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Exploring the Feasibility of Sorghum Farming in South Africa Using Garrett's Ranking Technique

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Abstract: The potential for sorghum to be the driver of economic development in Sub-Saharan economies, including South Africa, is enormous. However, there has been a notable decline in the production, use, and consumption of sorghum due to the changes in preferences and lifestyle of its consumers in Southern Africa. While existing and extant studies have studied the benefits and impacts of sorghum on the African economy, there is an inadequate understanding of the feasibility of sorghum farming in South Africa using Garrett's ranking technique. As a result, this study explores the feasibility of sorghum farming in the Nyoni area of KwaZulu Natal, South Africa. Hence, a survey was conducted with a sample size of 150 respondents that were purposively selected. An interview schedule was also used to collect primary data, and the data were analyzed using Garrett's ranking technique. The results of this study indicated that edaphic factors, climatic factors, volatile markets, information transfers, education, drought resistance variety, access to credit, and technological advancement were critical in making sorghum farming feasible in the Nyoni area of KwaZulu Natal. Therefore, this study recommends that there is an overarching need to explore the feasibility of sorghum farming, starting at a smaller scale until a more stable state of marketability and potential profitability has been established.

Keywords: climatic factor; drought resistance variety; edaphic factor; feasibility; Garrett's ranking technique; sorghum

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1. Introduction

For ages, sorghum has been cultivated in semi-arid regions of Sub-Saharan Africa and other parts of the world as a reliable food crop and animal feed. Despite its many applications as food, feed, fodder, and biofuel, sorghum farming has lost ground worldwide, especially in South Africa. Disincentives from other high-quality cereals that are more affordable, changes in eating preferences and habits, the fast urbanization of the world, and the difficulties involved in preparing meals for immediate consumption are the main causes of this. Additionally, the transition from sorghum plantations to other grains including maize, cotton, sugarcane, soybeans, and sunflower was caused by the untapped potential of other grains. It is believed that the economy of dry-land farmers in South Africa, where sorghum cultivation is more advantageous than other cereal crops, is critically affected by the downward trends in sorghum output and consumption. Thus, the objective of this study was to determine whether sorghum cultivation could be performed in South Africa's Nyoni area.

Sorghum's low marketable surpluses, preparation hassles, short shelf life, lack of technology, poor participation in processing, and small market are some of the major barriers to generating demand for the grain [1]. In addition to inadequate government support for enhancing millet yield, these crops continue to lag behind in the food market because of a lack of processing support. Processing and value addition are critical in this situation. In addition to creating and marketing sorghum food products, processing intervention at the farm level would increase farmers' awareness of sorghum's commercialization, which has a strong chance of creating additional jobs in rural areas.

Raw Farmacy (Pty) Ltd. selected the Nyoni area to launch a sorghum project in order to stop the decrease and increase the demand for sorghum. In order to provide a plethora of information about sorghum cultivation, this was accomplished through community engagement, knowledge exchange, and cooperative farming activities. Thus, four distinct objectives guided the conduct of this study: determining the size of the sorghum farming industry in South Africa; analyzing the key success factors and cost drivers for sorghum farming; analyzing the benefits of sorghum farming; and identifying potential roadblocks that might prevent sorghum farming in the Nyoni area. As the first study on the viability of sorghum growing in the Nyoni area, Garrett's ranking technique was used to determine the parameters that affect the mounting of a sorghum project.

2. Empirical Literature Review

Grain sorghum (*Sorghum bicolor* (L.) Moench) is believed to have originated in Eastern Africa, most likely in Ethiopia, an area characterized by unpredictable and variable rainfall [1]. From there, it spread across various African regions through the movement of local populations. Initially growing in the wild, sorghum was domesticated for use as food and animal feed and has been cultivated in Africa for approximately 2000 years, predating European colonization. The crop's spread to Asia and parts of the Western Hemisphere can be attributed to the forced migration of enslaved Africans. Globally, sorghum ranks as the fifth most important cereal crop, following rice, wheat, corn, and barley [2]. It serves as a primary food source for around 750 million people residing in the semi-arid tropical regions of Africa, Asia, and Latin America [3]. Notably, Africa leads the world in sorghum production, highlighting its critical role as a staple grain for food consumption [4].

Sorghum is cultivated in nations on all six continents on occasion or to some degree [5]. Although it is a subtropical or tropical crop that cannot withstand freezing, it is adaptable to a broad variety of agro-ecological environments, including high rainfall highlands and desert places [6]. In 1998, the total global output of grain sorghum was 61.7 million metric tons from 43.4 million hectares, with Africa producing 20 million metric tons from 22.9 million hectares [7]. Nigeria, Sudan, Ethiopia, and Burkina Faso are among African countries that produce more than a million tons per year, followed by Niger (600,000 tons), South Africa (480,000 tons), Tanzania (420,000 tons), and Uganda (290,000 tons) with significant output [8]. Accordingly, sorghum is cultivated for a variety of purposes, including animal feed, human consumption, and construction, depending on the demands of the specific people [9].

Food and beverages made from sorghum are part of the primary menu for those who utilize sorghum as a food source and a source of income. Sorghum is utilized in a number of methods for human consumption in many underdeveloped nations [10]. Thin and thick porridges, fermented and unfermented breads, lactic and alcoholic beers and drinks, malted goods for brewing, and malted porridge mixes are the principal food items manufactured in areas where sorghum is farmed as a subsistence crop [11]. In addition, sorghum may be used for fencing, construction, weaving, broom manufacturing, and firewood. Windbreaks, cover crops, and stakes for yams and other climber crops may also be made from the plants [12].

In South Africa, grain sorghum is cultivated in drier regions with shallow and heavy clay soils, and it accounts for less than 1% of total arable land [13]. Sorghum is grown commercially in the provinces of Free State (61%), Mpumalanga (24.3%), Limpopo (8.1%), and North West (4.6%) [14]. In 2005/06, compared to 2004/05, grain sorghum output fell significantly. During the 2005/06 season, an estimated 37,150 hectares of sorghum were planted, compared to 86,500 ha in the previous season, representing a 57.1% decline in the total area planted. This decrease may be ascribed to reduced producer pricing during the last two seasons, owing mostly to domestic overstock and currency strength [14].

Furthermore, it might be ascribed to moisture deficiencies. When compared to the most significant grain crops produced in South Africa, maize and wheat, sorghum provides a modest fraction of total domestic grain. There are various variables that contribute to sorghum yield reduction. Drought stress is one of the key agronomic challenges that restrict yield more than any other environmental parameter, particularly in dry and semi-arid locations. Drought stress is especially difficult for small-scale farmers (resource-poor farmers) since their agricultural operations rely exclusively on rainfall, with no alternative for irrigation.

Accordingly, drought stress typically disrupts plant growth and development patterns by inhibiting cell division, organ growth, net photosynthesis, and protein synthesis and altering hormonal balances in important plant tissues, resulting in significant yield consequences. Furthermore, grains from drought-stressed crops are often of inferior quality. Accordingly, the global population is steadily expanding and is expected to reach 8.2 billion by 2025, with the greatest problem being to produce enough food to feed the growing population [15]. Accordingly, this difficulty may be mitigated by creating and choosing cultivars that are more resistant to drought stress and capable of growing and sustaining sufficient yield more effectively under drought stress circumstances. Plants' processes for maintaining growth and output under drought stress conditions are complex and not completely understood.

Similarly, a study by [16] showed that age affected the technical efficiency of small-scale farmers positively and significantly at a 1% significance level. This was probably due to the amount of experience in farming and also the fact that older farmers had acquired more resources at their disposal. Efforts to boost small-scale farmers into agricultural value chains, especially export markets, indicate that only a few wealthy and better-connected people benefit from those opportunities. This makes it difficult for the smaller marginalized farmers to participate in these markets [17]. A study conducted in Kenya found that experienced farmers are more likely to be profit efficient [14]. A study conducted in Gauteng Province was used to analyze factors influencing the decision to participate in agro-processing, indicating that 19% of smallholder farmers participate in the industry [18]. It also revealed that factors such as education, land tenure, training, and information influence the level of participation. Currently, commercial agriculture is the main player in the South African agro-processing industry. However small-scale farmers play a limited role, despite having support from the government.

Studies on South African smallholder farmers indicated that the grain farming input costs based on a 5 ha farm size would total up to ZAR 43,000 with a total selling price of ZAR 3500 for a yield of 1900 Kg/ha leading to an income of ZAR 33,250, resulting in net income of −ZAR 9840 [19]. This model was based on a two-year period with no intervention from the government and not including transport costs. This study by [20] demonstrates that it might be unsustainable for smallholder farmers to successfully process their sorghum grains without any assistance. For this reason, there is little interest for the farmers to cultivate sorghum under such conditions. Two main cultivars of sorghum are grown in South Africa, and these are the bitter (tannin) and sweet (non-tannin) cultivars. Research shows that sweet cultivars are more widely preferred based on their broader uses. The bitter tannin is mainly used in malt production. According to the ARC-Grain Institute, the production of sorghum in South Africa ranges from 100,000 tons (13,000 hectares) to 180,000 tons (150,000 hectares) [21].

A recent International Sorghum conference held in 2018, which also highlighted the climate resilience of sorghum to drought, heat, and waterlogging, indicated that it could be a good alternative for maize. According to the conference proceedings as described by Farmers Weekly, the objective is to boost local production in South Africa to 500,000 tons per annum and consumption by 15 percent per annum, which demonstrates the interest and market potential of the crop [22]. This study does, however, heed the issues of VAT payable for the sorghum grain as a constraint that has caused a decline in consumption and thus hindered growth. This indicates the fact that growers opt to produce crops, such as maize, which have higher yields compared to sorghum, which comes with higher input costs and lower profit margins, as the selling costs need to match those of the cheaper imports.

There is, however, a notable trend of sorghum farming being predominantly practiced in the Mpumalanga and Free State regions of Southern Africa. This opens up the question of viability in the KZN region. For instance, it has been reported that sorghum production in 1000 metric tons per province between 2019 and 2020 was led by Mpumalanga at 40.8, followed by Limpopo at 34.8, Free State at 30.7, North West at 24.9, and KwaZulu Natal at 3.0 [23]. There has been a decline in the production of sorghum in South Africa, and some of the contributors are the losses of the Botswana market and a decrease in traditional beer production. Recent sorghum production statistics fronted by [24] demonstrate these dismal figures (Figure 1).

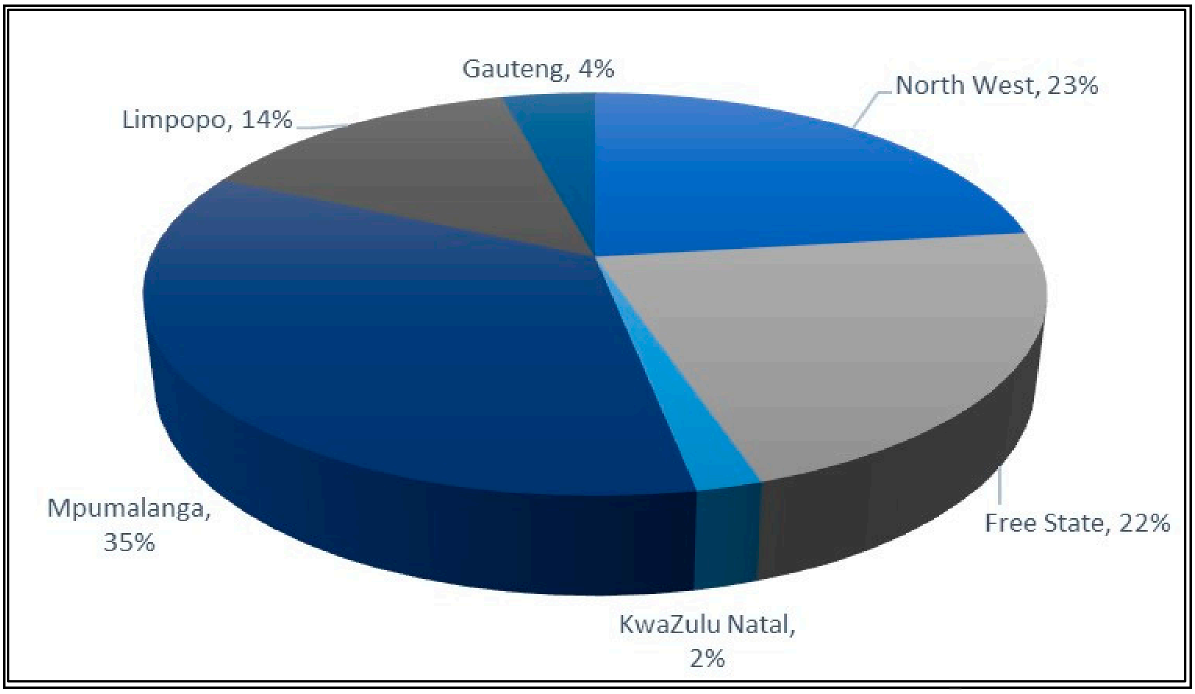

Figure 1. Sorghum production areas in South Africa [25].

Historically, sorghum has been a staple food crop in several African regions, given its resilience to climatic vulnerabilities and potential contribution to food and nutritional security. In sub-Saharan Africa, sorghum's adaptive capacity has been recognized as a mechanism to combat food insecurity and poverty [26]. These attributes align with South Africa's agrarian needs, especially given the country's periodic droughts and challenging farming conditions in certain regions. Within South Africa, specific farming practices, such as tillage, crop rotation, and residue management, significantly influence the productivity and sustainability of sorghum cultivation. Studies conducted by [27] in the marginal soils of South Africa highlight the impact of microbial biomass carbon and enzyme activities on the productivity of the sweet sorghum cropping system. In another study by the same author, the effects of these farming practices on nutrient availability in a sorghum-based cropping system were also underlined [27].

While sorghum has traditionally held socio-cultural and nutritional significance in various African regions, there has been an evident decline in its prominence in some areas. The study by [28] presents a comparative regional analysis, suggesting varying degrees of sorghum production in North America, Asia, and Africa's Sahel region, which can offer insights into the global dynamics of sorghum cultivation. Although not directly focused on South Africa, understanding these broader patterns can provide context. Furthermore, farmer knowledge, attitudes, and practices play a pivotal role in crop selection and cultivation techniques. For instance, in neighboring Zimbabwe, a study delves into farmers' perspectives on sorghum allelopathy, highlighting the importance of a grassroots-level understanding and acceptance of the crop [29]. In terms of advances in sorghum production within the smallholder farming systems of Africa, ref. [30] provides a comprehensive overview of best management practices and technologies that could potentially be adapted or considered for South African contexts.

Figure 2 below illustrates the market trends for sorghum internationally and in South Africa. The international trend indicates that South Africa is somewhere in the middle of the trade and yield producers, and this could be improved by increasing local production.

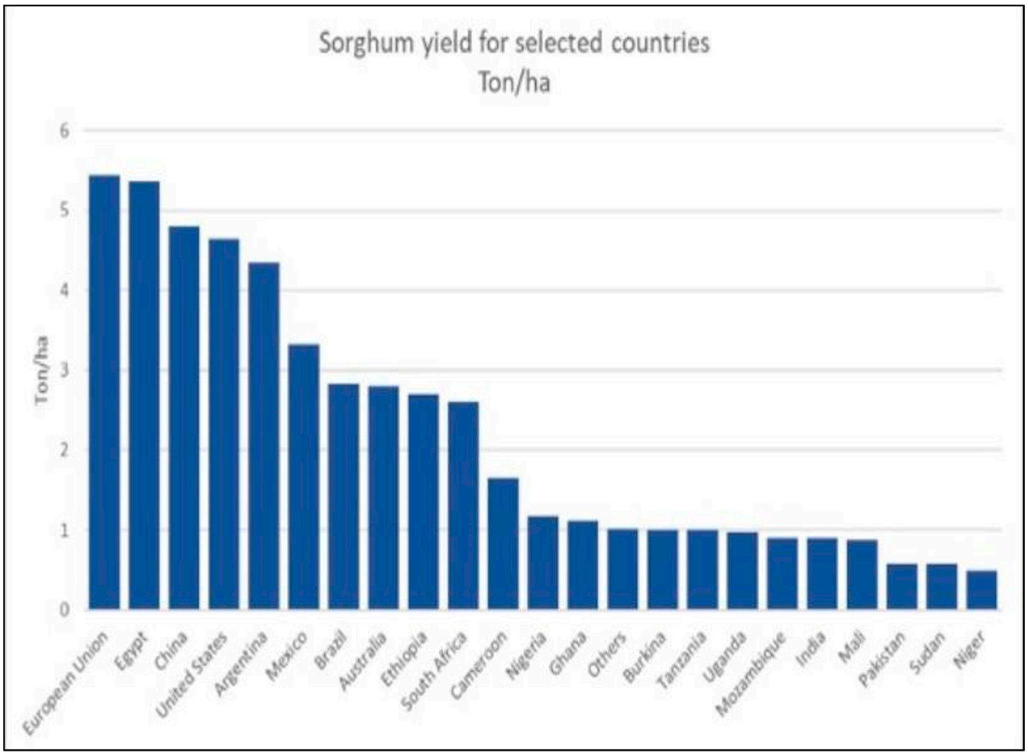

Figure 2. Sorghum yields in selected countries, including South Africa. Source: SAGov, Agriculture, Land Reform, and Rural Development.

On the other hand, Table 1 below demonstrates the decline of demand, locally owing to different reasons, such as the decrease in demand for malt, reduced export to Botswana, and local consumption in general households [14].

Table 1. Sorghum uses in South Africa. Source: [31].

Marketing Year	Sorghum Meal	Malt	Total Human Consumption	Animal Feed	Others	Total
			1000 tons			
2008/09	92.3	91.9	184.2	7.9	11.0	203.1
2009/10	100.3	82.0	182.3	8.6	13.4	204.3
2010/11	100.9	81.3	182.2	7.1	11.1	200.4
2011/12	88.4	69.4	157.8	5.6	8.5	171.9
2012/13	95.7	69.0	164.7	5.1	8.0	177.8
2013/14	90.3	62.2	152.6	6.8	7.0	166.4
2014/15	88.0	61.4	149.4	10.4	5.2	165.0
2015/16	97.9	62.7	160.6	9.7	1.9	172.2
2016/17	92.7	60.1	152.8	8.6	3.9	165.3
2017/18	87.7	56.3	144.1	10.7	1.8	156.6
2018/19	87.5	55.5	143.0	11.0	2.0	156.0
2019/2020 (Forecast)	87.0	55.0	142.0	11.0	2.0	155.0

2.1. Theoretical Underpinnings of This Study

There is a plethora of theoretical frames of analysis in the area of Sorghum farming. However, given the novelty of this study, the Sustainable Livelihoods Framework, Agricultural Innovation Systems Theory, and Resilience Theory are considered the most relevant and adopted to foreground this study.

2.1.1. Sustainable Livelihoods Framework

Embarking on a theoretical journey in elucidating the feasibility analysis within the agribusiness sector, specifically for sorghum farming ventures by Raw Farmacy (Pty) Ltd. in the Nyoni area, the Sustainable Livelihoods Framework (SLF) becomes an invaluable compass. At the core of the SLF lies a meticulous examination of five critical capital assets: human, natural, financial, social, and physical. Each of these capitals plays a quintessential role in the livelihood sustainability of individuals and communities engaged in agricultural practices [32]. The discourse around human capital circulates the essential components of skills, knowledge, labor, and good health, which are viewed as the cornerstone of any agricultural endeavor. In the case of Raw Farmacy (Pty) Ltd., an in-depth scrutiny of how skilled labor and knowledge transfer are being channeled to enhance human capital in the Nyoni area becomes pivotal. Furthermore, health implications, whether positive or adverse, emanating from sorghum cultivation and consumption, contribute significantly to the broader narrative within the SLF framework [33].

Natural capital, represented by crucial resources, like land, water, and biodiversity, forms the lifeblood of agribusiness. Sorghum's intrinsic attribute of drought resistance makes it a fitting crop for arid regions, making the exploration of natural capital exceedingly relevant for Nyoni. Research by [34] illuminates the drought-resilient character of sorghum, thus underlining its suitability for cultivation in regions with scarce water resources. Financial capital encompasses the financial resources, access to credit, savings, and other monetary avenues crucial for fueling the sorghum farming venture. The financial landscape, with its capability to either facilitate or thwart the operations of Raw Farmacy (Pty) Ltd., becomes a paramount domain of investigation within the SLF paradigm. A nuanced analysis of the financial viability, including the return on investment and the economic sustainability of sorghum farming in Nyoni, is indispensable [35].

Social capital embodies the networks, relationships, and social norms instrumental in fostering cooperation within or between groups. An examination of how social capital could be harnessed or nurtured by Raw Farmacy (Pty) Ltd. through community engagement, knowledge sharing, and cooperative farming initiatives could offer a wealth of insights. Additionally, the dynamic interplay between the social fabric of the Nyoni area and the sorghum farming venture forms a compelling dialogue within the SLF [36]. Physical capital, defined by infrastructure, equipment, and technology, is a cornerstone for modern agribusiness ventures. Delving into how Raw Farmacy (Pty) Ltd. leverages or augments physical capital through investments in farming technology and infrastructure is crucial. Moreover, an understanding of how such investments bolster productivity, efficiency, and the overall feasibility of sorghum farming in Nyoni is pivotal.

By navigating through the SLF lens, a holistic vista unfolds, revealing the complex interplay of various factors impacting the feasibility and sustainability of sorghum farming by Raw Farmacy (Pty) Ltd. It unfolds a rich tableau depicting how individual and communal assets are entwined with the agribusiness venture, thereby elucidating the multidimensional aspects of feasibility in this specific agricultural context. The cross-examination of these five capitals conjointly provides a comprehensive understanding of the broader socio-economic and environmental realms within which Raw Farmacy (Pty) Ltd. operates. This, in turn, furnishes a robust framework for conducting a detailed feasibility analysis, thereby laying the groundwork for an insightful exploration into the long-term viability and potential impacts of sorghum farming in the Nyoni area.

2.1.2. Agricultural Innovation Systems Theory

Diving into the vast ocean of theoretical discourse surrounding agribusiness feasibility, the Agricultural Innovation Systems (AIS) Theory emerges as a significant beacon illuminating the path towards sustainable agricultural ventures. By extending its roots deep into the aspects of innovation, knowledge dissemination, and collective action within agricultural sectors, the AIS theory crafts a conceptual canopy encompassing the intricate dynamics of innovation within Raw Farmacy (Pty) Ltd.'s sorghum farming venture in the Nyoni area. Initiating the discourse, the essence of innovation, as spotlighted by AIS, becomes the pivotal axis around which the sorghum agribusiness orbits. The theory postulates that innovation transcends mere technological advancements, enveloping a broader spectrum of organizational, institutional, and socio-economic transformations [9]. The lens of the AIS theory magnifies how these realms of innovation could be harnessed to bolster the productivity and sustainability of sorghum farming in Nyoni, thereby influencing its overall feasibility.

Dovetailing into the realm of knowledge dissemination, AIS lays a strong emphasis on the role of knowledge flows in catalyzing agricultural innovation. The interaction among various stakeholders such as farmers, researchers, policymakers, and private sector players is seen as the crucible within which novel ideas and practices are forged and disseminated. In the context of Raw Farmacy (Pty) Ltd., scrutinizing the channels through which knowledge concerning modern sorghum farming practices, drought resilience, and market strategies flow is imperative [37]. Collective action, another cornerstone of AIS, illuminates the collaborative tapestry that can drive innovation in agriculture. Sorghum farming in Nyoni could greatly benefit from collaborative ventures, be it in the form of collective purchasing of inputs, shared use of farming equipment, or joint marketing strategies. Such collective endeavors, as suggested by AIS, can significantly lower operational costs, mitigate risks, and enhance market access, thereby improving the feasibility profile of the sorghum farming venture [38].

Furthermore, the AIS theory accentuates the essential role of supportive institutions and conducive policy environments in nurturing agricultural innovation. It beckons a thorough examination of the existing institutional and policy frameworks within which Raw Farmacy (Pty) Ltd. operates. This includes an inquiry into how policies around land use, water management, and agricultural subsidies impact sorghum farming in Nyoni, as well as how the institutional landscape facilitates or hampers innovation [39]. Interlacing with the technology aspect, the marriage between genetic advancements and modern technology, as envisioned by AIS, could propel sorghum farming in Nyoni into new horizons of productivity and resilience.

Leveraging genetic markers for sorghum biomass prediction alongside UAV-based remote sensing data, as explored [40], encapsulates the kind of technological and genetic innovations envisaged by the AIS theory. As the theoretical discourse traverses the contours of the AIS theory, it unveils a multidimensional panorama encompassing various elements crucial for fostering innovation, enhancing knowledge dissemination, and galvanizing collective action within the sorghum farming venture. This rigorous exploration steered by the AIS theory not only illuminates the pathways towards enhancing the feasibility and sustainability of sorghum farming by Raw Farmacy (Pty) Ltd. but also lays a solid foundation upon which tailored strategies can be formulated to address the unique challenges and opportunities embedded within the Nyoni area's agricultural landscape.

2.1.3. Resilience Theory

Embarking on a theoretical voyage through the kaleidoscopic lens of Resilience Theory unfolds a profound understanding of the underlying mechanisms that could buttress the viability and sustainability of Raw Farmacy (Pty) Ltd.'s sorghum farming venture in the Nyoni area. Resilience Theory, with its tenets anchored in the ability of systems to absorb shocks, adapt, and transform, offers a robust scaffold for scrutinizing the multi-faceted dimensions of feasibility within this agribusiness endeavor. Initiating the exploration, the concept of resilience is a crucible in which the capacity of the sorghum agribusiness to withstand and bounce back from adversities is forged. Nyoni's arid environment, typified by sporadic rainfall and recurrent droughts, presents a quintessential backdrop against which the resilience of sorghum farming systems is tested [41]. The theory propounds that fostering resilience encompasses bolstering the sorghum farm's capacities to absorb shocks such as drought, pest infestations, and market fluctuations.

Delving deeper, Resilience Theory accentuates the paramount importance of adaptive capacities in ensuring the long-term feasibility of the sorghum farming venture. It posits that the ability to adapt to changing conditions, be it climatic, economic, or socio-political, is a hallmark of resilient agricultural systems. In the context of Raw Farmacy (Pty) Ltd., exploring adaptive strategies, such as diversifying sorghum varieties, optimizing water use, and developing drought-resistant cultivars, can be seminal in enhancing the farm's resilience and, by extension, its feasibility. Transitioning to the realm of transformation, Resilience Theory elucidates that at times, fundamental transformations are requisite to navigate the agricultural venture through the tides of persistently adverse conditions. This might encompass exploring novel market niches, adopting avant-garde farming technologies, or even venturing into alternative agricultural enterprises. The application of novel transfer learning frameworks for sorghum biomass prediction using UAV-based remote sensing data epitomizes the kind of transformative innovations that could pivot the sorghum farming venture towards a trajectory of enhanced feasibility and sustainability.

Moreover, Resilience Theory beckons a meticulous examination of the social-ecological systems encompassing the sorghum farming venture. It underlines the symbiotic interplay between the natural ecosystems and the socio-economic structures within which the agribusiness operates. Examining how local community engagements, governmental policies, and market dynamics intertwine with the ecological attributes of the Nyoni area to influence the resilience and feasibility of the sorghum farming venture has, therefore, become imperative. Resilience Theory also ushers in a discourse on the importance of learning and innovation in fostering resilience. The crosspollination of traditional farming knowledge with modern scientific insights can birth innovative solutions tailored to the unique challenges faced by Raw Farmacy (Pty) Ltd. Embracing a culture of continuous learning, experimentation, and innovation is instrumental in nurturing a resilient and feasible sorghum farming venture.

3. Materials and Methods

This study adopted a mixed research design. This study is conducted in Nyoni at the Mandeni Local Municipality, KwaZulu Natal. The Municipality has 13.3% of the population that has no source of income and lives below the poverty line (Mandeni Local Municipality, 2022). The Municipality is situated in Northern Zululand Tribal Council with five villages: Nyoni, Ndulinde, Zithulele, Makhwanini, and Amatigulu. Nyoni village was purposively selected because Raw Farmacy (Pty) Ltd. intends to mount the sorghum project and it is also easily accessible. The population in this region is widely affected by unemployment, which contributes to the provincial official unemployment rate of 30.9% and the expanded unemployment rate of 47.3% [42]. The population for this research study comprised 10 senior staff members of Raw Farmacy Ltd. (RFL), 20 senior staff members of the Ministry of Agriculture (MoA), and 120 agricultural farmers actively involved in crop production. These senior members of staff had worked in their respective organizations for more than 5 years. Similarly, the farmers were expected to have stayed in the Nyoni area for more than 5 years and had been involved actively in farming for more than 5 years. Senior members of staff were preferred in this study because they were deemed to be more knowledgeable in agricultural farming in general in the Nyoni area and current advancements in agricultural production. MoA agriculture staff were involved because they had a historical background in agricultural production in the Nyoni area. Farmers were included because they were the intended recipients of the sorghum project and they had some sound knowledge of agricultural production in the area.

In the pilot study, the questionnaire was pretested before the actual online and paper-based survey questionnaire. After pilot testing, all necessary amendments were performed on the data collection instruments before actual data collection. Primary data collection was performed through interviews. Interviews remain an invaluable tool in qualitative research, enabling the capture of rich, nuanced insights from participants and shedding light on their experiences, perceptions, and understanding. In the context of this study (to investigate the feasibility of sorghum farming in Nyoni village), interviews were meticulously designed to discern both the depth of knowledge and the intrinsic interest concerning sorghum farming among the respondents. The questionnaires focused on four thematic areas (extent of sorghum farming in South Africa, the cost drivers and critical success factors, advantages of sorghum farming, and potential obstacles that would constrain sorghum farming). The four categories were further decomposed into seven factors and captured in the interview schedule. Then, farmers were allowed to rank the variables in order to identify the feasibility of sorghum farming in Nyoni village. The reliability of this study instrument is measured through the coefficient alpha. Cronbach's alpha is adopted to measure the reliability of a study. Reliability measures usually indicate the degree to which the findings of a study are internally consistent and free from error. When coefficient alpha changes from 0 to 1, a value of 0.6 or less largely will indicate unacceptable internal consistency reliability, and a score of 0.6 and above will indicate a high level of internal consistency reliability of the instrument.

Garrett's ranking technique (GRT) was used to analyze factors that could make sorghum farming in Nyoni village feasible. Essentially, GRT was used to identify important factors perceived by respondents to influence the feasibility of the sorghum project. This technique required the respondents to specify the rank for all variables, and the results of the ranking were computed into percentage score values using the following formula:

$$Percentage\ Position = \frac{100(\lambda_{ik} - 0.5)}{N_k} \quad (1)$$

where λ_{ik} is the rank of the ith variable ranked by the kth respondent and N_k is the number of variables ranked by kth respondent.

4. Results and Discussion

4.1. Reliability Test

Cronbach's alpha coefficient for the entire model is 0.73. Because Cronbach's alpha coefficient was greater than 0.6, it was concluded that the data collection instrument was reliable.

4.2. Demographic Characteristics

Figure 3 shows that the majority of the respondents were male; that is, 70% of the respondents were males and 30% were females. Figure 4 shows that 80% of the respondents were farmers, 13% worked at the Ministry of Agriculture, and 7% were staff members at Raw Farmacy Ltd.

Respondents' ages for this study were divided into four categories: under 20–29 years, 30–39 years, 40–49 years, and over 50 years. The ages of the majority of the respondents were between 40 and 49 years, while the ages of the minority of the respondents were between 40 and 49 years (Figure 5). Working experience was categorized into three groups: 5–9 years, 10–19 years, and over 20 years. A total of 57% of the respondents had work experience between 5 and 9 years. Fewer respondents had work experience of more than 20 years (Figure 6).

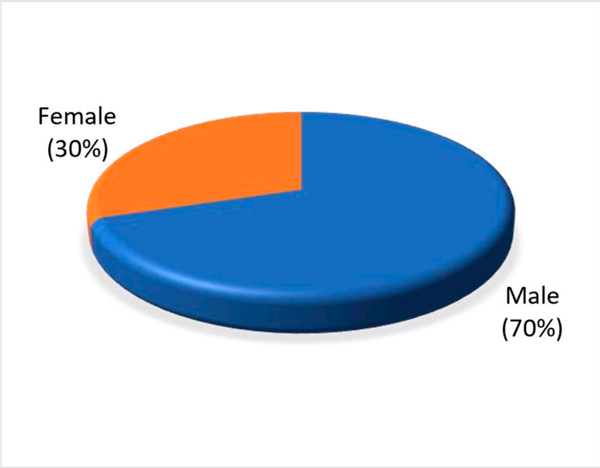

Figure 3. Gender of the respondents.

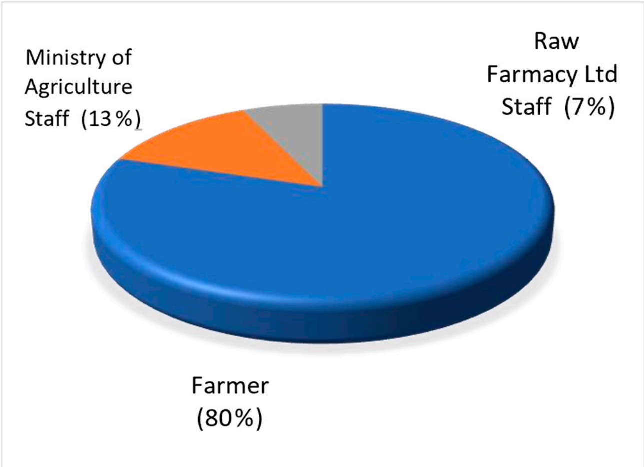

Figure 4. Job of the respondents.

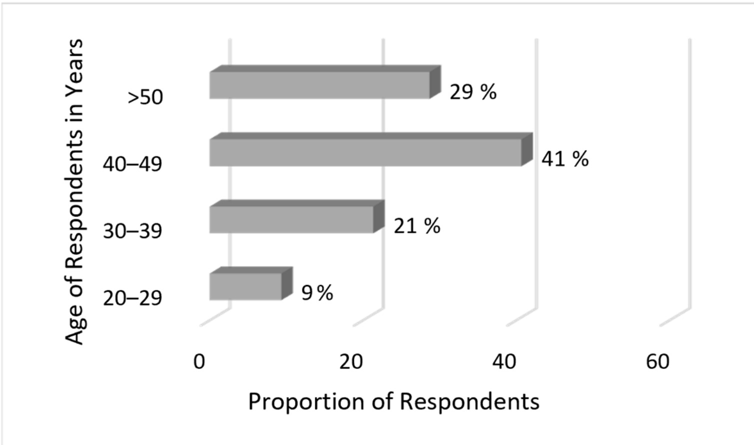

Figure 5. Age of the respondents.

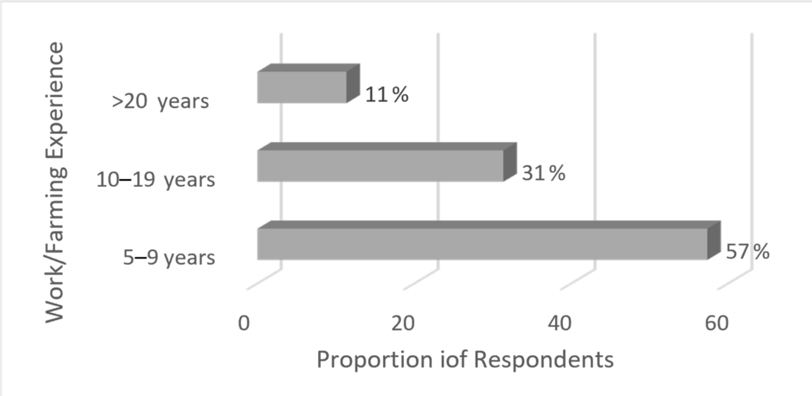

Figure 6. Work/farming experience of the respondents.

4.3. Analytical Results

Garrett's ranking technique has been used to analyze the potential factors that could influence the feasibility of sorghum farming by the respondents. Therefore, the respondents were required to rank each of the seven factors (that is, 1, 2, . . ., 7) per the four research questions of this study. The purpose of the ranking was to establish their preference in the selection of factors that could influence the feasibility of sorghum in the Nyoni area. Then, using Equation (1), the percentage position was computed, and the results are summarized in Table 2. The percentage position was used to identify Garrett's table values.

Table 2. Identification of Garrett's table values.

Rank	Computation of Percentage Score			Percentage Position	Garrett Table
1	0.5	0.5	100	7.1	79
2	0.5	1.5	100	21.4	66
3	0.5	2.5	100	35.7	57
4	0.5	3.5	100	50.0	50
5	0.5	4.5	100	64.3	43
6	0.5	5.5	100	78.6	34
7	0.5	6.5	100	92.9	22

Source: authors' computation.

The edaphic factor was ranked as the first factor that affected sorghum farming in South Africa.

The soil's health, encompassing aspects like microbial biomass carbon and enzyme activities, can have financial implications. Specifically, the cost of managing soil health for optimal sorghum growth in regions with challenging terrains, like some parts of South Africa, cannot be overlooked (Table 3).

Table 3. Potential factors that influence the feasibility of sorghum farming in South Africa.

Factors	Rank							Total Respondents	Total Score	Mean	Rank
	1	2	3	4	5	6	7				
Edaphic factors	75	31	25	4	7	5	3	150	10,133	67.55	1
Climatic factors	90	12	16	9	13	3	7	150	10,079	67.19	2
Topographical factors	56	2	11	6	30	17	28	150	7967	53.11	5
Pests and diseases	73	39	6	12	7	2	11	150	9894	65.96	3
Striga infestation	34	5	18	23	11	14	45	150	7131	47.54	6
Birds' infestation	15	9	12	8	27	7	72	150	5846	38.97	7
Irrigation water	38	22	20	16	14	13	27	150	8032	53.55	4

Source: authors' computation.

The climatic factor was ranked as the second factor that affected sorghum farming in South Africa.

Studies across West Africa and other countries and also extensive research on its production in South Africa under different environmental conditions indicate the great potential of sorghum as a resilient crop for the climate. This further strengthens the feasibility of growing the crop in the Nyoni area as one of Raw Farmacy's agricultural projects. However, external influences, such as erratic weather patterns, might potentially impact the production of sorghum, despite its inherent resilience to environmental vulnerabilities.

Pests and diseases were ranked as the third factor that affected sorghum farming in South Africa.

Sorghum production may face agronomic obstacles, including the presence of pests and diseases, as well as the use of inappropriate agricultural techniques.

Irrigation water was ranked as the fourth factor that affected sorghum farming in South Africa.

Sorghum's drought tolerance, water efficiency, and low-cost production make it an intriguing plant compared to corn silage production, which may have limited uses.

The topographical factor was ranked as the fifth factor that affected sorghum farming in South Africa.

Sorghum stands out as a crop with several advantages, especially in the challenging terrains and diverse climatic conditions of Africa. One of its most significant benefits is its adaptability to a range of topographical conditions. This characteristic underpins its potential to ensure food and nutritional security in areas where other crops might fail due to adverse conditions [43].

Striga infestation was ranked as the sixth factor that affected sorghum farming in South Africa. Striga is a parasitic weed and is considered a major pest of sorghum in Africa. The majority of farmers identified striga infestation as a major problem affecting them and had no chemical to control it. Striga is estimated to account for only 10% of aggregate crop loss and is capable of wiping out the entire crop; in fact, it is very destructive. Most of the farmers look forward to obtaining control or preventive measures for this witched weed/striga.

Bird infestation was ranked as the sixth factor that affected sorghum farming in South Africa.

Birds can cause havoc on sorghum plantations. Necessary measures need to be undertaken to control those bird menaces.

A volatile market was ranked as the first factor that affected the feasibility of sorghum farming in the Nyoni Area.

The uncertainty of the market for the sorghum grain creates difficulty for the farmers to adopt it as viable for income generation. The variety of sorghum use appears to be a considerable asset. Whether cultivated for food, fodder, or industrial purposes, sorghum's varied usage provides a large market reach, which increases its economic viability. Furthermore, the numerous market possibilities created by sorghum production might act as a catalyst for rural economic growth, providing agricultural communities with a consistent source of income. This aspect of adaptability is consistent with the overarching narrative in the literature and the Nyoni findings, embodying the numerous ways in which sorghum cultivation can be a predictor of economic vitality, food security, and agricultural sustainability, particularly in areas plagued by water scarcity and other environmental adversities. The production of sorghum offers a captivating narrative of perseverance, adaptability, and economic potential when seen through these perspectives (Table 4).

Table 4. Potential cost drivers that influence the feasibility of sorghum farming in Nyoni village.

Factors	Rank							Total Respondents	Total Score	Mean	Rank
	1	2	3	4	5	6	7				
Volatile markets	97	45	27	22	24	19	13	150	15,236	101.57	1
Social demographics	62	21	31	10	17	3	6	150	9516	63.44	4
Climate change	24	32	9	28	25	18	14	150	7916	52.77	7
Drought-resistant varieties	86	14	2	12	17	11	8	150	9713	64.75	3
Technological advances	65	23	18	4	19	5	16	150	9218	61.45	5
Information transfer and education	71	27	14	20	7	2	9	150	9756	65.04	2
Infrastructure network	56	16	31	18	11	14	4	150	9184	61.23	6

Source: authors' computation.

Information transfer and education was ranked as the second factor that affected the feasibility of sorghum farming in the Nyoni area.

Along with technical innovation, information transfer and education are seen to be important in improving drought resistance and sorghum cultivation's overall performance. The importance of information transmission is inextricably linked to the Nyoni findings, which revealed a visible knowledge gap in effectively managing sorghum agriculture. This association highlights an important component of agricultural development: farmers can be equipped with the necessary information and skills to negotiate the challenges of sorghum growing in a drought-prone environment by fostering effective extension services and educational programs. The integration of lessons from the literature and the Nyoni analysis emphasizes the need for a collaborative effort to bridge the knowledge gap through a well-structured knowledge transfer system [44]. Such a technique might act as a catalyst for distributing essential knowledge on drought management, insect control, and other pivotal elements of sorghum growing, greatly improving the chances of success in sorghum farming endeavors in other desert places.

Drought-resistant varieties were ranked as the third factor that affected the feasibility of sorghum farming in the Nyoni Area.

Genetic adaptation is a crucial aspect that determines the economics and profitability of sorghum agriculture. The Nyoni findings highlight the importance of fostering and harnessing genetic adaptability in sorghum, as advocated [45], which highlights the need for drought-resistant varieties to reduce the costs associated with irrigation and other agricultural inputs

Social demographics were ranked as the fourth factor that affected the feasibility of sorghum farming in the Nyoni Area.

Social issues may also have an impact. The lack of acceptance of sorghum within the community, either from cultural preferences or historical prejudices, may impede its effective incorporation into local agricultural practices. In order to tackle this issue, it is essential to implement community-based educational initiatives and awareness programs that prioritize the promotion of sorghum's advantageous attributes.

Technological advancement was ranked as the fifth factor that affected the feasibility of sorghum farming in the Nyoni Area.

Moving along the essential success factors spectrum, technological advances emerge as a strong accelerator for modernizing sorghum agricultural practices and increasing output. The study by [46], which focuses on using UAV-based remote sensing for enhanced production prediction and resource management, is strikingly similar to the Nyoni findings, which point to the benefits of incorporating contemporary agricultural practices. This convergence highlights a wider narrative within the agricultural paradigm: by accepting and integrating technological innovations, farmers may overcome conventional farming challenges, optimize resource utilization, and considerably increase yield outputs. The ability of technology, such as remote sensing, to provide real-time, actionable data about crop health and other agronomic factors may be a game changer in risk management for sorghum farming. Furthermore, these technologies might be game changers in building a more data-driven, accurate approach to sorghum farming, reducing some of the economic constraints that farmers face.

Climate change was ranked as the sixth factor that affected the feasibility of sorghum farming in the Nyoni area.

Sorghum grows well in warmer climates between 20 °C and 30 °C and requires fertile well-drained soil. Nyoni is in the iLembe district of Mandeni Municipality, which is not far from the coast. Due to its geographical location, the temperatures range between 10 °C and 40 °C. The Nyoni area fits these requirements, as it is generally a warm frost-free area.

The infrastructure network was ranked as the seventh factor that affected the feasibility of sorghum farming in the Nyoni Area.

Poor infrastructure results in high transaction costs owing to poor rural infrastructure [47].

Drought resistance was ranked as the first advantageous factor that affected the feasibility of sorghum farming in the Nyoni area.

Sorghum farming offers a number of benefits, particularly in water-stressed areas, like the Nyoni area. Drought resistance, a feature inherent in sorghum and expounded on by [48], is one of the pivotal benefits. These researchers' insights correlate with the Nyoni region's conditions, creating a consistent picture of the relief that sorghum production may offer to drought-prone areas. Sorghum's drought resistance basically provides farmers with a sense of security in the face of variable rainfall patterns, highlighting its importance as a crop for subsistence and economic sustenance. The linkages between academic knowledge and Nyoni's empirical findings highlight the critical role that drought resistance plays in supporting the economic and agronomic robustness of sorghum farming in dry places. This resilience not only reduces the need for expensive irrigation but also provides a semblance of food security and economic stability to agricultural communities (Table 5).

Table 5. Potential advantages that influence the feasibility of sorghum farming.

Factors	Rank							Total Respondents	Total Score	Mean	Rank
	1	2	3	4	5	6	7				
Drought resistance	98	14	18	12	1	5	2	150	10,549	70.33	1
Adaptable cultivars	46	38	25	17	9	4	11	150	9182	61.21	3
Variety of use	59	11	18	22	23	5	12	150	8936	59.57	4
Nutritional content	28	37	14	15	9	28	19	150	7959	53.06	5
Reduction in carbon footprint	12	15	19	11	13	12	68	150	6034	40.23	7
Cheaper than other crops	74	8	24	7	17	14	6	150	9431	62.87	2
Soil fertility	32	13	19	16	18	17	35	150	7391	49.27	6

Source: authors' computation.

Cheaper than other crops was ranked as the second advantageous factor that affected the feasibility of sorghum farming in the Nyoni area.

The cost effectiveness of sorghum-based products allows the lower-end consumer to also afford a high-nutrition staple meal. Furthermore, there is no real competition in the area for the sorghum market, which creates a great advantage for this small business. This could be due to the popularity of other preferred crops, such as sugar cane and gum tree, which are raw materials used in the nearby manufacturing industries, such as Tongaat Hulett sugar, Mondi Paper, and Sappie, which are producers of sugar pulp and paper, respectively. Communities see an immediate payout from these crops, as the supply chain is well understood and has been steady for years. Therefore, one common theme that was prevalent is that the crop can be viably farmed in the Nyoni area, as there is lots of land available.

Sorghum is an adaptable cultivar and was ranked as the third advantageous factor that affected the feasibility of sorghum farming in the Nyoni area.

The genetic variety that sorghum promotes is farther up the list of benefits. Ref. [49] sheds light on this genetic diversity, which is strikingly similar to Nyoni's findings, which highlight the possibility of choosing regionally adapted cultivars to improve productivity while minimizing input costs. The preference for regionally adapted varieties is a tribute to sorghum's genetic plasticity, which allows farmers to pick varieties that are compatible with the prevailing climatic and soil conditions. As a result, genetic flexibility serves as a foundation for optimizing crop outputs and lowering total cultivation costs. The convergence of findings from the literature and Nyoni highlights the pivotal role that genetic diversity plays in the successful cultivation of sorghum, highlighting the potential for tailored cultivation practices that leverage the genetic strengths of different sorghum varieties.

The variety of uses of sorghum was ranked as the fourth advantageous factor that affected the feasibility of sorghum farming in the Nyoni area.

The versatility of sorghum products covers a wide range of uses for different market segments. Apart from the nutritional benefits of the plant as a food source, the recent experience with the lockdown and ban of alcohol due to the COVID-19 pandemic has shown an increase in the home brewing of traditional beer, of which one of the main ingredients is sorghum. Sorghum is known to be used in the manufacturing of the following products for consumption: malt, used for beer production; sorghum beer; sorghum meal, which is known as "mabele"; corn rice; livestock feed; and other animal products. Moreover, sorghum is a GMO (Genetically Modified Organism) and is gluten free, which contributes to its nutritional and health benefits to humans. Despite such health benefits, the decline in sorghum production and the market have been observed mainly due to its high cost compared to other cereal grains [50].

The nutritional content of sorghum was ranked as the fifth advantageous factor that affected the feasibility of sorghum farming in the Nyoni area.

The main target market is the ordinary consumer, such as young and old people, who will benefit from the nutritional benefits of sorghum. Research performed by [4] indicates that there is a strong drive toward the production of healthy food and suggests that the spread of a food-grade white sorghum-based diet can aid the prevention of diseases, resulting in a significant reduction in medical costs. This study further denotes that there is growth in the healthy food market due to the increase in consumer demand for maintaining optimal health and the prevention of certain illnesses.

Soil fertility was ranked as the sixth advantageous factor that affected the feasibility of sorghum farming in the Nyoni area.

Crucially, sorghum cultivation also aligns with sustainable agricultural practices. Its deep root system aids in soil conservation, reducing erosion and enhancing soil structure. Furthermore, studies like those by [51] have highlighted how sorghum positively impacts microbial biomass carbon and enzyme activities, which are essential for soil health. In essence, the combined insights from research studies, including those by [52,53], and others, present a compelling case for the manifold advantages of sorghum, not just as an agronomic crop but also as a socio-economic tool to bolster food security, improve nutrition, and enhance sustainable agricultural practices in various regions.

A reduction in carbon footprint was ranked as the seventh advantageous factor that affected the feasibility of sorghum farming in the Nyoni area.

Research has demonstrated that sorghum reduces carbon footprint [54].

A lack of market preparedness was ranked as the first constraint that affected the feasibility of sorghum farming in the Nyoni area.

Another key impediment to the development of sorghum cultivation is a lack of market preparedness. The Nyoni findings imply a lack of market preparation for sorghum goods, a situation that is supported by scholarly research. This highlights the critical need for market development measures to increase demand for sorghum and sorghum-based goods. The route from farm to market is fraught with difficulties, such as a lack of processing facilities, insufficient market knowledge, and occasionally unfavorable market pricing. Without a determined effort to build a market culture that recognizes the value of sorghum, farmers' incentives to plant it may dwindle over time. As a result, the intersection of market preparedness and effective sorghum farming is a key subject that needs extensive investigation and strategic action (Table 6).

Table 6. Potential constraints that influence the feasibility of sorghum farming.

Factors	Rank							Total Respondents	Total Score	Mean	Rank
	1	2	3	4	5	6	7				
Education and awareness	56	35	12	9	17	13	8	150	9217	61.45	3
Lack of market preparedness	80	13	45	3	6	1	2	150	10,229	68.19	1
High cost of inputs	60	27	4	7	12	24	16	150	8784	58.56	4
Lack of good storage facilities	13	38	32	16	4	21	26	150	7617	50.78	5
Inadequate research	23	14	35	19	18	10	31	150	7482	49.88	6
Poor access to credit	95	18	9	3	11	5	9	150	10,197	67.98	2
Shortage of labor	15	24	16	17	12	14	52	150	6667	44.45	7

Source: authors' computation.

Poor access to credit was ranked as the second constraint that affected the feasibility of sorghum farming in the Nyoni area.

A study by [55] reveals that farmers who were reported to have cash-constrained access to credit could displace the financial constraint, enabling these farmers to acquire the required inputs for sorghum farming. The credibility of small-scale farmers is also questionable to creditors, which hinders the process of accessing funds [56]. For this reason, small growers find it difficult to expand or explore different revenues to support and grow their business.

Education and awareness of sorghum farming was ranked as the third constraint that affected the feasibility of sorghum farming in the Nyoni area.

The respondents believe that with more education on how to successfully farm and generate income from sorghum, more job opportunities can be created, as this is a rural community struggling with unemployment. The issue of awareness is quite crucial to facilitate the process of successfully farming sorghum in the region. Creating awareness will bring an understanding of the benefits and thereby spark interest in buying and using the grain in households, which will result in market opportunities in the area. Currently, there's doubt about investing in the grain due to that lack of awareness.

The high cost of inputs was ranked as the fourth constraint that affected the feasibility of sorghum farming in the Nyoni area.

South Africa is a net exporter of agricultural products; however, the inputs are mainly imported, which impacts profitable production. The exchange rate plays a huge role in the prices of both raw materials and export parities. The availability of high-quality seed is a vital aspect of sorghum agricultural success. This demands the development of strong seed production, certification, and distribution networks to guarantee that farmers have access to the finest seed types, allowing them to realize the full potential of sorghum cultivation. The discussion about quality seed availability intersects with the wider discussion about agronomic support, market preparedness, and education, establishing a complex web of variables that determine the trajectory of sorghum farming in different places.

The lack of good storage facilities was ranked as the fifth constraint that affected the feasibility of sorghum farming in the Nyoni area.

Proper storage is critical because of the reduction in post-harvest losses and increased shelf life.

Inadequate research was ranked as the sixth constraint that affected the feasibility of sorghum farming in the Nyoni area.

A lack of access to sophisticated agronomic practices has been noted as a key constraint in the Nyoni area, which is a problem that is echoed in the larger literature. When scientific improvements in agriculture are contrasted with real-world agricultural practices, a stark mismatch emerges.

Bridging this divide through research and development is critical for moving from subsistence farming to a more commercial, profitable, and sustainable agricultural paradigm. Modern agronomic practices, such as the use of improved seed varieties, the use of modern farm implements, and the adoption of water and soil conservation techniques, are critical in overcoming the myriad challenges that plague the agricultural sector, and particularly, sorghum farming.

A shortage of labor was ranked as the seventh constraint that affected the feasibility of sorghum farming in the Nyoni area.

Ideally, there is no shortage of manual labor. However, there is the challenge of formal employment. Currently, only a portion of the Raw Farmacy employees are employed on a more permanent basis, the rest are seasonal workers based on the current crop requirements. Introducing crops that will be more climate resilient and available will provide more stable employment, even for the current staff.

Practical Implications of the Findings

The findings from this study highlight several influential factors that can significantly affect sorghum planting, particularly when applied to current agricultural and socio-economic conditions in regions like Nyoni, South Africa. Understanding how these elements interact provides valuable insights into optimizing sorghum cultivation for improved productivity and sustainability.

1. Edaphic and Climatic Conditions. The research underscores that soil quality and climate are foundational for successful sorghum planting. Sorghum thrives in semi-arid environments due to its drought-resistant nature, making it suitable for regions with limited rainfall. However, variability in these conditions can greatly influence yields. For instance, if current climatic patterns shift due to climate change, with an increased frequency of droughts or unexpected heavy rains, sorghum planting could be compromised. To counter these challenges, farmers need access to drought-resistant seed varieties and should adopt practices like conservation tillage to preserve soil moisture. The empirical results stress that policies supporting research into climate-resilient agricultural technologies are vital for mitigating risks related to unpredictable weather conditions.

2. Market Volatility and Infrastructure. This study found that market conditions and infrastructure play a significant role in the viability of sorghum farming. In real-world applications, fluctuating market prices and inadequate transport systems can make it difficult for farmers to profit from their harvests. This is particularly relevant in current situations where global supply chains are still recovering from disruptions. Empirical evidence suggests that investment in local processing facilities and transport networks can stabilize prices and provide reliable market access, enabling farmers to receive fair returns. When markets are stable, farmers are more inclined to scale their production, reinforcing the local agricultural economy.

3. Access to Credit and Financial Support. Limited financial resources remain a pressing issue for many smallholder farmers, restricting their ability to invest in quality inputs such as high-yield seeds, fertilizers, and modern farming equipment. The findings suggest that policies enhancing farmers' access to credit and financial services can have a transformative effect on sorghum planting. Current empirical analysis of similar agricultural initiatives in Africa has shown that microfinance programs and government-backed loan schemes significantly boost smallholder productivity. Therefore, applying such support mechanisms can empower farmers in Nyoni to expand their cultivation efforts and adopt best practices that enhance yields.

4. Educational Outreach and Technological Advancement. The importance of farmer education and the use of modern technologies cannot be overstated. This study indicates that training programs and educational initiatives bridge the knowledge gap, equipping farmers with the skills needed to implement sustainable and efficient farming practices. For example, incorporating remote sensing and advanced irrigation techniques can optimize water usage and help manage crops more effectively. Empirical data from other agricultural sectors show that farmers with access to ongoing education and technological resources are more adaptable to environmental challenges and market fluctuations.

5. Resilience to External Pressures. External factors, such as climate change and global economic conditions, can unpredictably impact sorghum planting. The research points

to the necessity of proactive measures, such as continuous R&D into more resilient crop varieties and better storage facilities, to maintain productivity. This insight is particularly applicable now, as climate variability increases the risk of crop failure. Implementing robust storage solutions can also mitigate losses post-harvest, ensuring that surplus crops can be sold when market conditions are favorable.

5. Conclusions

The exploration of sorghum farming's feasibility in South Africa's Nyoni region provides valuable insights into the complex factors influencing agriculture in semi-arid areas. Through the use of Garrett's ranking technique, this study highlights the significant role of variables such as soil quality (edaphic conditions), climate resilience, market stability, educational resources, availability of drought-resistant crops, access to credit, and technological innovation. These factors collectively shape the viability of sorghum cultivation and underscore the need for robust support systems to empower farmers and enhance productivity.

The findings show that soil and climate play pivotal roles in determining the success of sorghum farming. Given South Africa's diverse landscape, particularly in areas like KwaZulu-Natal, sorghum's adaptability positions it as a potential cornerstone for food security. However, while its drought-resistant nature offers resilience, challenges like market instability and poor infrastructure must be addressed through targeted policies and investments to enable large-scale farming.

This study suggests that sustainable sorghum farming requires investment in modern technologies, like remote sensing and advanced irrigation, which improve yield prediction and optimize resource use, ultimately reducing risk and boosting farmer confidence. Alongside these technological improvements, knowledge-sharing programs are crucial to bridging traditional practices with modern agricultural approaches.

One significant barrier highlighted is limited access to credit, which restricts farmers from acquiring quality seeds and equipment. Strengthening financial support systems can unlock more opportunities for smallholder farmers, helping them scale up their operations. Additionally, educational programs are essential to fill knowledge gaps and promote innovation, making farmers more adept at using sustainable and profitable farming practices. Community-centered education initiatives can encourage local support and wider acceptance of sorghum cultivation.

The research also points out that market preparedness is a major obstacle, even with the crop's recognized benefits. To overcome this, efforts should focus on building processing facilities and initiating value-addition projects to enhance economic prospects for sorghum growers. Partnerships with agro-industrial players and government incentives could expand market opportunities and provide reliable income for farmers.

Climate resilience remains a critical theme in this research. While sorghum's drought tolerance gives it a comparative advantage, supporting this with proactive strategies, such as the development and distribution of drought-resistant seed varieties and improved storage solutions, is essential for maintaining productivity in adverse conditions. Continuous investment in research and development (R&D) is necessary to sustain and advance these practices.

In essence, achieving sustainable sorghum farming in Nyoni relies on a comprehensive strategy that includes investments in infrastructure, credit accessibility, educational initiatives, and market development. Aligning these with modern agricultural practices and supportive policies can lead to substantial benefits, from increased food security to greater economic stability. Starting with manageable, small-scale efforts and gradually expanding them as the market evolves can create a stable foundation for long-term growth and profitability.

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