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A Comprehensive Overview of Challenges and Prospects in Large-Scale Rice Production Among Farmers in Jawhar, Middle Shabelle, Somalia

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ABSTRACT

Rice, an essential staple crop, plays a pivotal role in global food security. This review provides a comprehensive analysis of the challenges and opportunities encountered in large-scale rice production within the context of Jawhar, Middle Shabelle, Somalia. The paper initiates by acknowledging rice's significance as a primary caloric source and introduces the two principal cultivated species, Oryza sativa and Oryza glaberrima, along with divergent cultivation methodologies. Addressing the plight of food production and specific rice cultivation impediments in Somalia, the study underscores the necessity for comprehensive remedial measures. Prominently, the review investigates environmental exigencies, with a focal point on the perturbations induced by climate change. Additionally, adverse repercussions associated with conventional farming practices, such as puddling and inundation, are scrutinized. The critical concern of water scarcity is explored, necessitating the formulation of water-conservation strategies to ensure the sustainability of rice agriculture. Climate change emerges as a predominant issue, with implications for rice cultivation through elevated temperatures, shifting precipitation patterns, and heightened prevalence of pests and diseases. Furthermore, we touch upon infrastructural and technical limitations, including manual harvesting and post-harvest operations, underlining the need for the adoption of modern technologies to enhance productivity. This scholarly review underscores the imperative of addressing environmental, climatic, and technical complexities to safeguard food security and promote sustainable large-scale rice production in Jawhar, Middle Shabelle, Somalia.

Keywords: Rice Production; Large-Scale farmers; Technological Advancements

Abbreviations: RB: Rice Blast; SB; Sheath Blight; BLB: Bacterial Leaf Blight; SR: Spatial Resolution; FAO: Food and Agriculture Organization; FPMA: Food Price Monitoring and Analysis; GIEWS: Global Information and Early Warning System; USAID: United States Agency for International Development; MOAI: Ministry of Agriculture and Irrigation; TOC: Theory of Change

Introduction

Rice is the world's single most important staple food for a large part of the human population, and also a food source for half of the world's population. Out of 49% of calories consumed by humans, 23% comes from Rice. Two species of rice are under cultivation currently, one of them known as Oryza sativa (Asian Cultivated) is worldwide grown, while the second Oryza glaberrima (African cultivated), is grown in the least scale in some parts of West Africa (Naveed, et al. [1]). Rice comes in a variety of flavors, and culinary preferences vary by region. It provides 21% of the energy and 15% of the protein needed by humans. Rice is a staple food for many Somalis and accounts for a significant portion of their diet. Rice demand in Somalia has steadily increased over the last several decades. (Ibrahim, et al. [2]). Rice is an edible starchy cereal grain belonging to the grass family Poaceae. The rice crop is the most important commercial species of rice and is differentiated into three subspecies: Indica, Japonica, and Javanica based on their commercial production zones (Sapkota, et al. [3]).

Oryza sativa L. spp is the seed of a monocot plant. Rice is a cereal crop in the Poaceae family that belongs to the genus Oryza. The genus Oryza has twenty-two wild and two cultivated species viz., Oryza sativa and Oryza glaberrima. Oryza sativa is a cultivated diploid species having 24 chromosomes of the AA genome (Kumar Tuwar [4]). There are two methods of rice cultivation that are used in the world seedling and sowing seeds. The seedling method is used in Asia, partly in Africa and South America. Rice seedlings are grown on special beds, often under a film, for 60 days. During this period the field intended for planting rice is used for other crops. 3–5 days before transplanting the seedlings the rice fields are flooded with a layer of water and soil tilling with rippers is started. (Amanullah [5]). Rice is an important staple food crop in Somalia and is consumed by all levels of Somalia. Daily consumption of the crop is highly valued. Somalia is suffering from a lack of food production, especially rice production. According to a study conducted on several factors, issues, challenges, and problems affecting paddy cultivation (Shah Zainal Abidin [6]).

Three common disease effects on rice plants caused by environmental impacts include Rice Blast (RB), Bacterial Leaf Blight (BLB) and Sheath Blight (SB) Rice plant disease identification and classification are dependent on the symptoms and signs produced by the pathogens. Many a time, the identification of a disease because of symptoms becomes very difficult (Shrivastava [7]). Rice (Oryza sativa L.), along with maize and wheat is one of the Main of human nutrition since around 50% of the population depends on its cultivation (Vinci [8]). The soil type of rice can be grown in a wide range of soil types. Soils with good water retention capacities are best – so clay soils with high organic matter content are ideal, but soils with high silt contents are also suitable. Sandy soils are not ideal for rice production. Rice does best in soils with a near-neutral pH (6–7) – that is, they are neither too acidic nor too alkaline – but lowland rice can be grown in soils with pH values in the range of 4–8 (Zingore [9]).

Climatic and Environmental Challenges

Climatic factors such as temperature, sunlight, and rainfall influence the growth and yield of rice in two ways. Directly, they affect physiological processes involved in grain production, such as vegetative growth, development of spikelets, and grain filling. Indirectly, they affect grain yield through the incidence of diseases and insects (Ary [10]). Intensive farming systems and the successive annual application of organic or mineral fertilizers lead to the progressive enrichment of soils with this element. Such situations may lead to a lack of rice crop response to fertilizer application, representing an environmental risk. Consequently, the high concentration of P in the soil and the existence of conditions favorable to leaching and soil erosion lead to the potential contamination of water bodies (Saraiva [11]).

Large-scale farmers repeated puddling adversely affects soil physical properties by destroying soil aggregates, reducing permeability in subsurface layers, and forming hard pans at shallow depths, all of which can negatively affect the following non-rice upland crop in rotation. Moreover, puddling and transplanting require large amounts of water and labor, both of which are becoming increasingly scarce and expensive, making rice production less profitable. (Kumar [12]). Water stress affects chlorophyll content in leaves of rice, which may lead to affect photosynthetic units and inactivation of photosynthesis. In addition, oxygen depletion in the flooded soil system results in oxygen quickly anaerobiosis causing soil reduction and affecting soil health. As a result, it's crucial to propose a water-saving strategy for rice farming that won't impact the physiology of plants or the chemical composition of the soil. Currently used rice growing methods need between 1900 and 5000 liters of water to yield 1 kilogram of grain.

About 10% of rice that is irrigated would experience water constraint by 2025. Even a short period of water deficit is highly sensitive to rice farming and rice productivity (Khairi [13]). Rice is the only cereal that can withstand water submergence, and this helps to explain the linkage between rice and water. Around the world, rice has been farmed for many centuries in a range of environments, including irrigated areas, deep water, tidal marshes, and uplands and lowlands that are rainfed. The affinity of the rice crop for water is universally known. Compared to other cereals, rice requires two to three times as much water. Although these varieties require an adequate supply of irrigation water and high fertilizer inputs, farmers grow them with low inputs because of the unpredictable supply of water. Such a situation leads to low productivity, poverty, and social problems such as large-scale migration in the offseason (Shalabh Dixit [14]).

The dominant practice in rice production is flooded irrigation, which requires large amounts of water, and 70% of the total irrigation water used in Chinese agriculture is used for rice production. Also, other environmental problems are associated with flooded irrigation. For example, flooded rice fields are important sources of methane emission, which is one of the major greenhouse gases associated with global climate change (Bouman [15]). As a result, the availability of surface water and soil is declining. This increased climate variability is affecting large-scale farmers in East Africa.

Many farmers are having a difficult time coping with the difficult circumstances, which lead to low harvests and food insecurity. Large-scale climate variability is one of the key issues affecting food production in Africa. Both inter-annual and seasonal rainfall variability is a challenge for farming decision-making in East Africa. Future climate change caused by increased greenhouse gas emissions is likely to result in changing rainfall patterns. Due to increasing climate variability farmers struggle with decisions such as seed variety to plant, when to plant, when to fertilize, when to do supplementary irrigation, and sometimes when to harvest. The farmer usually starts to make preparations for planting crops with the onset of the rainy season. (Nyadzi, et al. [16]).

Climate change will force agricultural production to adapt to the altered environmental conditions. Which in combination with the prevailing climatic conditions (particularly precipitation and tem-

perature), form highly suitable conditions for the ear-round cultivation of rice. Rice is the one of the country's most important staple foods. Sea level rise is one of the most significant consequences of global warming, and salinity intrusion, drainage disruptions, and inundation by seawater are commonly considered as main consequences for rice-producing low-lying delta plains (Schneider [17]). Higher temperatures beyond the optimum range eventually reduce rice yield higher respiration and increased developmental rates while encouraging the proliferation of disease, pests, and weeds.

Extreme weather conditions such as heat waves, drought, floods, erratic and inconsistent rainfall, change in crop production patterns, rise in sea level, polar ice, and glacier melting, and increase in an infestation of disease and pests are some of the incidences likely to happen due to climate change (Mandal [18]). Monocropping, poor agronomic methods, the use of unimproved seeds, low soil fertility caused by excessive nutrient mining combined with insufficient fertilizer use, and limited access to output markets are the main causes of the low yield. Several global and national initiatives have been in place to emphasise the improvement of paddy production and therefore eradicate hunger and food insecurity (Ngailo [19]).

High increases in temperature (>35oC) during the reproductive period may cause the emergence of sterile stamens, un-pollinated spikelets, poorly filled grains, or chaffy grains leading to yield and quality loss of rice (Kumar, et al. [20]). Poor climate change mitigation and adaptation strategies, pest and disease control, irrigation technology, low-quality seeds, outmoded technology utilization, and many social and economic factors detrimentally affecting agriculture productivity can be curbed if farmers are not financially excluded. Again, the demand for crop irrigation water in the nation, which 91 is difficult to come by, increases as rainfall (temperature) reduces (rises); hence, rice production is affected negatively (Ali Chandio [21]). Dry spells for a very short duration can result in substantial yield losses, especially if they occur around the flowering stage. All phases of rice development and growth are impacted by drought. Effects of drought on grain yield are largely because of the reduction of spikelet fertility and panicle exertion. Infestation of pests and diseases in rice is also a result of climate change. Rice diseases such as rice blast, brown spot, sheath, and culm blight could become more widespread in East Africa (Das [22]).

Infrastructural and Technical Limitations

Rice is the fastest-growing cereal commodity in East Africa. Long rivers, in river valleys or on leveled terraces on slopes, farmers plant irrigated rice (paddy rice). As technical progress among large-scale farmers is low, terraces and channels are created and maintained by hand. Irrigation is gravity fed and the channel walls (levee) made of soil are vulnerable to flooding (Dröge, et al. [23]). The harvest and post-harvest operations are manual. Harvesting is commonly done with a sickle or knife. Furthermore, large-scale farmers in Asia are mostly done by sickle or knife when they harvest rice crops and lose their production. Such technologies will help stabilize yield and encourage farmers to invest in inputs. Hence, rice technologies that increase labor input are likely to be less attractive to farmers (even if they increase yield). This has major implications for technology design and evaluation (Schiller, et al. [24]).

Technical issues in crop diversification in rice-based irrigation systems originate from the intricate and differential relationships among edaphic, climatic, hydrologic, biotic, and agronomic properties of flooded rice environments and dryland nonrice production systems. A low level of technical efficiency, on the other hand, indicates that output growth can be achieved given current inputs and available technology. Therefore, it is important to determine the degree of technical efficiency among farmers, and if low technical efficiency is found, to investigate the factors that will increase efficiency finally, the major constraints faced by rice farmers in the study area were low purchasing price of rice, lack of government support, difficulty in accessing capital and erratic rainfall patterns. (Kavi [25]).

Rice has become a commodity of strategic significance across many parts of Somalia for domestic consumption as well as an export market for economic development. However, the Somalian rice sector still faces remaining challenges such as high competition with imported rice, poor infrastructure, insufficient mechanization and post-harvest processing technologies, lack of skilled manpower and research facilities, and poor marketing infrastructure, and channels. Rice production is also restricted by many technical, management, socioeconomic, health, and policy constraints. Local rice production cannot meet the increasing demand for rice in many African countries (Tegegne [26]). In addition to biophysical and human resource constraints, rice production in East Africa is affected by socioeconomic and policy constraints such as Unfavorable input and output pricing policies at the national level. Low output prices vis-a`-vis high and rising input prices reduce profit and the competitiveness of large-scale farmers in local, regional, and global markets, limited access to credit, inputs (seed, fertilizers, pesticides, implements, and so on), markets, and market information and Poor rural infrastructure and transportation (Zingore et al., 2014).

Socioeconomic Factors

Rice (Oryza sativa) production has been intensified due to geometric increases in population. This has resulted in increased demand for cultivable land, which has, in turn, resulted in pressure on land and consequent cultivation of marginal lands. In many developing countries, families continue to provide the bulk of farm labor for most farm operations because many households cannot afford to hire wage labourers (Modupe Eunice [27]). Ethiopia is facing challenges to feed its growing population. The involvement of many intermediaries has also constrained the development of the sector and deprived the farmers of equitable returns from their produce. The factor of rice production and the lack of an organized marketing system have resulted in low producer prices for farmers. This causes the farmers to

decline their production in amount and the marketable surplus would have an impact on the large-scale farmer's income (Takele [28]).

Urbanization is growing in both developed and developing countries. Socioeconomic factors play a key role in rice cultivation. With growing urbanization, interestingly, who are rice producers in the peri-urban area, and what are the socio-economic characteristics of farmers in the peri-urban area and rice production Effective rice production nowadays does not depend entirely upon environmental factors, but also the farmer's socioeconomic status, which influences their cropping operation capacity (Fakkhong [29]). These climatic factors are changing over time having mixed effects on agriculture. More than half of the world's population depends on rice as their staple food. In Africa, the production is only 3% of the world's total production. The biggest producers of rice are Western African countries, Nigeria, Cote d'Ivoire, and Mali. Extreme climatic conditions, for instance, droughts and floods have already affected the production of rice on one hand. Changes in consumers' preference for rice both in urban and rural areas are also another demand driver. Rice consumption symbolizes increased status (RJ K [30]).

The rice cropping system and the post-harvest services in Nigeria encompass a wide range of agricultural activities ranging from land clearing, seedbed preparation, broadcasting fertilizer application, weeding, and bird scaring. Others include harvesting, threshing, parboiling, drying, winnowing, bagging, and marketing and distribution. These activities are largely executed manually and women and children the very vulnerable segments of society are largely involved. Presently, in Africa, the rice sub-sector is dominated by weak and inefficient producer-market linkages due to poor infrastructure including lack of improved processing facilities, low rice productivity, poor post-harvest handling and storage, expensive and poor access to inputs (High-quality seed, fertilizing, and crop protection products), inadequate market information, lack of transparency among players, low capacity to meet quality standards, and limited efficiency distribution networks (Chidi [31]).

Large-scale Farm production and resource productivity in the farms are limited by a lack of access to rice inputs. Group farming was introduced as the first attempt to organize farmers' production cooperatives in order to solve the problems of small farmers after the 2nd world War in many developing countries. Cooperative plays a vital role in many aspects of human interaction, including income generation, risk reduction, social networking, education, information sharing, and public service provision. (Afolami [32]). Many socioeconomic factors are affected by climate change which varies from place to place based on the economic, social, political, and environmental conditions of the locality.

Several types of social and economic factors including population growth, poverty, income distribution, unemployment, health status, education level, gender inequality, hazardous location, access to resources and services including knowledge and technological means, and lack of political voice, etc. Are directly and indirectly affected by climatic changes (Siwar [33]). Marketing channel choice is one of the critical components to successful marketing for rural rice producers, as different channels are characterized by different costs and profit margins. The majority of rice large scale farmers in Africa are smallholders with a rice farm size of less than 2 hectares and are faced with numerous challenges include; the lack of storage facilities, lack of security, lack of policy, lack of agricultural extension, and lack of rice marketing (Adu [34]).

The major constraint to domestic production of rice in Nigeria is connected to poor resource utilization, environmental and institutional factors. Its production has also mainly been in the hands of small-scale resource-poor farmers who depend heavily on the use of traditional technologies, which results in low productivity. There has been a low level of improved farm inputs usage among small-scale farmers. This could be as a result of the high cost of inputs, diversion of subsidized farm inputs, soil degradation, annual bush burning which destroys the soil organic matter, land issues, lack of capital, neglect of the agricultural sector, inadequate extension agents, market failures, insufficient technical-know-how in the area of fertilizer application and improved seeds among others (Toluwase [35]).

Socio-Political and Security Factors on Rice Production

Modernization is a never-ending process by which nations transform traditional communities, institutions, and customs into modern ones. Following World War II and within the framework of the early post-colonial development decades, modernization initiatives began in the West and East. Modernization interventions began in many pastoral regions during pre-colonial times, but they intensified during post-colonial times. In the twentieth century, the concept of pastoralist modernization evolved with the goal of settling pastoralists and adapting their traditional customs to modern expectations and perceptions (Muhammad, et al. [36]).

Long-standing political, economic, and social structures that support lives and livelihoods in Somalia have been disturbed and reshaped by more than a decade of conflict and recurring drought and flooding. At the height of the civil war in the early 1990s, these circumstances combined to create a humanitarian disaster of epic proportions: starvation, epidemic breakouts, and direct violence took the lives of an estimated 400,000 people. While Somalis' hardship did not remain as obvious in the second half of that decade, the country's history of civil strife and economic stratification has hindered many people's ability to cope with additional stress or even meet their fundamental human requirements (Andre Le Sage [37]).

The agriculture sector's problems were caused by severely primitive production tools, environmental issues, a lack of agrarian services, mismanaged markets, arbitrary price regulations, and an impoverished labor force. In grain-producing areas, these political-economic and ecological variables are stated differently than in the banana sector. The agrarian crises in Somalia are ingrained in the institutional order left behind by the colonial rulers and the regimes that have ruled afterward. The warlords and regional faction leaders have exacerbated the crisis. Although the sharp declines in grain production from 1970 to 1980 were undoubtedly caused by unfavorable climatic conditions (e.g., the 1973-1974 drought).

The main reason for the decade-long failure to make progress toward national food self-sufficiency was ineffective agricultural policy. The fall in cultivated land during the 1982-83 season was caused by the reform process's abandonment of state agricultural production. Its recovery was gradual as peasant farmers gradually acclimated to the new policy environment. The Shabelle River valley, which surrounds Jowhar, is a flat, fertile alluvial plain. It is around 60 miles northeast of the capital and fewer than 500 feet above sea level. The valley receives roughly 600 millimeters of rain per year on average. The Shabelle River, which meanders through the valley, usually runs dry between January and March. Peasants and pastoralists used to live in the valley. However, with the Italian annexation of southern Somalia, it drew a slew of investment initiatives.

In the 1960s, rice farming was introduced to the valley. This economic initiative began at an experiment site five kilometers northeast of Jowhar as part of a People's Republic of China-sponsored effort. The goal was to see if Somalia could grow enough rice to supply a major portion of its own rising demand. The experimental phase was completed by the end of the decade, and the station's employees began to encourage its field laborers, the majority of whom were peasants from nearby villages, to plant rice in small plots on their property. By the mid-1970s, a small but growing number of people were producing rice. The station aided these villagers' efforts by providing advice on improved agriculture practices and seeds.

However, before this attempt could take root, the newly formed Agricultural Development Corporation, a marketing parastatal, imposed price controls and required deliveries of rice and other crops. Farmers who were already producing the crop abandoned it entirely within two years, thereby halting the development of peasant rice agriculture. Rice was exclusively planted in the trial station and on state farms elsewhere between 1974/1975 and 1983. The preceding study of rice production in the Jowhar Valley demonstrates that the region's expansion was encouraged by the neoliberal reform program. Such expansion illustrates only one aspect, albeit a favorable one of the program's impact on the rural sector. The impact of the reform initiative was also felt in agriculture-related state institutions (Samatar [38]) (Table 1).

Table 1: Cropped Areas in Somalia, 1970-1987 (in thousands of hectares).

	Total Crop Land[a]	Maize	Sorghum	Rice	Wheat	Beans	Groundnuts	Sesame
1970	571	133	290	1.3	0.9	21.9	3.3	73
1971	500.4	102	280	1.4	0.6	17.8	2.6	44
1972	638	117	390	1.2	0.8	20.8	3.3	57
1973	591.8	101	345	1.2	3.5	17.9	2.9	77
1974	580.7	99	330	1.4	3.5	17.6	2.8	84
1975	641.1	106	400	1.6	3.5	18.8	3.3	57
1976	733.5	119	490	1.8	3.5	19.7	3.5	45
1977	764.5	150.6	458.3	4.4	3.5	18.8	2.5	75
1978	730.8	148.7	420.1	9.8	3.5	21.8	1.9	75
1979	765	147.5	460.8	4.8	3.5	16.6	2.4	80
1980	730.8	109	456.8	5.9	3.5	18.5	2.5	83
1981	896	197	517	5.7	3.5	25.9	2.6	90
1982	931.9	209	540	6.0	3.5	27.0	3.0	90
1983	745.5	218.6	335.5	1.0	3.6	27.0	3.0	98.4
1984	964.7	220	544.7	1.3	3.6	38.1	4.7	92
1985	909.1	234.3	447	2.6	3.6	46.8	5.2	109.2
1986	802.7	245.1	385	3.2	0.3	28.9	2.9	81
1987	984.8	259.5	516.2	3.6	0.0	48.3	4.2	104.7

Note: Source: Somali Democratic Republic, Ministry of Agriculture, Food Early Warning.

Technological Innovations and Best Practices of Rice Production in Somalia

The world's current population of 7.8 billion people (as of 2020) is anticipated to rise to 9.7 billion by 2050 [39]. It is anticipated that the globe will require 70% more food than is currently available, with fewer natural resources such as land and water due to urbanization, soil degradation, climatic changes, water shortages, and animal overuse. Poor logistics and storage are estimated to waste approximately 33% of agricultural produce (Alfred [40]). The role of information and communication in agricultural knowledge dissemination is widely known (Das [41]).

According to (Nzonzo [42]), the use of information in agriculture is increasing farming output in a variety of ways. Weather trends, best agricultural practices, and timely market information help farmers make informed decisions about what crops to sow and where to sell their produce and buy supplies. As (Alfred [40]) stated, meteorological data (or climate data) can be used to track the growth and disease of paddy rice. As an example. Yield estimation modeling rice crops at various spatial resolution (SR) levels using meteorological and soil data as input features. Day and night temperature (min, max, mean), diffused irradiance, cumulative precipitation, relative humidity, wind speed, rainfall, pH, soil moisture, and temperature (0-40cm) are among these characteristics.

It was discovered that disease incidence in paddy rice growth is also directly impacted by temperature and wetness duration. Winds may also have an impact on the growth and production of paddy rice plants, as strong winds are particularly destructive to the growth and production of rice plants, especially when they occur during the flowering and ripening phases of rice. Remote sensing data, also known as remotely sensed data, and vegetation indices can be utilized in a variety of ways to estimate paddy production, monitor paddy growth, and detect illnesses. Much research is built around mapping rice-growing areas, cropping patterns, and paddy vulnerability to flooding. Seven of the 36 spectral bands of the Moderate Resolution Imaging Spectroradiometer (MODIS) sensors pertain to plant and terrain surfaces over a variety of wavelengths.

Market Access and Value Addition of Rice

The rice growing industry is dominated by small farmers who hold less than one hectare of land on average as well as the large-scale farmers. As a result, no amount of effort has been taken to increase farmer welfare. Small land ownership is a barrier to mechanization, technological adoption, and managerial efficiency. The agricultural system must be consolidated in the shape of an agricultural, institutional model to achieve farming efficiency, profit, and, ultimately, farmer welfare. Conflict is detrimental, both in terms of its direct effects on people and the disruption it can cause in inter-market exchange, which can become entwined with food poverty issues. However, not all conflicts are the same in terms of the ability of (informal) institutions to function during conflict. Prices for three key cereal grains—rice, maize, and sorghum—were obtained from the Food and Agriculture Organization of the United Nations (FAO) Food Price Monitoring and Analysis (FPMA) Tool database of the Global Information and Early Warning System on Food and Agriculture (GIEWS) (henceforth referred to as the GIEWS price data), which can be found at http://www.fao.org/giews/data-tools.

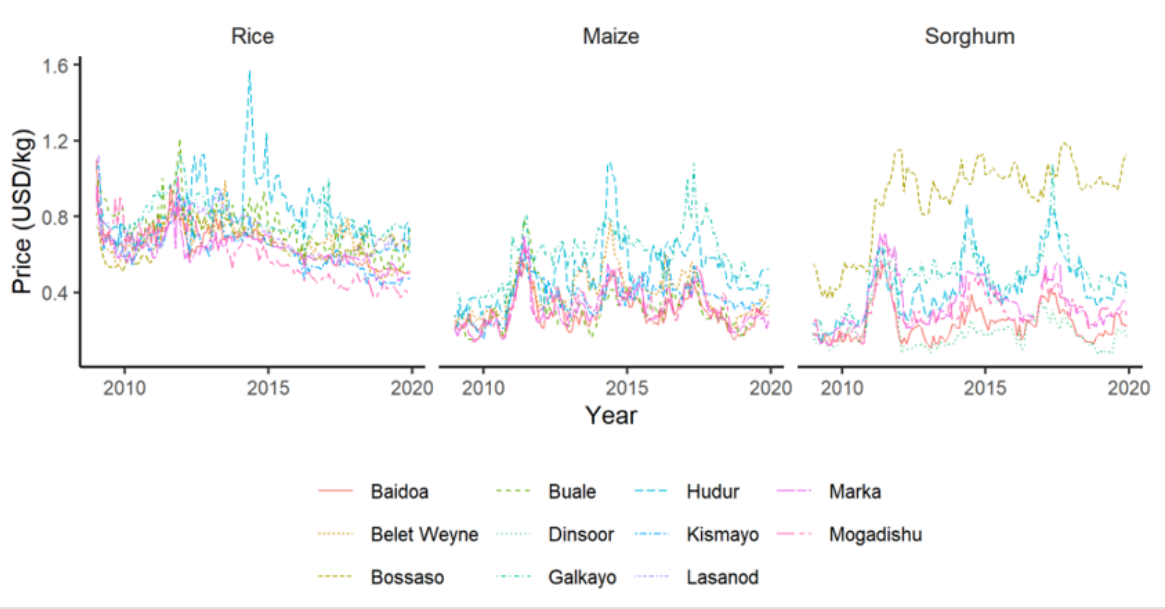

Figure 1: Comparison of cereal prices across the cities of Somalia during 2009-2019 period.

The maintained price series for the three cereal grains in the specified cities/markets is depicted in (Figure 1); the prices are represented in US Dollars per kilogram. With a few exceptions, such as Hudur (a smaller city in southern Somalia) and Bossaso (a port city in northern Somalia where local grain production is essentially non-existent), the graphs depict the co-movement of commodity prices across multiple marketplaces (Hastings [43]). Agribusiness product marketing efficiency (food and fiber) can be divided into two categories: operational efficiency and price efficiency. Marketing operations that can raise or maximize the ratio of marketing output to input are referred to as operational efficiency. It assesses the profitability of marketing institutions (traders, factories, or processors) as a function of operational costs. Marketing margins, farmers are, and profit-to-cost ratio analyses are common in operational efficiency (Kohls, et al. [44,45]).

The private sector dominates Tanzania's conventional rice marketing route, which includes smallholder rice farmers, rice millers, village rice collectors, wholesale dealers, retailers, and end consumers. The majority of these buyers are large-scale farmers who own four-wheel tractors, trucks, motorcycles, and milling machines. They primarily provide a variety of services to smallholder farmers, such as input supply, milling, paddy purchase, and loans (Mgale [46]).

Policy Implications and Governance Reforms of Rice Production

Natural resources are the foundation of rural life in Somalia, as they are throughout Sub-Saharan Africa. Water for domestic use, cattle watering, and irrigation are examples, as are pasture for grazing livestock, medicinal and edible plants, fish, and trees for fuel wood and building lumber. Pastoralism is the most common land use in Somalia. The accuracy of aggregate livestock statistics is questionable at best. Nonetheless, Somalia was reported to have 19.7 million goats, 13.2 million sheep, 4.8 million cattle, and approximately 6.6 million camels in 1999. Crop production is hampered by a lack of agricultural inputs, a lack of extension services, a lack of funding, and limited access to small-scale or large-scale loan schemes, all of which contribute to low agricultural output and poor land utilization. International food aid supplements the domestic grain supplies. The United States Agency for International Development (USAID) alone provides an annual humanitarian aid package to Somalia totaling US$ 26 million, the majority of which is utilized for emergency food assistance. (Farah [47]) Agricultural institutions and policies in Myanmar prior to 1988 resulted in centralized control of land, crop selection, and input supply.

The farmers' 50 kyats from the government pale in comparison to the 150 kyats they earn from private dealers. The calculated implicit tax on rice production is 10% of total revenue (percent quota requirement times percent price gap). Quota restrictions appear to be altered based on the previous year's yield figures. In the long run, taxation also applies at the margin. Only rice exports have been monopolized by the government since the end of 1988. Other items are exported through joint ventures with the government, but these ventures are not state monopolies. Each export shipment must be licensed by a private dealer. Officially, these merchants are permitted to spend their foreign exchange profits. However, we hear that the government mandates exporters to use a portion of this foreign cash to acquire commodities that are currently in short supply in domestic markets on their own behalf. This measure has sparked criticism for discouraging exports (Pingali [48]).

Farmers' rice production is influenced by government policy, and such policy can have a qualitative effect on farmers' rice output by providing them with production technologies and information to boost their long-term productivity. Governments in developing countries intervened in agriculture through a range of trade policies. To begin, the government stepped in to shield consumers and industry from shifting commodity prices, at the expense of farmers' interests. It imposed a range of charges on agricultural product exports in order to raise its revenue from those exports. The funds were distributed to a variety of government bodies and programs. Rice export levies are used by the government to finance agricultural extension initiatives for other crops. Second, in order to protect consumers and industry from commodity price swings, the government frequently sets agricultural commodity prices that are much lower than those on the global market. Export restrictions were frequently employed by the government to avoid commodities shortages in the domestic market, resulting in higher food prices.

Governments in many nations are expected to employ consumer subsidies to manage food prices. As a result, farmers were forced to sell their products at a lesser price to government organizations. Consumers were also offered the commodities at a fraction of their market value. Third, the government implemented protective tariffs to defend domestic industry and state firms from overseas competition (Cornejo [49]). The Somalia government's priority investments policies are guided by the country's poverty reduction strategy, the ninth National Development Plan 2020-2024 (NDP 9), which is organized around four major pillars: inclusive politics, security and the rule of law, economic development, and social development. The four pillars incorporate six imperatives: to strengthen gender and other types of social equity, to build household, community, and government resilience, to better manage environmental and natural resources, to prioritize long-term solutions, to strengthen the humanitarian-development-peace nexus, and to strengthen institutional capacity for effective governance. These six imperatives guide Somalia's United Nations Sustainable Development Cooperation Framework 2021-2025.

The strategic goals document of the Ministry of Agriculture and Irrigation (MoAI) is a reflection of the NDP 9, with an emphasis on the key priority investments required to boost agricultural production and productivity while minimizing natural disasters like as droughts and floods. These, along with major priorities from the Ministries of Fisheries and Blue Economy and Livestock, Forestry, and Range,

comprise the key priority investments listed below. The Somalia National Investment Promotion Strategy and related Theory of Change (ToC) envision that accelerating output production, import substitution, and export promotion, along with the principles of centrality of enabling reforms, private capital, prioritizing the most important investments that are achievable, and putting in place enablers by supporting both soft and hard systems and infrastructure, would promote the country's self- sufficiency across various sectors. (Somali Government [50]).

Conclusion

In conclusion, this review provides a comprehensive examination of the challenges and prospects associated with large-scale rice production in Jawhar, Middle Shabelle, Somalia. Rice, as a vital global food source, faces multifaceted challenges in this region, from climate change impacts to environmental and technical limitations [51]. The study underscores the urgent need for holistic solutions to enhance food security and sustainability in rice cultivation. Addressing environmental challenges, such as climate change and soil health, is paramount. Implementing water-saving strategies and modernizing farming techniques can mitigate water scarcity and labor-intensive practices. As climate change continues to pose a threat to rice production, adaptation strategies and resilient crop varieties become essential. Additionally, efforts to improve infrastructure and technology adoption are crucial for increasing productivity and alleviating the burden on manual labor.

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