

Review

Agricultural productivity and economic transformation in Tanzania: A review of challenges and strategic interventions

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Agriculture remains the backbone of Tanzania's economy, contributing significantly to gross domestic product, employment, and rural livelihoods. Despite its importance, the sector continues to experience low productivity due to limited mechanization, inadequate irrigation, weak institutional support, and climate-related challenges. This review examines the key constraints affecting agricultural productivity in Tanzania and assesses strategic interventions required to enhance its role in economic transformation. Drawing on existing literature, policy documents, and empirical reports, the study identifies critical policy gaps, technological limitations, and market inefficiencies that hinder agricultural performance. The review highlights the importance of investment in irrigation and mechanization, strengthening research and extension services, improving market access and value chain development, and promoting climate-smart agricultural practices. It argues that enhanced agricultural productivity can stimulate industrialization, value addition, employment creation, and export growth, in line with Tanzania's Vision 2025 and Vision 2050. The study provides evidence-based insights for policymakers and stakeholders seeking to transform agriculture into a sustainable driver of inclusive economic growth and structural transformation.

Key words: Agricultural productivity, economic transformation, Tanzania, strategic interventions, rural development, policy framework.

INTRODUCTION

Agriculture remains a central pillar of economic development in most African countries, providing livelihoods for the majority of the population while contributing significantly to gross domestic product, employment, food security, and foreign exchange earnings. In sub-Saharan Africa, agriculture employs more than 60% of the labor force and plays a critical role in poverty reduction and rural development. Despite this

importance, agricultural productivity across the region remains relatively low compared to other developing regions, limiting the sector's ability to drive structural transformation and sustainable economic growth.

Low agricultural productivity in Africa has been attributed to a combination of structural, technological, institutional, and environmental constraints. These include heavy dependence on rain-fed agriculture, limited

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mechanization, low adoption of improved seed varieties and fertilizers, weak research and extension systems, inadequate rural infrastructure, and restricted access to credit and markets. Climate change and environmental degradation have further intensified these challenges, increasing production risks and yield variability. As a result, agriculture in many African economies has struggled to transition from subsistence-oriented production to a modern, market-driven, and value-adding sector capable of supporting industrialization and economic diversification.

Tanzania reflects many of these broader African agricultural challenges. Agriculture remains the backbone of the Tanzanian economy, contributing approximately one-quarter of gross domestic product and employing more than 65% of the population, particularly in rural areas (United Republic of Tanzania [URT], 2021). The sector supplies food for domestic consumption, raw materials for agro-industries, and foreign exchange through exports such as coffee, tea, cashew nuts, cotton, and tobacco. However, agricultural productivity in Tanzania remains low, with yields for many crops falling below regional and global averages. Smallholder farmers dominate production and often operate with limited access to modern inputs, irrigation, mechanization, extension services, and reliable markets.

Improving agricultural productivity is widely recognized as a prerequisite for economic transformation. Development theories emphasize that productivity growth in agriculture can release labor and resources to higher-productivity sectors, stimulate agro-processing and industrial development, enhance food security, and raise rural incomes. In Tanzania, national development frameworks such as Vision 2025 and Vision 2050 underscore the modernization of agriculture as a foundation for industrialization, value addition, employment creation, and inclusive economic growth. However, the persistence of low productivity suggests the presence of critical policy gaps, institutional weaknesses, and implementation challenges that require systematic examination.

Against this background, this review critically examines the key challenges constraining agricultural productivity in Tanzania and explores strategic interventions that can enhance the sector's contribution to economic transformation. By synthesizing existing literature, policy documents, and empirical evidence, the study situates Tanzania's agricultural experience within the broader African development context while identifying practical pathways for transforming agriculture into a dynamic and sustainable engine of economic growth.

CONCEPTUAL AND THEORETICAL FRAMEWORK

Understanding the role of agricultural productivity in

economic transformation requires a clear theoretical and conceptual grounding that explains how productivity improvements translate into broader development outcomes. This study draws on agricultural productivity theory, endogenous growth theory, and structural transformation theory to explain the linkages between agricultural performance and economic transformation in Tanzania within the broader African development context.

The conceptual framework illustrates how strategic interventions in agriculture lead to sustainable economic transformation in Tanzania. The framework is grounded in structural transformation and productivity theory, showing clear pathways from foundational inputs through enhancers and institutions to economic outcomes such as (Figure 1 and 2):

- 1) Inputs and resources: These form the basic foundation of agricultural production, such as land, labor, capital, seeds, and technology. Without adequate endowments, productivity gains remain limited.
- 2) Enhancers of productivity: Irrigation, mechanization, research and extension services, digital tools, and climate-smart agricultural practices elevate productivity by improving efficiency, resilience, and output quality. Digitalization in particular enhances decision-making and market engagement for smallholders.
- 3) Institutional and policy support: Effective inter-ministerial coordination, public investment frameworks, cooperatives, and public-private partnerships create enabling environments for sustained productivity gains. Institutional support ensures that innovations reach farmers and that policy barriers are minimized.
- 4) Agricultural productivity: This is the central node. Productivity improvements here represent outcomes of effective inputs, enhancers, and institutional actions. Enhanced productivity is both an outcome and a precondition for wider economic transformation.
- 5) Economic transformation outcomes: Productivity gains lead to value addition through agro processing, integration into industrial value chains, rural employment, increased household incomes, export expansion, poverty reduction, and inclusive growth. This aligns with structural transformation literature showing that improved agricultural performance catalyzes broader economic shifts.
- 6) Feedback loops and policy adjustment mechanisms: Outcomes generate feedback into policy and practice via monitoring and evaluation, guiding iterative refinement of interventions and institutional mechanisms to sustain transformation.

Theoretical foundations

Agricultural productivity theory

Agricultural productivity theory emphasizes the efficient

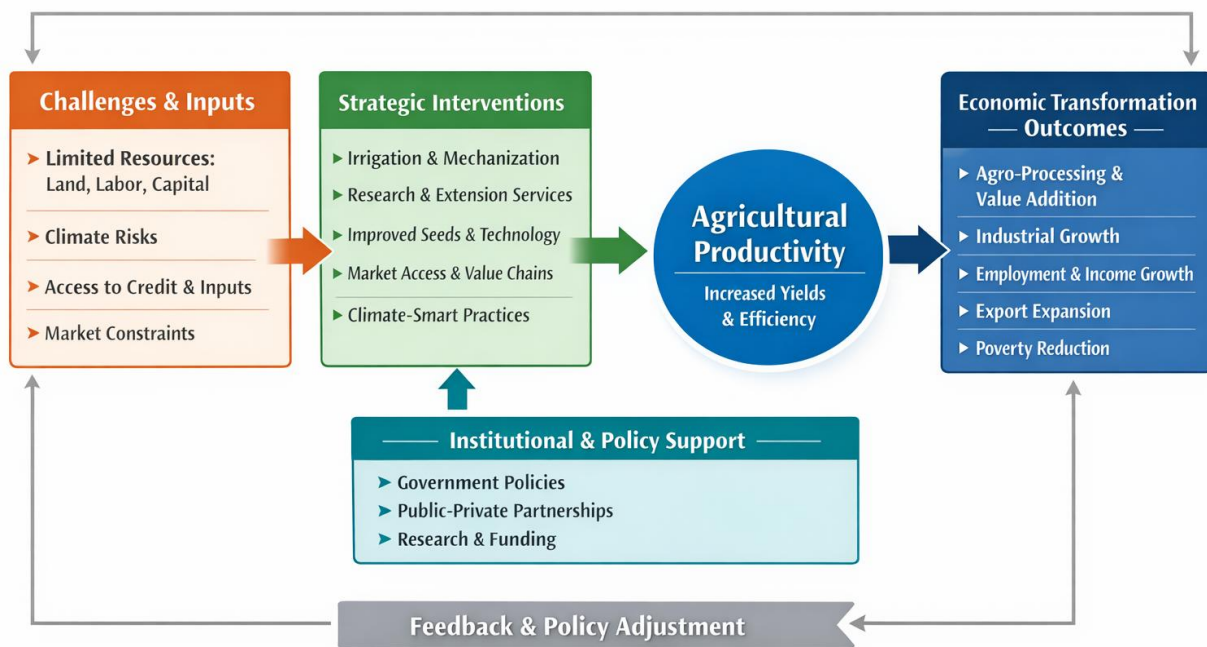


Figure 1. Conceptual framework linking agricultural productivity to economic transformation in Tanzania. Source: Author's Compilation.

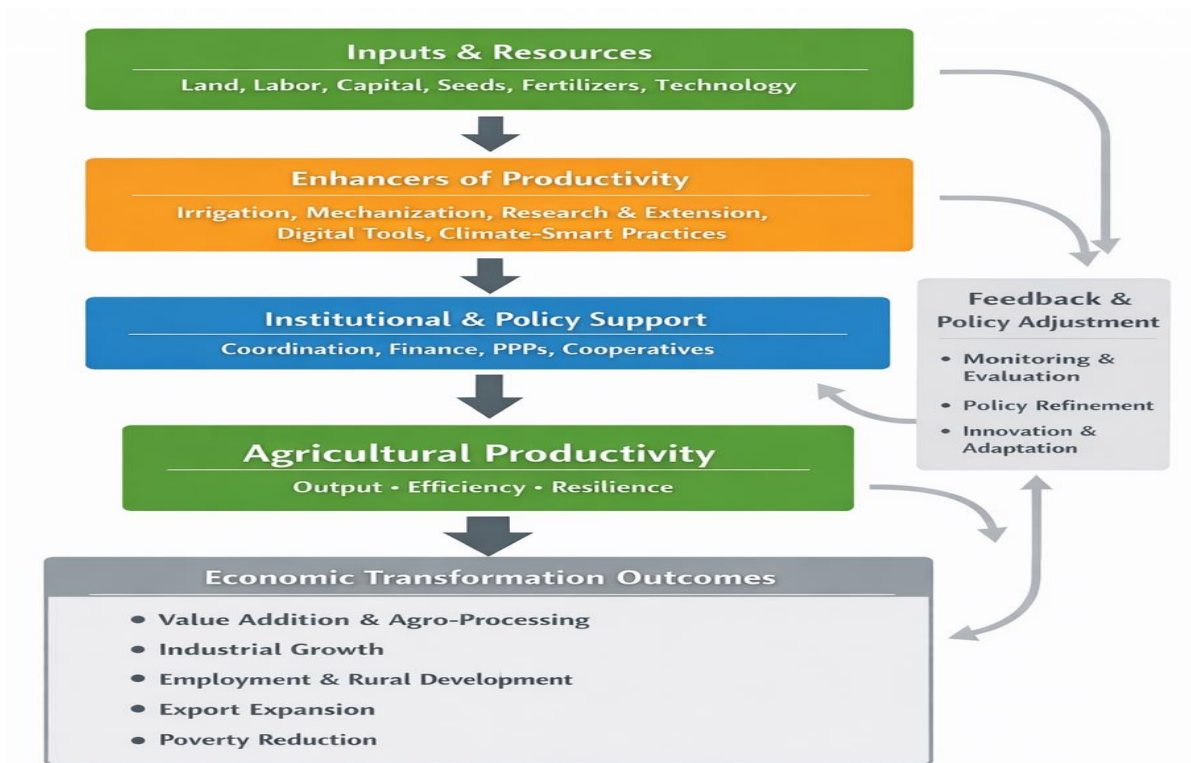


Figure 2. Conceptual framework linking agricultural productivity to economic transformation in Tanzania. Source: Author's Compilation.

use of inputs such as land, labour, capital, and technology to increase output and improve farm-level performance. Productivity growth is primarily driven by technological advancement, improved input use, mechanization, irrigation, and enhanced farm management practices (Food and Agriculture Organization [FAO], 2020). In the context of Tanzania, low productivity reflects limited access to modern inputs, weak extension services, and reliance on traditional farming methods. Improving productivity is therefore fundamental to increasing agricultural output, reducing production costs, and enhancing competitiveness within domestic and export markets.

Endogenous growth theory

Endogenous growth theory posits that long-term economic growth is driven by internal factors such as human capital development, innovation, research, and technological progress rather than exogenous forces (Romer, 1990). Applied to agriculture, the theory highlights the importance of investment in agricultural research, extension services, education, and technology adoption as key drivers of sustained productivity growth. In Tanzania, underinvestment in agricultural research and weak dissemination of innovations constrain productivity improvements. Strengthening these endogenous factors can generate spillover effects that support agro-processing, employment creation, and industrial development, thereby linking agriculture to broader economic transformation.

Structural transformation theory and value chain perspective

Structural transformation theory explains how agricultural productivity enables labor reallocation from low-productivity farming to industrial and service sectors (Herrendorf et al., 2014; Wuyts and Kilama, 2016). Endogenous growth theory emphasizes that knowledge, innovation, and technology adoption are key drivers of productivity gains, making research, extension, and information and communication technology (ICT) adoption essential for structural transformation (Romer, 1990; Ayim et al., 2022). Climate-smart agriculture and sustainable development frameworks ensure that productivity improvements are resilient and environmentally sustainable (Girma and Petros, 2024; Ramessur, 2021). In Tanzania, weak agro-industrial linkages and limited value addition constrain the transformation potential of agricultural productivity gains.

Conceptual linkages

The conceptual framework underpinning this study illustrates how agricultural productivity influences economic transformation through a set of interconnected pathways. The availability and effective use of inputs such as land, labour, capital, improved seeds, fertilizers, irrigation, and technology determine agricultural productivity. These inputs are enhanced through strategic interventions including mechanization, extension services, research and development, farmer training, and climate-smart agricultural practices.

Institutional and policy frameworks play a critical mediating role by shaping incentives, resource allocation, and market access. Government policies, agricultural institutions, cooperatives, and public-private partnerships influence the adoption of productivity-enhancing technologies and the integration of farmers into value chains. When these institutional mechanisms function effectively, productivity gains translate into increased output, reduced post-harvest losses, and improved market participation.

Improved agricultural productivity supports economic transformation through multiple outcomes, including increased value addition via agro-processing, employment creation, export expansion, rural income growth, and poverty reduction. These outcomes align with Tanzania's national development objectives under Vision 2025 and Vision 2050, which emphasize the modernization of agriculture as a foundation for industrialization and inclusive economic growth.

Pathways to economic transformation

The framework proposes that strategic interventions improve agricultural productivity, which strengthens linkages between agriculture and industry through value chains and agro-processing. Productivity gains increase food supply, lower input costs for industry, and enhance competitiveness, thereby supporting industrial growth and economic diversification. Feedback mechanisms also exist, whereby economic transformation generates additional resources for reinvestment in agriculture, reinforcing productivity growth and sustainability.

Overall, the conceptual and theoretical framework demonstrates that agricultural productivity is not an end in itself but a critical mechanism through which Tanzania can achieve structural transformation, industrial development, and long-term economic growth.

KEY CHALLENGES AFFECTING AGRICULTURAL PRODUCTIVITY IN TANZANIA

Limited adoption of modern seeds, mechanization, and

digital tools persists among smallholder farmers due to funding and knowledge gaps (Sandefur et al., unpublished; Ayim et al., 2022). Weak policy coordination and institutional fragmentation reduce the impact of interventions designed to boost productivity (URT, 2020; Wuyts and Kilama, 2016). Post-harvest losses remain high due to inadequate market and storage infrastructure, constraining value addition and industrial linkages (World Bank, 2021; Ramessur, 2021). Climate variability and environmental degradation further threaten long-term productivity (FAO, 2020; Girma and Petros, 2024).

Low mechanization and limited irrigation

A significant constraint on agricultural productivity in Tanzania is the low level of mechanization and inadequate irrigation infrastructure. The majority of smallholder farmers rely on manual labor and traditional farming tools, which limits efficiency and reduces crop yields (FAO, 2020). Furthermore, most farms remain rainfed, leaving agricultural output highly vulnerable to seasonal variability and climate shocks such as droughts and floods. The predominance of small-scale farms complicates the adoption of modern machinery, as individual farmers often cannot afford equipment on their own. Without coordinated government or private-sector interventions, widespread mechanization and the expansion of irrigation networks remain a distant prospect, perpetuating low productivity and limiting Tanzania's ability to shift labor into higher-value economic activities.

Limited access to credit and agricultural inputs

Access to affordable financing and quality inputs is another major barrier for Tanzanian farmers. Many smallholder farmers are unable to secure loans or credit at reasonable interest rates, constraining their capacity to purchase improved seeds, fertilizers, and mechanized equipment (URT, 2021). Input supply chains are often inconsistent, particularly in remote and rural areas, which reduces farmers' ability to achieve optimal yields. This financial and logistical gap not only lowers current productivity but also limits the adoption of modern agricultural technologies that are essential for long-term sectoral transformation.

Market and post-harvest constraints

Poor market infrastructure and post-harvest handling further hinder agricultural growth. Inadequate storage, processing, and transportation systems result in post-

harvest losses estimated between 20 and 30% for key crops. Weak market linkages also prevent farmers from accessing profitable domestic and international markets, reducing incentives to invest in productivity-enhancing inputs (World Bank, 2021). Moreover, the limited capacity for agro-processing curtails value addition, preventing Tanzania from capturing higher economic gains from its agricultural products. These constraints collectively dampen the potential of agriculture to serve as a driver of industrialization and economic transformation.

Climate change and environmental risks

Tanzania's agricultural sector is increasingly vulnerable to climate change and environmental degradation. Erratic rainfall, recurrent droughts, and flooding events negatively affect crop yields, while soil degradation and deforestation compromise long-term productivity. These environmental challenges necessitate the adoption of climate-smart agricultural practices that enhance resilience, improve soil fertility, and sustain production over time (URT, 2020). Failure to address these risks threatens both food security and the broader goals of economic transformation.

Institutional and policy gaps

Finally, institutional weaknesses and policy fragmentation reduce the effectiveness of interventions in agriculture. Weak coordination among government ministries and agencies undermines policy implementation, while inadequate extension services limit farmers' knowledge of modern techniques and innovations. Insufficient investment in agricultural research further constrains the development and adoption of improved crop varieties and technologies. Without coherent policies and institutional support, efforts to enhance productivity and integrate agriculture with industrial and economic transformation remain fragmented and less effective.

STRATEGIC INTERVENTIONS TO ENHANCE AGRICULTURAL PRODUCTIVITY

Investment in irrigation, mechanization, and affordable equipment is critical for increasing yields and labor efficiency (African Development Bank [AfDB], 2021; Sandefur et al., unpublished). Strengthening research and extension services ensures adoption of climate-smart, high-yield varieties, supported by digital advisory tools to improve farm-level decision-making (FAO, 2020; Ayim et al., 2022). Market access and value chain development are essential to connect smallholders with

agro-processing industries, reducing post-harvest losses and increasing export potential (World Bank, 2021; Wuyts and Kilama, 2016). Climate-smart practices and sustainable land management enhance resilience, ensuring that productivity gains are environmentally sustainable and contribute to long-term economic transformation (Girma and Petros, 2024; Ramessur, 2021).

Investment in irrigation and mechanization

Expanding irrigation infrastructure is essential to reduce dependence on unpredictable rainfall and improve crop yields. Similarly, promoting mechanization through affordable equipment access and machinery leasing programs can enhance farm efficiency, particularly for smallholder farmers (AfDB, 2021). Public-private partnerships can play a pivotal role in supporting farm modernization, increasing productivity, and reducing labor intensity, thereby enabling smallholders to contribute more effectively to Tanzania's structural transformation.

Strengthening research, extension services, and technology adoption

Enhancing agricultural research institutions to develop high-yield, climate-resilient crop varieties is critical for long-term productivity gains. Strengthened extension services are equally important, as they disseminate knowledge on modern farming techniques, soil fertility management, and pest control. Digital agriculture tools, including mobile advisory services and precision farming technologies, can further support data-driven decision-making and improve overall efficiency (FAO, 2020). Together, these measures facilitate the adoption of innovations that directly boost productivity and support economic transformation.

Improving market access, value chains, and agro-processing

Investments in rural roads, storage facilities, and transportation networks are necessary to reduce post-harvest losses and improve farmers' access to markets. Developing agro-processing industries adds value to primary agricultural products, increases export potential, and generates employment. Facilitating farmer cooperatives and producer associations strengthens bargaining power and market linkages (World Bank, 2021). These interventions collectively enhance the profitability of agriculture and reinforce its role as a driver

of economic transformation.

Promoting climate-smart and sustainable agricultural practices

Adopting climate-smart agricultural practices, including conservation farming, agroforestry, and efficient water management, helps mitigate environmental risks and sustain productivity. Sustainable land management ensures soil fertility is preserved, while training and incentives for renewable energy adoption, such as solar-powered irrigation and processing equipment, further enhance efficiency and environmental sustainability. These practices align agricultural growth with Tanzania's long-term development goals.

Strengthening policy and institutional support

Coherent policy frameworks and effective institutional coordination among ministries of agriculture, finance, trade, and industry are essential for implementing agricultural interventions. Allocating sufficient funding for infrastructure, research, and extension services supports sectoral modernization, while public-private partnerships mobilize resources, technology, and expertise. By integrating these measures, Tanzania can build a resilient, high-productivity agricultural sector that drives industrialization, employment generation, and broader economic growth.

By implementing these strategic interventions, Tanzania can transform agriculture into a high-productivity, value-added sector, contributing significantly to industrialization, job creation, and overall economic growth.

CONTRIBUTION OF AGRICULTURAL PRODUCTIVITY TO ECONOMIC TRANSFORMATION IN TANZANIA

Productivity gains provide raw materials for industrial growth and agro-processing clusters, linking structural transformation theory to tangible outcomes (Herrendorf et al., 2014; Wuyts and Kilama, 2016). Increased output strengthens rural economies, generates employment, and supports export expansion (World Bank, 2021; Sandefur et al., unpublished). Adoption of digital tools, climate-smart agriculture, and modern technologies enhances efficiency and competitiveness, reinforcing industrialization and income diversification in rural Tanzania (Ayim et al., 2022; Girma and Petros, 2024; Ramessur, 2021). Initiatives such as Southern Agricultural Growth Corridor of Tanzania (SAGCOT) exemplify the integration of theory into practice,

connecting smallholders to processing firms and export markets (TanzaniaInvest, 2021).

Contribution to industrialization and value addition

Increased agricultural output provides essential raw materials for agro-processing industries, thereby fostering industrialization and domestic value addition. The development of agro-industrial clusters integrates farming, processing, and marketing activities, creating employment opportunities while stimulating rural economies. A notable example is the SAGCOT, which links smallholder farmers to agro-processing firms and export markets (URT, 2020). By strengthening these linkages, enhanced agricultural productivity ensures a steady supply of inputs for industries, promotes local value chains, and contributes to structural transformation by moving labor and capital into higher-value economic activities.

Contribution to gross domestic product (GDP), employment, and exports

Agriculture remains a major contributor to Tanzania's GDP, accounting for approximately 25% of national output, and employs over 65% of the labor force, particularly in rural areas. Gains in agricultural productivity increase household incomes and stimulate local economies, while generating foreign exchange through exports of key commodities such as coffee, cashews, and horticultural products (World Bank, 2021). Beyond economic metrics, strong agricultural performance supports poverty reduction and social stability, which are critical for achieving broader economic transformation objectives. By improving both the quantity and quality of agricultural output, the sector reinforces Tanzania's capacity to participate in global markets and enhance domestic economic resilience.

Alignment with national vision policies

Tanzania's national development visions, including Vision 2025 and Vision 2050, prioritize the modernization of agriculture, improvement of productivity, and integration of the sector with industrialization and value addition strategies. Strategic interventions that enhance productivity directly support national priorities such as ensuring food security, promoting agro-processing and exports, and diversifying rural employment opportunities (URT, 2025). By linking agricultural performance to these policy frameworks, Tanzania can create a coherent pathway from improved farm-level productivity to broader

economic transformation, ensuring that gains in the sector translate into sustainable social and economic development.

Human capital development and technology linkages

Investments in human capital through training, extension services, and agricultural research enable farmers to adopt modern techniques and technologies, bridging the gap between agricultural output and economic transformation. The adoption of digital tools, precision farming technologies, and climate-smart practices increases efficiency, resilience, and competitiveness, further supporting industrial growth and economic diversification. These technology-driven improvements not only enhance productivity but also reinforce Tanzania's ability to develop high-value agricultural products for domestic and export markets, strengthening the link between the agricultural sector and the broader economy.

Enhanced agricultural productivity generates a multiplier effect across Tanzania's economy, linking farm-level gains to industrial development, export growth, and inclusive economic transformation. By integrating technology, human capital development, and policy-aligned interventions, Tanzania can leverage agriculture as a cornerstone for sustainable economic growth, poverty reduction, and structural transformation.

DISCUSSION

The findings of this review reveal that low agricultural productivity remains a binding constraint to economic transformation in Tanzania, a situation that mirrors experiences across many sub-Saharan African economies. Despite agriculture's dominant role in employment and rural livelihoods, productivity growth has been slow, limiting the sector's capacity to stimulate industrialization, value addition, and structural transformation. This pattern is consistent with broader African evidence, where agriculture continues to be characterized by smallholder dominance, low technology adoption, and weak integration into modern value chains.

One of the most critical constraints identified is limited mechanization and irrigation. Tanzania's heavy reliance on rain-fed agriculture exposes farmers to climate variability and seasonal shocks, a challenge similarly observed in countries such as Ethiopia, Malawi, and Zambia. Empirical studies from these countries demonstrate that investment in small-scale irrigation and mechanization significantly improves yields, farm incomes, and production stability. In contrast, countries such as Morocco and Egypt, which have invested heavily

in irrigation infrastructure, exhibit higher and more stable agricultural productivity, underscoring the importance of water management in driving agricultural transformation.

Access to inputs, finance, and extension services also emerges as a key determinant of productivity performance. In Tanzania, smallholder farmers face limited access to affordable credit, improved seeds, fertilizers, and modern farming knowledge. This constrains their ability to adopt productivity-enhancing technologies. Comparable experiences in Kenya and Ghana show that strengthened extension systems and targeted input subsidy programs can accelerate technology adoption and productivity growth when supported by effective institutional frameworks. The Tanzanian case, therefore, reflects broader regional challenges associated with weak rural financial systems and under-resourced agricultural support services.

Market access and post-harvest constraints further weaken the link between agricultural productivity and economic transformation. High post-harvest losses, inadequate storage facilities, poor rural roads, and limited agro-processing capacity reduce farmers' incentives to invest in productivity-enhancing inputs. Evidence from countries such as Rwanda and Senegal indicates that improvements in rural infrastructure and value chain integration significantly enhance market participation and value addition. Tanzania's experience suggests that productivity gains alone are insufficient unless accompanied by investments in agro-processing, logistics, and market development.

From a theoretical perspective, the findings align with endogenous growth theory, which emphasizes the role of investment in human capital, innovation, and technology in sustaining long-term economic growth. In the agricultural context, productivity improvements driven by research, extension services, and mechanization can generate spillover effects that support industrial development and employment creation. The review also supports structural transformation theory, which posits that economic development requires the reallocation of resources from low-productivity activities to higher-productivity sectors. In Tanzania, weak productivity growth in agriculture limits this transition, constraining the sector's contribution to industrialization and economic diversification.

Policy frameworks such as Tanzania's Vision 2025 and Vision 2050 correctly identify agriculture as a foundation for economic transformation. However, the persistence of low productivity suggests gaps in policy coordination, implementation, and investment prioritization. Successful African experiences demonstrate that coordinated interventions—combining irrigation, mechanization, extension services, market access, and institutional reform—are more effective than isolated measures. The discussion, therefore, highlights the need for an

integrated approach that strengthens agricultural productivity while simultaneously building agro-industrial linkages and market systems.

Overall, the discussion underscores that transforming agriculture into a driver of economic growth in Tanzania requires more than incremental productivity improvements. It demands a comprehensive strategy that addresses structural constraints, enhances institutional capacity, and aligns agricultural development with industrial and trade policies. Without such integration, agriculture's potential contribution to inclusive and sustainable economic transformation will remain underutilized.

CHALLENGES AND POLICY GAPS IN TANZANIA'S AGRICULTURAL SECTOR

Empirical studies highlight that low adoption of technology, limited credit access, and weak institutional frameworks constrain productivity growth (Sandefur et al., unpublished; Ayim et al., 2022; Wuyts and Kilama, 2016). Policy fragmentation across agriculture, trade, and industry reduces the effectiveness of interventions, while climate and environmental risks threaten long-term sustainability (URT, 2020; Girma and Petros, 2024). Investments and coordinated strategies are needed to overcome these barriers and align productivity improvements with economic transformation objectives (Ramessur, 2021; World Bank, 2021).

Institutional and policy fragmentation

One of the primary challenges is the fragmentation of institutional and policy frameworks across government ministries. Policies in agriculture, trade, industry, and infrastructure are often poorly coordinated, limiting the effectiveness of interventions and reducing overall efficiency (URT, 2020). For example, initiatives to promote mechanization or agro-processing may not align with trade policies or rural infrastructure development, resulting in fragmented efforts that fail to fully unlock the sector's potential. Strengthening inter-ministerial coordination and harmonizing policies is therefore essential to ensure that agricultural productivity improvements translate into broader economic transformation.

Limited access to technology and research

Technological adoption remains a critical constraint, particularly among smallholder farmers who dominate Tanzania's agricultural landscape. The uptake of

improved seeds, mechanized equipment, and digital advisory tools is low, often due to limited awareness, training, or affordability (FAO, 2020). Additionally, agricultural research institutions are underfunded and inadequately resourced, reducing their capacity to develop and disseminate context-specific innovations that could enhance productivity and resilience. Without stronger investments in research and technology extension, productivity gains remain limited, and the sector's contribution to industrialization and economic diversification is constrained.

Market and value chain constraints

Market inefficiencies and weak value chains further hinder the sector's growth. Inadequate transport, storage, and processing infrastructure leads to high post-harvest losses, diminishing profitability and reducing the availability of raw materials for agro-industries. Moreover, weak linkages between farmers, cooperatives, and agro-processing firms limit opportunities for value addition and competitiveness in both domestic and export markets. Strengthening market infrastructure, developing cooperative frameworks, and integrating farmers into agro-industrial value chains are essential for translating productivity gains into economic transformation.

Climate and environmental risks

Climate variability presents ongoing challenges for Tanzania's agriculture. Droughts, floods, and erratic rainfall patterns disrupt production cycles and income stability, while soil degradation, deforestation, and unsustainable land use reduce the long-term potential of agricultural land. These environmental risks threaten both food security and the sustainability of productivity improvements. Implementing climate-smart agricultural practices, including water-efficient irrigation, agroforestry, and soil conservation, is critical to safeguarding yields and supporting resilient economic growth.

Funding and investment gaps

Finally, inadequate investment from both public and private sectors limits the ability of the agricultural sector to modernize and scale up. Funding constraints impact essential areas such as mechanization programs, irrigation infrastructure, and agricultural research initiatives. Additionally, smallholder farmers often struggle to access affordable credit needed to invest in productivity-enhancing inputs. Without strategic investments, the adoption of modern technologies and

sustainable practices progresses slowly, hindering efforts to strengthen agriculture as a catalyst for industrialization, job creation, and economic transformation.

Addressing these challenges requires comprehensive and coordinated policy interventions, targeted investments in research, infrastructure, and climate-smart technologies, and stronger institutional frameworks. By tackling institutional, technological, market, environmental, and investment constraints in a holistic manner, Tanzania can enhance agricultural productivity and fully leverage the sector's potential to drive industrial growth, value addition, and inclusive economic transformation.

STRATEGIC RECOMMENDATIONS FOR ENHANCING AGRICULTURAL PRODUCTIVITY

Recommendations for irrigation, mechanization, research strengthening, and ICT adoption are supported by evidence linking such interventions to productivity gains and structural transformation (AfDB, 2021; Romer, 1990; Ayim et al., 2022; Sandefur et al., unpublished). Market access improvements, value chain integration, and climate-smart practices have been empirically linked to higher incomes, resilience, and industrial growth (World Bank, 2021; Girma and Petros, 2024; Ramessur, 2021). Policy coherence and institutional support ensure sustainability and alignment with Tanzania's Vision 2025 and Vision 2050 goals (URT, 2021; Wuyts and Kilama, 2016).

Investment in irrigation and mechanization

Expanding irrigation infrastructure is critical to reduce reliance on rain-fed agriculture, stabilize yields, and improve productivity across diverse agro-ecological zones. Complementary to this, promoting affordable mechanization programs through equipment leasing schemes, cooperative ownership models, and targeted subsidies can enhance farm-level efficiency, particularly for smallholder farmers who dominate the sector. Public-private partnerships (PPPs) are essential for financing large-scale irrigation and mechanization projects, facilitating knowledge transfer, and ensuring sustainable adoption of modern agricultural technologies (AfDB, 2021). These investments not only increase output but also support the structural transformation of the rural economy by freeing labor for value-added industrial activities.

Strengthening research, extension services, and technology adoption

Enhancing agricultural research institutions and extension

extension services is fundamental to improving productivity. Increased funding can support the development of high-yield, drought-resistant, and climate-smart crop varieties tailored to Tanzanian conditions. Extension services play a critical role in ensuring farmers adopt modern practices, including pest management, soil fertility improvement, and conservation agriculture. Additionally, the integration of digital agriculture tools such as mobile-based advisory services, precision farming technologies, and data-driven decision support systems can further improve efficiency and resilience (FAO, 2020). Collectively, these measures bridge the gap between scientific innovation and on-farm application, fostering productivity gains that are essential for economic transformation.

Market access, value chain development, and agro-processing

Strengthening market access and developing value chains are key to converting agricultural productivity into economic benefits. Investments in rural roads, storage facilities, and transport infrastructure reduce post-harvest losses and enhance farmers' access to domestic and international markets. Support for agro-processing industries allows for value addition, creates employment opportunities, and strengthens Tanzania's industrial base. The promotion of cooperatives and producer associations enhances bargaining power, facilitates market linkages, and ensures equitable distribution of economic gains (World Bank, 2021). These interventions integrate smallholders into broader economic networks, transforming agriculture from a subsistence activity into a driver of industrialization and export growth.

Climate-smart and sustainable agricultural practices

Given the increasing risks posed by climate variability, adopting climate-smart agriculture is essential for sustaining productivity. Practices such as conservation farming, agroforestry, efficient water management, and renewable energy use in irrigation and processing improve resilience while maintaining environmental sustainability. Soil conservation and sustainable land management practices ensure long-term fertility and productivity, supporting consistent output for both domestic consumption and industrial use. By embedding sustainability in agricultural development, Tanzania can protect natural resources while strengthening the sector's contribution to economic transformation.

Policy and institutional support

Effective institutional and policy support underpins the

success of all strategic interventions. Coordinated policies across agriculture, trade, and industry minimize fragmentation and enhance efficiency, while targeted funding and credit access enable smallholder farmers to adopt productivity-enhancing technologies. Establishing monitoring and evaluation systems ensures the effectiveness of interventions is assessed, guiding iterative policy adjustments. By creating an enabling environment through coherent governance, Tanzania can maximize the impact of investments in agriculture and reinforce the link between productivity gains and economic transformation.

CONCEPTUAL FRAMEWORK LINKING AGRICULTURAL PRODUCTIVITY TO ECONOMIC TRANSFORMATION

The conceptual framework integrates inputs, productivity enhancers, and institutional support to illustrate how strategic interventions in agriculture drive economic transformation in Tanzania.

Framework components

- 1) Inputs and resources: Land, labor, capital, seeds, fertilizers, and technology serve as foundational resources for production.
- 2) Enhancers of productivity: Irrigation, mechanization, research, extension services, digital tools, and climate-smart practices amplify output and efficiency.
- 3) Institutional and policy support: Government policies, funding mechanisms, cooperatives, and agro-industrial partnerships provide the enabling environment for sustained growth.
- 4) Economic transformation outcomes: Improved productivity results in increased agricultural output, value addition through agro-processing, rural employment creation, industrial growth, export expansion, poverty reduction, and inclusive economic growth.

Pathways to transformation

Strategic interventions enhance productivity, which strengthens agro-industrial linkages, market participation, and rural entrepreneurship. Productivity gain enables labor shifts into industrial and value-added sectors, fostering structural transformation. Coordinated policies and institutional support ensure that these outcomes are sustainable, aligned with national development goals such as Vision 2025 and Vision 2050, and capable of driving inclusive economic transformation.

Conceptual Illustration

In the visual conceptual model, inputs, enhancers, and institutional support are depicted as converging toward productivity improvements. Arrows from productivity improvements then flow toward economic transformation outcomes, with feedback loops connecting outcomes to policy refinements and intervention adjustments, reflecting a dynamic and iterative process.

CONCLUSION

This review demonstrates that agricultural productivity is central to Tanzania's economic transformation. While agriculture provides employment, food security, and raw materials for industry, its potential is constrained by low mechanization, limited access to credit and inputs, climate variability, weak market linkages, and institutional fragmentation.

Strategic interventions, including investments in irrigation and mechanization, strengthening research and extension services, improving market access and value chains, adopting climate-smart practices, and reinforcing policy and institutional support, are essential for enhancing productivity and linking agricultural gains to broader economic outcomes.

Enhanced agricultural productivity drives industrial growth, value addition, employment creation, export expansion, and poverty reduction, directly supporting Tanzania's Vision 2025 and Vision 2050 objectives. The conceptual framework presented illustrates the pathways through which resources, interventions, and institutional support translate into sustainable economic transformation.

Finally, a holistic and integrated approach to agricultural development is critical for unlocking Tanzania's economic potential. Future research should focus on empirical assessments of intervention effectiveness, adoption of innovative technologies, and regional disparities to inform policy and guide strategic investments.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests,

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