and improving women's roles in decision-making. However, mechanization also deepens gender inequalities, as women often lack access to tractors due to social norms and smaller farm sizes (Daum et al., 2020). Environmentally, it reduces slash-and-burn practices but increases soil compaction, flooding, erosion and deforestation due to expanded cultivation.

**Mechanized farming is becoming an attractive employment option for young people in Benin, with tractor driving being a particularly desirable profession. However, limited tractor use across the country restricts opportunities** (Adegbola et al., 2020b; Daum et al., 2020). Specialized programs at public and private institutions, including agricultural schools and universities, provide training in mechanization practices. Short-term courses offer young people practical skills, such as equipment use and maintenance, tractor driving, hitching accessories and manufacturing. Strengthening training centers is essential and requires better materials, upgraded facilities, research funding, promotional events and improved contracts for teaching staff.

**The production of agricultural machinery presents lucrative opportunities for local manufacturers, but support measures are needed to grow the sector. These include improved access to finance, skill development and quality assurance** (Adegbola et al., 2022b; Daum et al., 2023). A survey of local manufacturers indicates gradual expansion, particularly in the post-harvest segment. Commonly produced machines include seed drillers, mills and shelling machines, while the highest profits come from power tillers, thresher-cleaners, dryers, huskers and harrows. Larger machinery, however, is mostly imported.

Manufacturers also generate income through aftersales services, offering spare parts, warranties and emergency repairs. The growing machinery rental market could further expand business opportunities. To support the sector, key measures include better credit access for raw materials and tools, investments in technical training, research to drive innovation, quality standards to ensure durability and contract enforcement mechanisms. The Stratégie Nationale de Mécanisation Agricole (SNMA) (2022–2026) provides a significant opportunity to address challenges like limited skills, financial constraints and high costs of electricity and raw materials, creating an enabling environment to boost local machinery production.

### Skill development

**The government of Benin is investing in expanding agricultural technical and vocational training (ATVET). While students are generally satisfied with the quality of training, further investment is needed in practical training, digital skills, school facilities and greater engagement of women** (Adegbola and Zossou, 2024). The ATVET system includes public and private universities, agricultural technical colleges and professional training centers. By 2025, the government plans to establish 25 vocational schools dedicated to agricultural education. A survey of students in ATVET programs shows that 49% aspire to become agripreneurs and 23% aim to work in extension services. Most students are satisfied with course content, finding it relevant and taught by qualified, approachable teachers. However, they identified gaps in digital skills training, practical work opportunities and access to internet, computers, and literature. Women remain underrepresented, making up only a third of students and 12% of teachers. Addressing these gaps will require increased public investment



and better alignment of development assistance with national priorities.

## Employment

**Benin has implemented national initiatives to create job opportunities for youth, but funding for employing recent graduates remains a key barrier. Entrepreneurship offers a promising alternative** (Adegbola et al., 2020a). Government programs targeting services, wage subsidies, public works and self-employment have reached many young people but face institutional challenges that limit their impact. Improvements are needed in monitoring beneficiaries, providing training and finance, and raising awareness about these programs. Public-private partnerships should also be encouraged to offer practical training and internships in areas like food processing, financial management, marketing and innovation, while shifting attitudes from salaried jobs to entrepreneurship.

**In rural areas, agriculture has significant potential to employ youth, especially in processing, but remains underutilized due to low investment, lack of information and the physical demands of agricultural work** (Adegbola et al., 2020b). The Agricultural Entrepreneurship Promotion Project (PPEA), for instance has helped young people gain farm skills, increase self-employment and create more community-level jobs. However, the sector's full potential remains unrealized. Policies should promote awareness of agricultural opportunities, offer agro-processing training, and increase financing for agribusiness ventures. Short-term agriculture-related courses, apprenticeships, and internships are critical for engaging youth in agribusiness and unlocking the sector's potential.

## Climate change adaptation and sustainability

**Adaptation strategies can help Beninese farmers cope with climate change and boost their incomes** (Adegbola et al., 2017). Farmers in Benin are increasingly affected by rainfall variability and droughts, which disrupt agricultural production. In response, many rely on cultural practices, such as rainmaking and sacrifices and have adopted short-cycle rice and maize varieties along with mulching techniques using plant residues. While these short-cycle varieties help mitigate financial losses, they provide only modest revenue increases. To further support farmers, more climate-smart practices should be promoted. Such practices not only enhance

resilience but can also reduce greenhouse gas emissions, particularly in rice fields. Exploring opportunities for farmers to earn carbon credits for emissions reductions could provide additional financial benefits.

## Nutrition

**Personalized nutrition advice could be a valuable tool to address malnutrition, but significant challenges remain in achieving more comprehensive changes in dietary patterns** (Behrendt et al., 2024). Field-testing a digital food recommender in Benin showed positive effects on reducing carbohydrate intake but no significant changes in other micro- or macro-nutrients, highlighting the challenges of achieving a balanced diet. Developed by the Technical University of Munich, the recommender system uses household eating behavior data to provide tailored advice, suggesting adjustments to up to three food items to combat malnutrition and obesity. While recommendations to reduce carbohydrate consumption were effective, suggested changes for increasing specific vitamins had limited impact, likely due to the unavailability of certain foods and the greater complexity of balancing micronutrients compared to carbohydrates.

### KEY TAKE AWAYS FROM PARI RESEARCH IN BENIN

**Input and technology access:** Limited access to improved seeds, fertilizers, veterinary services and machinery constrains agricultural productivity in Benin.

**Impactful innovations:** Innovations in crops and livestock have boosted productivity and incomes in Benin but face low adoption due to limited awareness and scalability challenges.

**Mechanization challenges:** Mechanization enhances productivity and employment but is hindered by high costs, limited skills and dependence on machinery imports. Supporting local manufacturing and services is key to overcome these barriers.

**Youth in agriculture:** Agriculture offers significant employment potential for youth in Benin, especially in agro-processing. Realising this potential requires additional investments, training and awareness initiatives.

**Climate adaptation:** Climate-smart practices like short-cycle crops and mulching improve resilience. Scaling these methods and exploring carbon credits could further support Benin's farmers in adapting to climate change.





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All studies are available at [www.r4ai.org](http://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.

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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](mailto:presse.zef@uni-bonn.de)  
Phone: +49-(0)228 - 73 18 46



**zef**  
Center for  
Development Research  
University of Bonn