

The Policy Environment for Climate Vulnerability on Trade Competitiveness and Export Diversification in Tanzania's Rice Value Chain

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Abstract

Rice is an essential food crop that significantly contributes to Tanzania's economic growth, food security, and poverty alleviation. However, the country's rice value chain is susceptible to climate change, fluctuations, and economic globalization. These issues can disrupt the rice value chain and diminish its capacity to benefit local people and economies. This study provides a detailed analysis of the policy environment for climate vulnerability on trade competitiveness and export diversification in the rice value chains in Tanzania. The study used a combination of institutional economics, political economy, and global value chain theories to evaluate how climate variability affects trade competitiveness and export diversification within the rice value chain in Tanzania. Analysis of the policy environment for climate variability on competitiveness and export diversification revealed significant gaps related to policy regulation, access to farm inputs, infrastructure, and resilience to climate vulnerability, finances, as well as trade and marketing that should be addressed to improve incentives in the rice value chain. The review emphasizes the improvement of policies and regulations for the rice value chain to tackle climate variability and improve trade competitiveness and export diversification that could strengthen the resilience of rice value chains against climate stresses. Climate vulnerability assessments are important in the implementation arrangements of the policy. Vulnerability mapping could help to target geographically impacted areas for immediate intervention to accelerate rice trading in the country. Investing in technology, strategic research on rice export development to enhance rice production quality and productivity can potentially increase Tanzania's competitiveness in international markets throughout the rice value chain. The study underscores the need for policies and initiatives that enhance the strength of value chains to climatic and economic tensions. This article is relevant for policymakers, academics, and other stakeholders interested in encouraging the sustainable development through the rice value chain in Tanzania.

Keywords: Climate Vulnerability, Trade competitiveness, Exports diversification, Rice Value Chain

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1. Introduction

It is highlighted that, pressures imposed by climate change and variability have great influence to economic pressures, that in turn has accelerated volatile markets, unexpected changes in agricultural policy, poor infrastructure as well as international competition (Daramola, 2005). The decline of rainfall, rising of temperatures and flooding, and have put pressure on domestic rice value chains. Liberalization of the agri-food sector has been one of the strategic approaches to increase the opening of global markets competition (Niang *et al.*, 2014)

In many developing countries smallholder farmers have been facing various challenges in the agricultural sector including lack of access to financial services, limited knowledge of high-quality inputs, low usage of technology and poor linkages on markets across the value chain for various crops. There is poor access to appropriate and adequate financial services, particularly credit which causes rural farmers to confine themselves to low-risk crops and sub-optimal inputs, which lead to lower yield (Demirgüç-Kunt *et al.*, 2020). Inadequate access to finance make smallholder farmers end up with lower yield and make their produce less competitive in the market while increasing the risk of falling into a debt cycle and compel them to seek credit for repaying previous loans (Tinsley and Agapitova, 2018).

Rice or paddy is the world's most important staple food for food security, poverty alleviation, and youth employment. According to the Consortium of International Agricultural Research Centers (CGIAR) (2016), over 3.5 billion people worldwide depend on rice for at least 20% of their daily calorie intake. The world's average per capita milled rice consumption is 64 kilograms providing 19% of daily calories (Bhandari, 2019). In Africa, the annual rice consumption per capita is projected to increase by about 5 kg from 2019 to 2028 (CGIAR, 2016).

In most of sub-Saharan Africa (SSA), rice is the most-demanded staple food and cash crop (Arouna *et al.*, 2021; Velde & Maertens, 2014). According to the International Rice Research Institute (IRRI) (2020), paddy rice production in SSA in 2018 was estimated to be 26.5 million tons from about 11.95 million hectares of land. Increasing incomes, population, and modest gains in SSA rice production (only 55% of demand) have generated an export market for the commodity estimated to be worth \$5 - 6 billion annually. Consequently, the rice sector is key to economic growth in the region and has the potential to create wealth and jobs, food security, and social stability (Seck *et al.*, 2012).

In Tanzania, rice is the third most important cereal food crop after maize and cassava (Wilson & Lewis, 2015). Tanzania is the largest producer of rice in East Africa, producing an estimated 2.2 million metric tons of rice yearly, accounting for three-quarters of the total rice grown in the region (URT, 2019). Similarly, economic activities related to rice production, processing, distribution, and consumption are considered key for economic development, food security, and poverty reduction (Demont, 2013). The country is endowed with abundant land and good access to water, giving it a considerable potential for rice production and export. Rice is grown in most regions of the country but mainly in Morogoro, Mbeya, Tabora, Shinyanga, Mwanza, and Arusha, accounting for about three-quarters of all rice produced in the country (Msafiri, 2021). Smallholder farmers currently grow most rice (74 %) under rain-fed conditions, while irrigated rice (20 %) and large-scale production (6 %) are currently less important. In 2019, the United Republic of Tanzania (URT) developed the National Rice Development Strategy (NRDS), which aims at doubling rice production and improving food security and export to neighboring countries (Wilson & Lewis, 2015). Approximately 30% of the crop is consumed by the producing households, some are sold in local markets and more than 60% is sold on commercial markets within the country, mainly in Dar es Salaam.

The demand for rice in Tanzania was projected to triple by 2020, with a substantial deficit forecast of 2.84 million tons. These trends will continue past 2025 (Wilson & Lewis, 2015). Although Tanzania has not been self-sufficient in rice for many years, rice imports tend to exceed exports (Figure 1). Tanzania considers rice a strategic priority for agricultural growth and commerce, and in 2019 it launched the 10-year NRDS to double rice acreage and productivity, increasing value addition and maximizing trade potential by 2030 (URT, 2019). Around 42% of all rice produced in Tanzania is marketed, which is a more significant proportion than any other food crop, but this is primarily due to the influence of large-scale growers. Tanzania is one of the few African countries best positioned to leverage the subsector's trade potential due to the presence of big arable lands and enough water supplies.

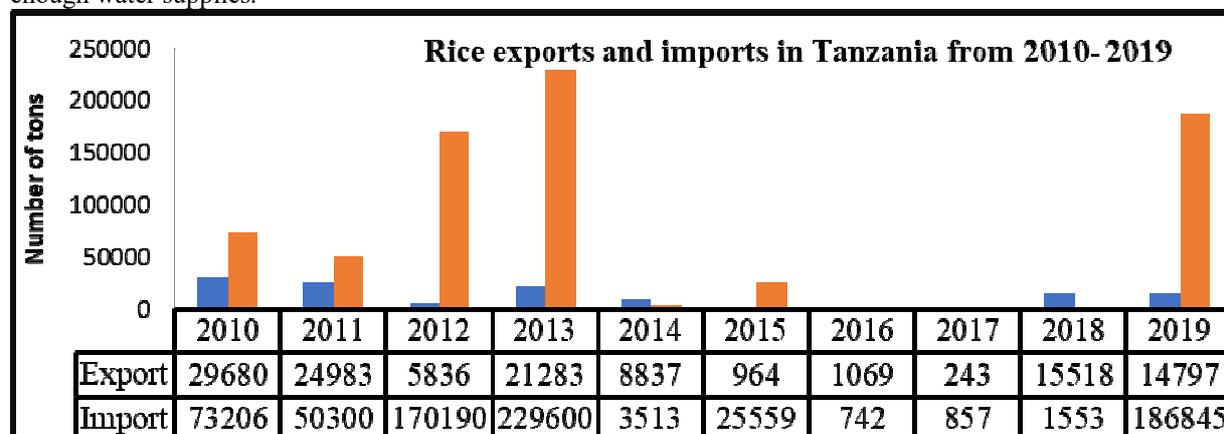


Figure 1: Rice exports and imports in tons in Tanzania from 2010 - 2019

Source: FAO (2022)

Paradoxically, whilst the rice is being imported into Tanzania as of current, there are still exports to neighbouring countries, mainly Burundi, Kenya, Rwanda, the Democratic Republic of Congo (DRC), and Uganda (Wilson & Lewis, 2015) (Figure 2). The country's unique geostrategic location, proximity to eight other countries, and membership in regional trading blocs with a combined market size of over 600 million people and a total Gross Domestic Product (GDP) of approximately \$1 trillion have made trade a major driver of economic growth. Regional preferences for Tanzania's high-quality, low-yield fragrant rice have contributed to the increase in exports. Despite these prospects, the global export potential of rice and other commodities is hampered by supply-side constraints, particularly regarding product consistency, marketing, and climate variability. Consequently, agriculture's relative lack of competitiveness, mainly impacted by non-tariff obstacles, also hinders international trade.

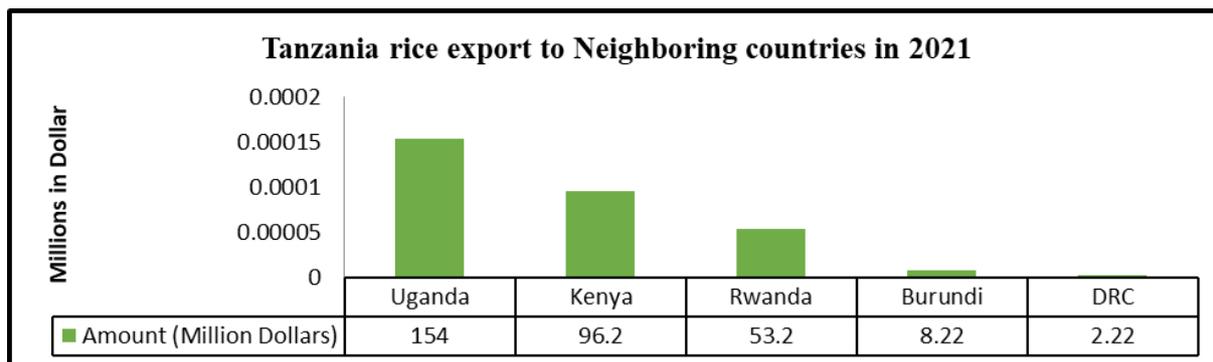


Figure 2: Tanzania Rice Exports to Neighboring Countries in 2021

Source: The Observatory of Economic Complexity (OEC) (2022)

The rice value chain comprises producers, brokers, transporters, wholesalers, and retailers, each having increasing engagement costs. Reportedly, it is not uncommon for value chain transactions to comprise up to 35 distinct participants, each with underlying transaction costs 5 (Kwesiga *et al.*, 2019). Over the years, the importance of rice as a food and cash crop in Tanzania has been increasing, but realising its value chain potential for growth and poverty reduction has remained a challenge and complex. While Tanzania continues to import rice, significant growth in exports to neighboring nations like the DRC, Burundi, Kenya, Rwanda, and Uganda has continued in the opposite direction, highlighting the commodity's trade potential. One of the most significant obstacles is strengthening and maintaining the connection to regional and global value chains by increasingly satisfying requirements in a competitive way to gain market access and boost productivity for sustainable export growth. Despite the importance of rice, most farmers continue to grow traditional varieties with long maturity and low yields, which are affected by rainfall irregularities and pests (Kwesiga *et al.*, 2019). According to FAO (2022), the main challenges for the paddy sector in Tanzania are unawareness about new cultivars, thereby affecting technology transfer; availability, distribution, and cost issues for both improved seed, fertiliser, and crop health products that have an impact on input delivery to the farm gate and high post-harvest losses.

The weak competitiveness of the value chain, which affects the subsector's trade resilience to tariff and non-tariff barriers, inhibits the expansion of rice exports. While a large body of literature exists on the rice value chain in Tanzania, there are few studies on the policy environment for climate vulnerability on trade competitiveness and export diversification in Tanzania's rice value chain. Improving the sector's competitiveness due to climate variability necessitates the need for more information on the policy environment for climate vulnerability on trade competitiveness and export diversification in Tanzania's rice value chain. This study attempted to bridge the existing knowledge gap by focusing on the rice value chain in Tanzania, the implications of climate vulnerability on its trade competitiveness and export diversification, and the policy environment for climate variability on trade competitiveness and export diversification. The conclusions and recommendations from this study are informative to policymakers to promote the trade competitiveness and export diversification of Tanzania's rice sub-sector in the face of climate variability and provide targeted technical assistance to value chain actors and trade support institutions to increase trading opportunities for farmers in international markets. This study is organized as follows: The next section highlights the theoretical reviews of the study, section three provides the methodology. Section four provides an in-depth analysis of the findings regarding the implications of climate variability on trade competitiveness and export diversification in the rice value chain in Tanzania. The study's summary, conclusions, and recommendations are in section five.

2. Theoretical Review

The goal of the current study was to evaluate the impact of the policy environment for climate vulnerability on trade competitiveness and export diversification in Tanzania's rice value chain. Three theories were used in this investigation: institutional economics, political economy, and the Global Value Chain (GVC) theories. The subsections 2.1 to 2.3 provide descriptions of the theories.

2.1 Institutional Economics Theory

The theory stresses the role of formal and informal laws and institutions in determining economic outcomes. Institutions may comprise legal frameworks, property rights, conventions, and practices that direct the decision-making of economic participants. Institutional structures may greatly impact the incentives and behavior of market actors, including farmers, merchants, and processors, in the context of climate sensitivity and trade competitiveness in Tanzania's rice value chain. Government policies and regulations may play a crucial role in encouraging investment in climate-smart technology and infrastructure, enhancing rice production's resilience and competitiveness. For instance, regulations that incentivize the deployment of irrigation systems, drought-

resistant seedlings, and soil conservation methods might offset the consequences of climate vulnerability on the rice value chain (Williams *et al.*, 2009). In addition, policies and strategies that encourage the development of climate information services, weather forecasting systems, and early warning systems may assist farmers in preparing for and adapting to climate shocks.

Institutional structures facilitating access to financing and insurance may assist smallholder farmers in risk management and investment in climate-smart technology. The institutional economics viewpoint emphasizes the significance of formal and informal institutions in affecting economic behavior and results, especially in climate sensitivity and trade competitiveness in Tanzania's rice value chain. Thus, governments and development practitioners should pay particular attention to the design and execution of institutional arrangements that support investments in climate-smart technology, promote secure property rights, and provide smallholder farmers with access to finance and insurance. This theory was applicable in the current study for the literature search to explore the institutional pressures, institutional logic, and institutional support systems regarding climate variability for trade competitiveness and export diversification in Tanzania's rice chain.

2.2 Political Economy Theory

The political economy theory explores the relationship between a government and its people owing to enacted public policies (Corporate Finance Institute, 2023). Regarding Tanzania's rice value chain, political economy factors such as the distribution of power and resources among different actors, the role of the state in regulating and supporting the rice sector, and the influence of international trade agreements on domestic policies can impact actors' ability to adapt to climate vulnerability and compete in export markets. The allocation of power and resources among the many rice value chain players may substantially affect climate adaptation and competitiveness. Large-scale rice processors and exporters, who often have more significant political and economic clout, may have different objectives and interests than smallholder farmers, who are more susceptible to climate shocks and may lack the financial means to invest in climate adaptation technology. Hence, policies guided by the interests of strong players may not coincide with the requirements of smallholder farmers, resulting in a misalignment between policy intentions and results. In addition to influencing climate adaptation and competitiveness, the state's role in regulating and supporting the rice industry may affect climate adaptation. State-led programs such as the Participatory Irrigation Development Program (PIDP) and the Agricultural Sector Development Program (ASDP) may encourage investments in climate-smart technology and infrastructure that enhance the resilience and competitiveness of rice production. Yet, political and administrative obstacles such as corruption, bureaucratic inefficiency, and inadequate governance institutions might limit the success of these efforts.

The impact of international trade agreements on domestic policy may affect the competitiveness of rice value chain operators in export markets. According to the United Nations Conference on Trade and Development (UNCTAD) (2013), Trade liberalization policies that promote market access and competitiveness, for instance, may not account for the possible implications of climate change on smallholder farmers and may worsen their susceptibility to climatic shocks. Thus, there is a need for policies and institutions that balance the interests of various players and account for the possible effects of climate change on the rice value chain. The political economy theory shows the significance of power relations and interests in affecting economic decision-making and results in Tanzania's rice value chain in the context of climate sensitivity and trade competitiveness. In this review, the theory was used to stress the relationship between politics and economics and the influence of power relations and interests on economic decision-making and results. When designing and implementing policies and institutions that counteract climate vulnerability and promote trade competitiveness, policymakers and development practitioners should pay close attention to the distribution of power and resources among different actors, the role of the state in regulating and supporting the rice sector, and the influence of international trade agreements on domestic policies.

2.3 Global Value Chain Theory

The Global Value Chain (GVC) theory highlights the interdependence of production, trade, and investment activities across nations and people and how these activities influence financial results (Hernández *et al.*, 2014). In the context of Tanzania's rice value chain, the GVC theory emphasizes the significance of understanding the roles of many players, including farmers, processors, merchants, and consumers, in determining the competitiveness and climate resilience of the value chain. Understanding the various phases of production and the distribution of value added in the rice value chain is therefore essential. In the case of Tanzania's rice value chain, paddy rice production entails numerous phases, such as cultivation, harvesting, processing, and selling; in which various players play distinct roles. Knowing the distribution of value contributed throughout various stages may aid in identifying possibilities for upgrading and innovation that enhance the value chain's competitiveness and resilience (Kaplinsky & Morris, 2016).

Another essential aspect of the GVC theory comprehends the power dynamics between various value chain

participants. The power dynamics between various parties may impact smallholder farmers' capacity to invest in climate adaptation technology and compete in export markets. For instance, large-scale rice processors and exporters may have greater negotiating leverage than smallholder farmers, resulting in a concentration of value added in the processing and marketing phases of the value chain. Thus, the GVC theory emphasizes the significance of comprehending the function of global governance institutions and international trade agreements in influencing the competitiveness and resilience of the value chain (Hernández *et al.*, 2014). In general, the GVC theory underlines the significance of understanding the interdependence of production, trade, and investment activities across multiple nations and players in determining the competitiveness and climate resilience of Tanzania's rice value chain. Policymakers and development practitioners should pay close attention to the distribution of value-added across different stages of production, the power dynamics between different actors, and the role of global governance institutions in determining the incentives and constraints facing actors along the value chain (Kaplinsky & Morris, 2016).

3. Methodology

This section provides an overview of the research methodology employed in the current study. The study primarily relied on secondary data derived from the rice value chain in Tanzania. The study used a qualitative research approach. The systematic document review method was applied to collect published and unpublished secondary data sources such as policies and legal provisions like the Food Security Act, the Food Import and Export Regulations, and related literature (see Table 1). Different resources such as reports, policies, laws, and various studies on climate variability for trade competitiveness and export diversification in the agricultural sector in Tanzania were reviewed. The collected data were assembled to remove duplication and brought up together in an organised format before being analysed to answer the objectives of this study. The literature search was confined to climate variability for trade competitiveness and export diversification in the rice value chain. To ascertain the key issues that emerged, the content analysis technique involved dealing with secondary data sets organised based on coding the script segments, after which themes were identified and compared to find similarities and differences, followed by interpretation of the themes and finally provide conclusions. The final step of the research methodology involved synthesizing the collected data. This process involved summarizing the key findings, identifying the implications for policy and practice, and making recommendations for future research.

Table 1: Policy/Acts/Documents Reviewed

s/n	Policies/Documents Reviewed in Brief	Year
1	Food Security Act	1991
2	The Cereal and Other Produce Act	2009
3	The Food Import and Export Regulations	2022
4	The National Climate Change Strategy	2012
5	The National Rice Development Strategy	2009
6	The Land Act No. 4 and The Village Land Act No. 5.	1999
7	The Agricultural Sector Development Program (ASDP)	2019
8	The Participatory Irrigation Development Program (PIDP)	2007

Source: Authors construction, 2022

4. Findings and Discussions

The study indemnified four key areas of interest regarding the study topics, which are presented here as the findings and discussions. The findings and discussions are organized into four subsections; the rice value chain in Tanzania (subsection 4.1), implications of climate vulnerability on trade competitiveness and export diversification of the rice value chains in Tanzania (sub-section 4.2), the policy environment for climate vulnerability on trade competitiveness and export diversification of the rice value chains in Tanzania (sub-section 4.3), and gaps and challenges in the policy environment for climate variability for trade competitiveness and export diversification (sub-section 4.4).

4.1 The Rice Value Chain in Tanzania

A value chain is defined as the chain of activities required to bring a product from its conception through its design, sourcing of raw materials and intermediate inputs, processing, marketing, and distribution, to the final consumer (Kumar & Rajeev, 2016). The rice value chain in Tanzania has been studied by several researchers (Kisanga, 2015; Ngailo *et al.*, 2016; Nkuba *et al.*, 2016; Wilson & Lewis, 2015). According to Mdoe and Mlya (2021), the value of rice produced increases as it moves from one stage to another until it reaches the consumer at the final market. A typical rice value chain in Tanzania is shown in Figure 3.

The trend in rice exports, as already discussed in the introduction (Section 1), is the second indicator used to examine the performance of the rice value chain in Tanzania. According to Wilson and Lewis (2015), Tanzania's

total annual rice production, the competitiveness of exports in importing countries, consumer preferences in importing countries, and policy restrictions on export trade are the major factors that influence the volume of rice exports from Tanzania. The volume of exports depends on the quantity of surplus production, which rely on the total volume of rice produced. It is worth noting that the performance of the rice value chain has generally improved following the government's decision to give high priority to rice through its NRDS (URT, 2019).

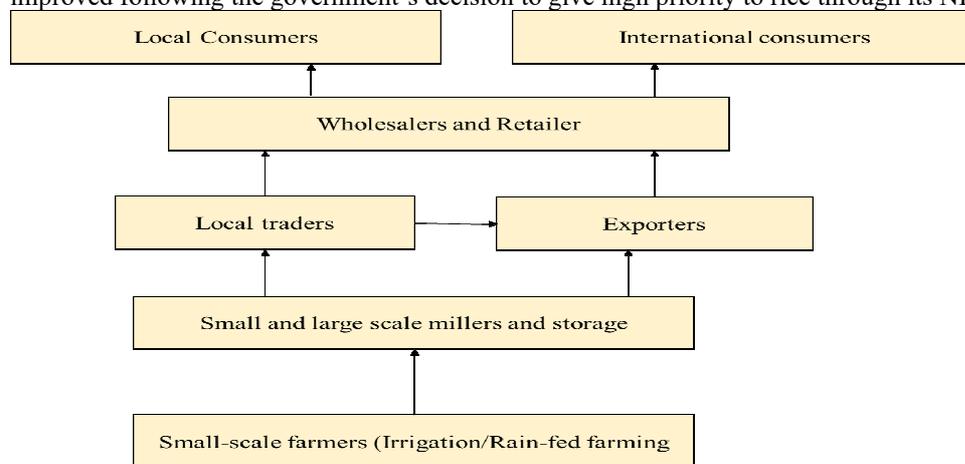


Figure 3: A typical rice value chain in Tanzania Modified from Mdoe and Mlay (2021)

Source: Mdoe and Mlay (2021)

Rice yields are reported to be influenced by the use of improved seeds (Kangile *et al.*, 2021; Kitilu *et al.*, 2019), the availability and management of irrigation water (Kangile & Mpenda, 2016; Senthilkumar *et al.*, 2018), weather variability as a result of climate change (Mkonda & He, 2018). The present study was mainly concerned with the implications of climate variability on trade competitiveness and export diversification of the rice value chain in Tanzania. This is further discussed in sub-section 4.2.

4.2 Implications of Climate Vulnerability on Trade Competitiveness and Export Diversification of the Rice Value Chains in Tanzania

Tanzania is one of the largest rice producers in SSA, with the potential to expand its exports. However, climate vulnerability significantly challenges Tanzania's rice value chain's trade competitiveness and export diversification (Kulyakwave *et al.*, 2019a; Kwesiga *et al.*, 2019). The effects of climate change on agricultural production and food security in the country are significantly affecting smallholder farmers who rely on rain-fed agriculture (Kwesiga *et al.*, 2019). The present review concerns the effects of climate vulnerability on the trade competitiveness and export diversification of Tanzanian rice value chains, which are impacted by the climate vulnerability. For instance, climate change raises the frequency and severity of extreme weather events like floods and droughts, reducing the amount of water available for irrigation and increasing the number of insect infestations. This has recently been proven in the analysis by Kulyakwave *et al.* (2019c) among smallholder rice farmers in Tanzania. This, in turn, affects the quality and quantity of rice that is produced, which ultimately results in decreased exports and higher imports, as observed in sub-section 4.1.

The vulnerability of Tanzania's rice value chain to the impacts of climate change also affects the availability and cost of labour, undermining the country's competitiveness in the global rice market. According to Lema and Majule (2009), the consequences of climate change lead to a decrease in labour availability, which simultaneously leads to an increase in the cost of work due to competition for workers during peak periods. This, in turn, affects the degree to which Tanzania's rice value chain remains competitive in the international market. Climate change can similarly affect the availability and cost of inputs such as fertilizers and pesticides. According to Mtengeti *et al.* (2015), regular flooding of rice fields can cause fertilizer losses for irrigated rice and increase the cost of inputs for farmers. This has a knock-on effect on the quality and quantity of rice produced and the competitiveness of Tanzania's rice in the international markets.

Climate change is projected to increase the occurrence of pests and diseases in rice production (Duku *et al.*, 2016; Iannella *et al.*, 2021), which further diminishes rice productivity while increasing the cost of production (Nkuba *et al.*, 2016). It is anticipated that pests and diseases will flourish worldwide as temperatures continue to rise from climate change (Wang *et al.*, 2022). Because of the high prevalence of pests and illnesses across the rice value chain, there has been a rise in the application of pesticides and other chemical inputs. This has the potential to harm both the environment and human health. There is a high probability that the sector's export diversification and competitiveness would suffer as a result of the adverse effects of climate change on the rice value chain. Thus, reduced yields from the shifting rainfall patterns are a significant effect of climate change on the rice value chain in Tanzania. Rice yields have been hampered by the shifting patterns of rainfall, which also

contribute to a lack of available water for irrigation.

4.3 Policy Environment for Climate Vulnerability on Trade Competitiveness and Export Diversification of the Rice Value Chains in Tanzania

Tanzania has created several policies and measures to combat the effects of climate change and to advance the cause of sustainable agriculture. The National Climate Change Strategy (NCCS) was formulated in 2012 to direct the governments' efforts to adapt to and mitigate the effects of climate change. The NCCS lists the agricultural sector as one of the key sectors for the adaptation to climate change, and it advocates implementing climate-smart agricultural practices to strengthen the sector's resistance to the effects of climate change (URT, 2021).

In 2009, the NRDS was formulated to facilitate the growth of the rice value chain in Tanzania (URT, 2019). The key objectives of the NRDS based on the rice value chain are outlined in Table 2. Within the context of the rice value chain, the primary goals of the NRDS are the enhancement of productivity, the enhancement of value addition, and promoting export diversification (URT, 2019). The plan acknowledges the significance of the private sector in advancing the development of the rice value chain, and it promotes the formation of public-private partnerships to boost the sector's competitiveness and increase the variety of products it exports.

Table 2: Objectives of the NRDS relative to the rice value chain

Rice value chain stage	Strategy/Objective
Production	Improving seed systems and fertilizer distribution;
Production	Developing improved varieties, production, and integrated crop management options;
Milling, marketing, and trade	Post-harvest activities and marketing
Production	Improving irrigation and water harvesting technology;
Production, harvesting, drying, milling	Enhancing access to and maintenance — of agricultural equipment;
Production, Milling	Improving the capacity for technology development, training, and dissemination
Production, marketing	Providing access to credit and agricultural finance;
Marketing	Promoting the medium and large-scale processing industry.

Source: URT (2019)

The Tanzania Agricultural Development Bank (TADB), was founded to assist the agricultural industry, namely the rice value chain. The TADB offers financial and technical assistance to agribusinesses and farmers to boost agricultural sector production and value addition. To further strengthen the agricultural industry's resistance to the effects of climate change, the TADB offers financial facilities for climate-smart agricultural techniques, including irrigation and conservation agriculture. In addition, the government of Tanzania initiated the ASDP (URT, 2016), the overarching objective of which is to raise agricultural production and improve the sector's competitiveness. Within the rice value chain context, the program acknowledges the significance of adjusting to and mitigating the effects of climate change. It promotes the use of environmentally responsible agricultural methods. The ASDP has also developed the NIDP, which aims to encourage the construction of irrigation infrastructure. This is important for increasing the rice value chain's resilience to climate change and has been a focus of the NIDP (URT, 2016).

In 2018, the government came up with Strategy II, to boost the rice value chain's competitiveness and diversify its exports. The NRDS II emphasizes the significance of public-private partnerships in fostering the growth of the rice value chain and promotes the private sector's engagement in fostering the sector's growth (URT, 2019). The plan acknowledges the need of adapting to and mitigating the effects of climate change as an essential factor in improving the rice value chain's competitiveness. In addition, the Tanzania Agricultural Research Institute (TARI) was founded in 2016 to advance research and development in the agricultural industry, namely within the rice value chain. To strengthen the rice value chain's resistance to the effects of climate change, TARI has created several enhanced rice varieties that are resistant to drought, pests, and diseases (TARI, 2017).

Restriction of imports is also a key strategy to improve the policy environment for climate variability for trade competitiveness of the rice value chain. In 2005, a Common External Tariff (CET) of 75% on imported rice was agreed upon by the EAC (the TRA is the enforcing and collecting agency in Tanzania for this) (Msafiri, 2021). This in effect, tripled the existing tariff on imported rice. The charge protects domestic producers from a flood of cheap rice imports. The CET applies, however, only to the mainland of Tanzania (imports to Zanzibar are subject to a smaller tariff of 25% or are even exempt from tariff altogether). The law of unintended consequences again comes into force, and there is evidence that while official imports have declined, unofficial imports through Zanzibar have not (indeed, importers through Zanzibar are likely to be making significant profits, as are those who are simply avoiding paying the tariff through a spectrum of devious ways).

The CET provides nominal protection to Tanzania’s rice industry. Despite these rules and programs, there is still more work to be done to integrate climate-sensitive farming practices into the rice value chain. Several obstacles stand in the way of smallholder farmers gaining access to money, technology, and knowledge regarding climate-smart farming methods. These farmers are the primary participants in the rice value chain. According to recent research in Tanzania, smallholder rice farmers still have considerable problems in accessing climate-smart agricultural finance, which restricts their capacity to implement climate-smart agricultural practices (Silas & Ndaki, 2023). This implies gaps and challenges in the policy environment on climate variability for trade competitiveness and export diversification in the country’s rice value chain. Some of these gaps and challenges are discussed in sub-section 4.4.

4.4 Gaps and Challenges in the Policy Environment for Climate Variability for Trade Competitiveness and Export Diversification

The rice value chain in Tanzania is confronted with several obstacles, some of which restrict the policy environment on climatic variability, which in turn hinders trade competitiveness and export diversification. This desk review focuses on the primary challenges in Tanzania's rice value chain. These challenges include low linkages with rice producers, inability to afford high-quality inputs, high transportation and transaction costs, limited access to inputs, climate change, limited access to financing, ineffective weed control, insufficient access to markets, low market prices, and high taxes and levies. A summary of these gaps is provided in Table 3 and are discussed in subsections 4.4.1 to 4.4.6.

Table 3: Gaps in the policy environment on climate variability for trade competitiveness and export diversification in Tanzania’s rice value chain

Gap	Actors affected in the rice value chain	Effects in actors
Policy regulation	Farmers, traders, millers	Poor implementation of policies
Access to farm inputs	Farmers	Limited use of inputs Pest infestation Low rice productivity Low commercialisation
Infrastructure	Traders, millers, input suppliers, wholesalers, farmers	High transportation and transaction costs High cost of inputs to farmers
Resilience to climate change	Farmers, traders, millers	Reduced rice harvest, crop losses Reduced rice supply to the marker, poor trade
Finance	Farmers, traders, input suppliers,	Limited ability of farmers to access high-quality inputs Low rice productivity Limited surplus and low level of commercialisation
Trade and marketing	Traders, millers	Too many taxes and levies Poor access to markets Low returns
Land governance	Farmers	High cost of production Low production Low commercialisation and low returns

Source: Mdoe and Mlay (2021)

4.4.1 Gaps and Challenges in Policy Regulation

Although several policies and strategies are in place for the rice value chain, as discussed in sub-section 4.3, the sector's potential is constrained by regulatory inadequacies (Mdoe & Mlay, 2021). Enhancing Tanzania's rice value chain competitiveness and export diversification requires effective regulations that account for the effects of climate variability. For instance, both export bans and permits have several negative consequences. The negative consequences of the intermittent export bans include the creation of business uncertainty, and the failure of farmers to sell their rice in real time of market peaks. Meanwhile, the negative consequences of export permits include increasing the cost of exporting rice, reduced the competitiveness, and decreasing the reliability of rice delivery times to importing countries, due to delays in processing the permits.

The agricultural commercialization programmes, which have further accelerated inequality, include the ASDP; that among the gaps observed was implementation without promoting the use of product-enhancing inputs among smallholder farmers; also without considering the financial viability, sustainability, and maintenance of the irrigation infrastructure (Mdoe & Mlay, 2021). Consequently, the intentions of the programmes to increase the productivity and incomes of smallholder farmers were not achieved. Instead, the programmes increased wealth inequality between smallholder farmers and large/medium-scale farmers who had

the resources to buy product-enhancing inputs.

The National Rice Development Strategy (NRDS) was launched in 2009 with the aim of accelerating rice commercialization process (URT, 2019). Although the NRDS has a vital irrigation component, it does not emphasize or promote the efforts to enhance access to improved seeds and fertilizers relative to micro climatic conditions in different agro zones of Tanzania. Nevertheless, agricultural finance, and agricultural markets, particularly among small-scale rice farmers is less insisted (Mdoe & Mlay, 2021). Generally, successful policy implementation and facilitation require strong alliances and cooperation across diverse rice value chain players. Yet, gaps in collaboration and partnerships across stakeholders impede the successful implementation of policies and initiatives within the rice value chain. Addressing the gaps and challenges in policy regulation for the rice value chain in Tanzania will enhance capacity for trade competitiveness and export diversification in the face of climate variability.

4.4.2 Gaps and Challenges in Access to Farm Inputs

Although the policy and regulatory framework for the rice value chain in Tanzania also emphasises farmers' access to farm inputs (URT, 2019), this is yet to be fully realised. Several studies have reported the limited access of rice farmers to farm inputs (Msangya & Yihuan, 2016; Nkuba *et al.*, 2016). Msangya and Yihuan (2016) investigated the challenges for small-scale rice farmers in Ulanga District in Morogoro. The study revealed that most farmers lacked farm inputs like pesticides to control plant diseases that have raised because of climate change, thus reducing their yields. Similarly, most Farmers used seeds from the previous year's harvest, while few used improved rice varieties. Lack of access to high-quality inputs like seeds and fertilisers has been one of the reasons for low rice productivity in the country. The study also revealed heavy infestation of farms with weeds and the lack of herbicides for the farmers to manage the weeds. Climate change is projected to increase the occurrence of pests and illnesses in the rice value chain (Duku *et al.*, 2016; Iannella *et al.*, 2021), which further diminishes rice productivity while increasing production costs (Nkuba *et al.*, 2016). Therefore, the policy and regulatory framework for the rice value chain should be firm concerning the access of pesticides and herbicides to farmers.

Farm inputs for rice farmers also include high-quality seeds, yet these are also out of the reach of many farmers in Tanzania. According to Msangya and Yihuan (2016), most farmers (95%) in Ulanga District in Morogoro, for instance, processed their seeds (indigenous varieties) from the previous year's harvest, while a few (5%) used improved rice varieties. About 90% of the farmers use traditional varieties, and 75% of those using improved varieties use 'informal' seed systems. These farmers obtained seed from their previous harvest or bought, exchanged, or received seed from other farmers within their village or neighboring villages. The use of unimproved or local varieties possessing different colours and shapes, which when milled, give poor quality grains, were often rejected by most customers, which can reduce trade competitiveness and export diversification. Therefore, unimproved yields are usually low quality, keeping the farmers at a subsistence production level.

Forming strategies such as farmer groups and rural banking institutions may help farmers to have access to inputs for rice production. In this regard, agricultural input subsidies can also help (Kinuthia, 2020). Similar sentiments have been shared by Rashid *et al.* (2020). Although such subsidies can enhance access to inputs, they may not entirely contribute to higher yields, and a more-encompassing strategy and initiatives to increase farmers' access to loans, extension services, and markets are necessary to increase rice production and trade competitiveness of the rice value chain in the country. Generally, the obstacles and policy gaps for enhancing access to farm inputs for rice production systems in SSA are complex and dynamic. However, developing policies and strategies that improve smallholder farmers' access to weed management technologies, training on weed management, and using integrated weed management strategies may help bridge the gap for rice farmers.

4.4.3 Infrastructural Gaps and Challenges

Perhaps the challenge with wider-reaching effects on the rice value chain in Tanzania is infrastructure. Regarding infrastructure in the rice value chain, the maintenance of irrigation systems is key in tackling climate vulnerability for rice farmers (Mdoe & Mlay, 2021). In addition, investments in storage facilities, transportation infrastructure, and marketing infrastructure can enhance the quality and quantity of rice produced for export. Unfortunately, the rice value chain in Tanzania is constrained by inadequate infrastructure in the form of roads, irrigation systems, and storage facilities. Although the ASDP has strived to increase agricultural productivity by rehabilitating irrigation infrastructures (URT, 2016), infrastructural challenges still persist in some parts of the country. Lack of adequate storage facilities can induce post-harvest losses and poor product quality (Mgale & Yunxian, 2020). Similarly, the status of the roads in rural areas can particularly drive up the cost of transportation and restricts access to markets.

Investing in technology, research, and development to enhance rice production's quality and productivity can potentially increase Tanzania's competitiveness in international markets throughout the rice value chain. Therefore, the government needs policies and strategies that can promote and/or upgrade infrastructural networks, including irrigation and road networks in cultivation areas, processing areas, and market areas. Ultimately, this will improve the linkage between farmers, processors, and markets, lowering transaction and

transport costs and improving profit margins. According to Msafiri (2021), with infrastructural development, the rice subsector shall be capable of expanding its competitiveness within the country and across regional and international markets.

Farmers' access to markets is hindered, and their revenue is reduced by high transaction costs, especially transportation-related ones. (Mgale & Yunxian, 2020). According to Gbadegesin *et al.* (2019), high transaction costs from poor infrastructure and inaccessibility to more remunerative markets force many smallholder paddy farmers in Tanzania to sell their harvest at low prices. The authors suggest the construction of infrastructure, such as rural roads and market centres that can lessen the financial burden of transportation and broaden consumers' access to markets and trade competitiveness in the face of climate variability. High transaction costs, such as transportation and processing fees, courtesy of unimproved infrastructure, lower the incentives for farmers in the rice value chain. Policies and strategies should therefore target solutions to reducing transaction costs for farmers to increase their participation in the rice value chain.

4.4.4 Gaps and Challenges in Resilience to Climate Change

Climate variability provides a substantial obstacle in the rice value chain in Tanzania, affecting production, marketing, and international trade competitiveness. To improve the sector's competitiveness and export diversification, the policy environment must address the sector's lack of climate change resilience. Unreliability and fluctuation of rainfall conditions and the possibility of recurrent droughts and floods are some of the implications of climate change (Kulyakwave *et al.*, 2019a). Although the policy framework in Tanzania promotes irrigated rice production, most farmers still rely on rain-fed rice production. Yet, the effects of climate change contribute to significant yield differences between rain-fed and irrigated rice production systems, with rain-fed rice being more prone to adverse impacts from climate change than irrigated production systems (Mkonda & He, 2018).

Kwesiga *et al.* (2019) have recently investigated yield variabilities in rain-fed lowland rice in Kilombero Flood plains of Tanzania and shown significant differences. The significance of incorporating measures for adapting to climate change into existing plans and policies, particularly those about agriculture and rural development, is emphasised in the study. Although the NRDS was introduced in 2009 to expedite rice commercialisation, it emphasises the need for improved irrigation infrastructures. As a result, promoting irrigation must be accompanied by efforts to enhance accessibility to improved seeds, fertilisers, modern agricultural equipment, agricultural finance, and agricultural markets, particularly among small-scale rice farmers (Mdoe & Mlay, 2021).

Climate-smart farming practices can make smallholder farmers more resistant to the effects of climate change; enhance access to weather information, and assist in adopting drought-resistant crop types. However, there are informational challenges toward climate vulnerability for rice farmers in Tanzania (Mugabe, 2020). Many smallholder farmers in Tanzania's rice value chain do not have access to climatic information, such as weather predictions, which hinders their capacity to make educated planting and harvesting decisions. Lack of access to climatic information exposes them to risks such as crop failure, insect infestation, and lower yields, which affects their earnings and food security. Technological gaps for combating climate variability also exist in the country. The regulatory frameworks and policies for climate variability on trade competitiveness and export diversification in the rice value chain in Tanzania should target addressing such informational gaps.

Studies have uncovered the gap in adopting climate-smart technologies and practices in the rice value chain, such as drought-resistant rice cultivars, water management, and conservation techniques. For instance, this has recently been established for rice farmers in Geita District in Tanzania (Kasase *et al.*, 2022). The low adoption of climate-smart farming options by rice farmers can be attributed to inadequate extension services, weak institutional frameworks, and limited financial resources. These challenges and gaps hinder effective utilisation of these technologies and practices. A multi-stakeholder strategy encompassing policy makers, development partners, business sector actors, and civil society groups is required to address the gaps in climate change resilience. This strategy would encompass creating and implementing climate adaptation plans and policies, promoting climate-smart technologies and practices, and supplying suitable funding and extension services to smallholder farmers (Komba & Muchapondwa, 2018).

Generally, the policy framework and regulations for climate vulnerability for rice farmers are still inadequate. Establishing laws and programs that assist smallholder farmers who wish to implement adaptation measures in response to climate change is necessary. This is because climate change and vulnerability in the rice value chain may considerably harm rice yields, particularly in places with low rainfall (Kulyakwave *et al.*, 2019b). The study advocates for the creation of policies and programs that encourage the adoption of climate-smart agriculture practices. Some examples of these practices include the use of drought-tolerant and early-maturing rice varieties, as well as the promotion of technologies for water management. The study also suggests expanding access to climatic information to assist smallholder farmers in making decisions based on accurate information on climate change, issues that are still generally lacking in the current policy framework for the rice value chain.

4.4.5 Financial Gaps and Challenges

There are many financial gaps and challenges in the policy framework for climate variability in Tanzania, with far-reaching effects on trade competitiveness and export diversification for rice farmers in Tanzania. The financial gaps and challenges in this regard are closely related to accessibility to farm inputs, as discussed in sub-section 4.4.2. The lack of credit to small-scale farmers is a common bottleneck to purchasing inputs for farming which hindered an increase in rice production. A previous study by Msangya and Yihuan (2016), in Ulanga District in Morogoro showed that small-scale rice farmers lacked security and could not get credit services from commercial financial institutions. The study recommended the need for credit facilities for farmers to increase acreage and engage in marketing-associated activities like processing and packaging. For the government to guarantee subsidised input access to rice farmers to counteract the effects of climate vulnerability, it must oversee and regulate the procurement, stockpiling, and distribution of inputs to reach all farmers in the country. Additionally, to enhance credit access, financial institutions must provide borrowers with reasonable interest rates and adjust lending conditions to encourage more credit-seeking. If well implemented, access to credit and subsidised inputs to the rice value chain actors are more likely to boost rice production, favouring rice trade development (Msafiri, 2021). Cognizant of the changing climatic scenarios and climate vulnerability in the rice value chain, there is a pressing need to enhance smallholder farmers' access to financial resources and credit for them to invest in climate-smart agricultural techniques that will strengthen their resistance to adverse effects of climate change.

Access to financial services can improve the performance of smallholder rice farmers in Tanzania (Mbonaga, 2019). Nevertheless, there are still gaps in credit and financing programs for rice farmers and Tanzania's rice value chain actors (Mbuga, 2021). According to Msangya and Yihuan (2016), using hand hoes, oxen ploughs, and lack of credits reduced the timeliness of farm operations and limited the efficacy of cultivation and weeding. This shows the inadequacy of the financial policies and regulatory frameworks for rice farmers in Tanzania. In this regard, boosting smallholder farmers' productivity and ability to compete on a global scale may be accomplished through investments in the creation of credit and financing programs adapted to meet these farmers' specific requirements. Mmari and Kapaya (2022) investigated financial service access and agricultural commercialisation of smallholder rice growers in Kilombero District and showed that financial service access significantly positively affected commercialisation. Cognizant of this, the government must expand financial access to smallholder farmers to increase productivity and trade competitiveness in the wake of climate vulnerability.

According to Gbadegesin *et al.* (2019), lack of access to financial services, and immediate cash needs, many sell their harvest when prices are low and buy when prices are high. Good access to financing is crucial for improving Tanzania's rice value chain's competitiveness and export diversification. Nevertheless, financing limitations restrict the sector's potential. Most smallholder farmers do not have access to formal banking institutions, which limits their capacity to invest in land and implement sustainable agricultural techniques to counteract climate vulnerability (Rashid, 2021). The authors also highlight high-interest rates and insufficient financial products as contributing factors to smallholder farmers' restricted borrowing and investment possibilities. The study recommended developing financial solutions that meet the requirements of smallholder farmers, such as microfinance and crop insurance, as well as lowering interest rates. Such provisions are still largely missing in the current policy and regulatory framework for the rice value chain in the country.

4.4.6 Gaps and Challenges in Trade and Marketing

In addition to all challenges and gaps in the policy framework for climate vulnerability on trade competitiveness and export diversification in the rice value chain in Tanzania, challenges in trade and marketing cannot be overlooked. Enhancing the competitiveness and export diversification of Tanzania's rice value chain requires implementing effective trade and marketing strategies that have not yet been achieved in the current policy framework. The business's potential is restricted due to gaps in trade and marketing regulations. According to Msangya and Yihuan (2016), most rice farmers still sell their produce at the farm gates at meagre prices that cannot improve their financial gains. The study showed that only 8% of the farmers sold their rice at the market places, while 92% sold it at home. During harvesting periods, many buyers came into the village and bought low-quality rice from farmers. This makes farmers economically stagnant despite their efforts in the rice value chain. Therefore, there is a need for the government to provide precise market centres where small-scale farmers could directly have access to markets to gain good profit and lessen their burdens.

Poor market knowledge, restricted market links, and the low bargaining power of smallholder farmers are major issues in the rice value chain. Many smallholder farmers cannot access market information, such as market prices and demand, limiting their capacity to make pricing and marketing decisions (Mgale & Yunxian, 2020). Lack of access to dependable markets for their rice can lead to low pricing and decreased profitability. According to Gbadegesin *et al.* (2019), farmers may sell their harvest when prices are low due to inaccessibility to more remunerative markets and immediate cash needs. Although the ASDP has strived to increase agricultural productivity by promoting marketing and value-addition linkages (URT, 2016), marketing and trade challenges

persist for rice farmers. In collaboration with different stakeholders, the government of Tanzania must work closely to secure market information for the farmers, millers, and traders in domestic, regional, and internal markets (Msafiri, 2021). Consistently, the government needs to ensure a predictable business environment for local and foreign investors engaged in the rice business in the country. More emphasis on seeking better-priced market opportunities can be done through Tanzanian embassies abroad, national investment centres, and other non-government institutions shall be an important move in promoting rice trade in the country. Market information can be conveyed through business forums as well as, media platforms such as radio, television, mobile phones, and social media.

Farmers' challenges in accessing markets comprise insufficient infrastructure and exorbitant transportation expenses, as highlighted in sub-section 4.4.3. Farmers lack the skills to properly negotiate pricing and contracts, which can further limit their ability to reach markets and earn greater prices for their rice. This is something that they mention as being a problem. In this regard, there is a need for market-oriented research on rice production in Tanzania (Sekiya *et al.*, 2020). The government should develop interventions to improve the competitiveness of rice in the domestic market and the international market to increase incentives to farmers. This and other measures and policy interventions will boost the global competitiveness of domestic rice production and ensure adequate food supply.

5. Summary, Conclusions, and Recommendations

Tanzania is the leading producer of rice in East Africa and ranks second in SSA. Despite recent growth in domestic rice production outstripping consumption, rice imports have outperformed exports. The present study has identified the implications of climate vulnerability on trade competitiveness and export diversification of the rice value chain in Tanzania. Similarly, the study reveals the critical aspects of the policy environment for climate vulnerability on trade competitiveness and export diversification of the rice value chains. Most importantly, the study has identified the gaps and challenges such as gaps in policy regulation, access to farm inputs, infrastructure, resilience to climate change, finance, and trade and marketing regarding climate vulnerability on trade competitiveness and export diversification of the rice value chain in Tanzania. To improve rice trade returns and competitiveness in Tanzania, the study recommends that the country should invest in value chain infrastructure development, promote value upgrading through better linkages between farmers, millers, and markets, enhance capacity-building programs to value chain actors, enhance reliable access to credit and subsidized inputs to farmers and millers, and strengthen research and development including market intelligence analysis. Climate vulnerability assessments are so important in the implementation arrangements of the policy. This should operate together with clear recognition of climate risks. Vulnerability mapping will help to target geographic areas where impacts are expected to be highest for immediate intervention action. Incorporating these measures can ensure that the implementation of policy will open rooms into other sectors for further decision making. In turn this can create very significant cross-sectorial cooperation between ministries in addressing the revealed gaps. Similarly, investing in technology, strategic research on rice export development to enhance rice production's quality and productivity can potentially increase Tanzania's competitiveness in international markets throughout the rice value chain.

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