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A Data-Driven, Tiered Business Support Framework for Small, Medium, and Micro-Agro-Processing Enterprises in South Africa

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Abstract

The South African Government prioritises Small, Micro-, and Medium Enterprises (SMMEs) as catalysts for employment creation, in alignment with Sustainable Development Goal 8 (SDG 8), Decent Work and Economic Growth, which advocates for sustained, inclusive, and sustainable economic growth. However, the extent to which agro-processing SMMEs translate this policy ambition into measurable socio-economic gains remains contested due to persistent structural, financial, and operational constraints. This study develops a comprehensive, data-driven business support framework tailored to agro-processing SMMEs in the Free State province of South Africa. Employing a mixed-methods approach, survey data from 88 agro-processing SMMEs were analysed across 18 business performance dimensions. Average agreement scores and performance gaps were utilised to diagnose strengths and vulnerabilities within the sector. While overall performance was relatively strong (average agreement score: 86.7%), a critical weakness emerged in operational cost management (76.1%), revealing a 14.2% gap relative to the highest-performing dimension, equipment selection (90.3%). Based on these empirical insights, the study proposes a three-tiered business support architecture: (i) maintaining and leveraging high-performing dimensions (≥85% agreement), (ii) targeted enhancement for moderate-performing areas (80–84.9%), and (iii) crisis intervention for critical weaknesses (<80%). The framework integrates cross-cutting support services, including financing, regulatory guidance, and technology access, delivered through a phased implementation strategy comprising crisis intervention, system establishment, and optimisation and scaling. A multi-channel delivery mechanism, combining a hub-and-spoke model, mobile support units, and a digital platform, ensures provincial accessibility. By translating performance diagnostics into differentiated policy action, the framework promotes efficient resource allocation, supports both high-potential and vulnerable agro-processing SMMEs, and embeds a robust monitoring and evaluation system to track key performance indicators. The study contributes to the SMME development literature by demonstrating how structured, tiered, and context-specific support models can strengthen resilience, competitiveness, and sustainable agro-industrial growth in developing-country settings.

Keywords: employment creation; data-driven model; partnership networks; sustainability; targeted interventions; three-tiered approach; key performance indicators

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1. Introduction

Globally, the agro-processing sector plays a fundamental role in promoting manufacturing-based value addition and job creation [1]. However, during economic

recessions, climate change, and higher investment costs, numerous obstacles arise. Key among these are infrastructure limitations, including insufficient transportation, storage, and processing facilities, which can impede the smooth movement of raw materials and finished goods. This is worsened by persistent limited access to finance, especially for many small, medium, and micro-enterprises (SMMEs), which face difficulties in obtaining capital to invest in modern equipment and technology [2].

With the advent of global trade, persistent gaps in quality control and standards persist, particularly in ensuring consistent product quality and meeting international standards, posing challenges for agro-processors [3]. There is also evidence of issues in the realm of market entry, with significant gaps in opportunities to expand into new markets, both domestically and internationally, which necessitate implementing strategies to overcome trade barriers and comply with regulations.

There is evidence that the design of a business support framework directly addresses the critical, long-standing gaps in South Africa's agro-processing SMME sector [4]. The industry has historically been characterised by market concentration, financial constraints, skills shortages, and difficulties in meeting stringent international standards. These systemic challenges have often left SMMEs with fragmented and ineffective support [5]. Additionally, broader corporate behaviours, such as the transparency and quality of sustainability disclosures, have been shown to influence firm performance and stakeholder trust, adding another layer of complexity to the business environment [6].

The persistent failure to address critical gaps has resulted in missed opportunities for the agro-processing SMMEs and the broader economy [7]. Experiences in similar contexts in Nigeria showed that, without proper support, agro-processing SMMEs with weaknesses in operational cost management are at high risk of failure, leading not only to job losses but also to the stifling of the potential for a more inclusive and diverse agro-processing sector [8]. Similarly, South African agro-processing SMMEs that are excelling in areas such as equipment selection and customer responsiveness are unable to fully capitalise on their strengths without strategic support for market expansion and brand enhancement. This means they often fail to transition from local to national or international markets, limiting their growth potential and the sector's overall contribution to the economy [9]. The lack of a strategic framework has meant that the potential of these agro-processing SMMEs to become innovative leaders and key employees remains largely unrealised.

Guided by Assan [10] and Boru et al. [2], this paper defines innovation as any process-changing tool or approach used in performance management by SMMEs in agro-processing activities. In the industry, an innovation system is also seen as a dynamic process of interaction embedded in specific social, economic, institutional, and policy contexts and driven by multiple stakeholders [11]. These facets also show the existence of many stakeholders who should provide goods and services for the final adoption decision to be made [12]. Understanding innovativeness in this way can therefore be viewed as a toolkit for exploring and unpacking the desired and main behaviour in the innovation-decision processes of individuals (managers) and organisations (SMMEs), as influenced by their environments within a stakeholder platform.

Inspired by the South African experiences reported by Krishnan and Das Nair [13], this paper therefore posits that, to accelerate business resilience, business development innovations must focus on processes to improve performance for South African agro-processing SMMEs. As such, from an economic transformation perspective, Mabugu and Hlongwane [14] further argued that demand-driven approaches need to be used in innovation design and evaluation programmes. These complexities, though they seem to occur in isolation, can in practice occur simultaneously, thereby posing challenges for decision makers in managing firm-level variables as catalysts for business transformation. As alluded

to by Ahimbisibwe et al. [15], an innovation such as adapted robotics-based processing plants, advocating for agro-processing SMMEs in South Africa, can be understood as a multi-actor process.

Specifically, this paper was highly motivated by the reality that designing a business support framework using data is an innovation, given its tailored, data-driven approach, which contrasts with traditional, generic support models. This is particularly significant in South Africa's agro-processing sector, where a lack of targeted support has exacerbated existing gaps. The study aimed to analyse the performance of SMMEs in the Free State province and to design an adaptive business framework that effectively bridges these gaps. It is crucial to bridge them to foster economic growth and job creation, enhance the sector's competitiveness by resolving critical issues such as operational cost management, and ensure the efficient allocation of limited resources to areas with the most tremendous impact.

Current studies on South Africa's agro-processing sector reveal a significant gap in integrated support frameworks for SMMEs [4,16,17]. Although some innovations are noted in the literature by Chitonge [5] and Krishnan and Das Nair [13], extensive evidence shows a lack of a cohesive model that simultaneously addresses key firm-level variables, such as innovation, management practices, and financing [9,18]. Furthermore, there remains a persistent disconnect between high-level entrepreneurship policies and their practical implementation, particularly regarding investments in modern infrastructure and digital technology [17,19]. Building on the initial work of Bowman and Chisoro [16], this study aims to bridge this gap by developing a comprehensive, data-driven firm-level business support framework that guides practitioners in establishing and nurturing resilient agro-processing SMMEs. The following objectives guided this study: (1) to assess the performance of agro-processing SMMEs in the Free State province across a range of key business dimensions; (2) to identify and prioritise critical performance gaps requiring intervention; and (3) to develop a comprehensive, data-driven business support framework that provides targeted strategies for agro-processing SMMEs at different performance levels.

The innovative business development models proposed in this paper bridge this by identifying specific weaknesses, such as significant performance gaps in operational cost management. By moving beyond a one-size-fits-all model, the framework ensures that resources are precisely allocated where they are needed most: providing crisis intervention for struggling agro-processing SMMEs, targeted enhancement for those in the improvement zone, and advanced support to leverage the strengths of high performers. This integrated approach transforms abstract challenges into concrete, actionable strategies, making the support both efficient and highly relevant to the specific needs of the agro-processing SMMEs.

2. Materials and Methods

2.1. Study Area

The study area is the Free State province of South Africa, as indicated in Figure 1. The Free State, formerly known as the Orange Free State, is a province of South Africa. Its capital is Bloemfontein, which is also South Africa's judicial capital. Its historical origins lie in the Boer Republic known as the Orange Free State, later the Orange Free State Province. The study area included the district municipalities of the Free State, including Mangaung, Fezile Dabi, Thabo Mofutsanyana, and Sedibeng, and the towns within these district municipalities, including Heilbron, Parys, Bethlehem, Harrismith, Vereeniging, Deneysville, QwaQwa, Phuthaditjaba, and Thaba Nchu. This study treats the Free State province as a case study to develop and propose a context-specific yet methodologically replicable business support framework.

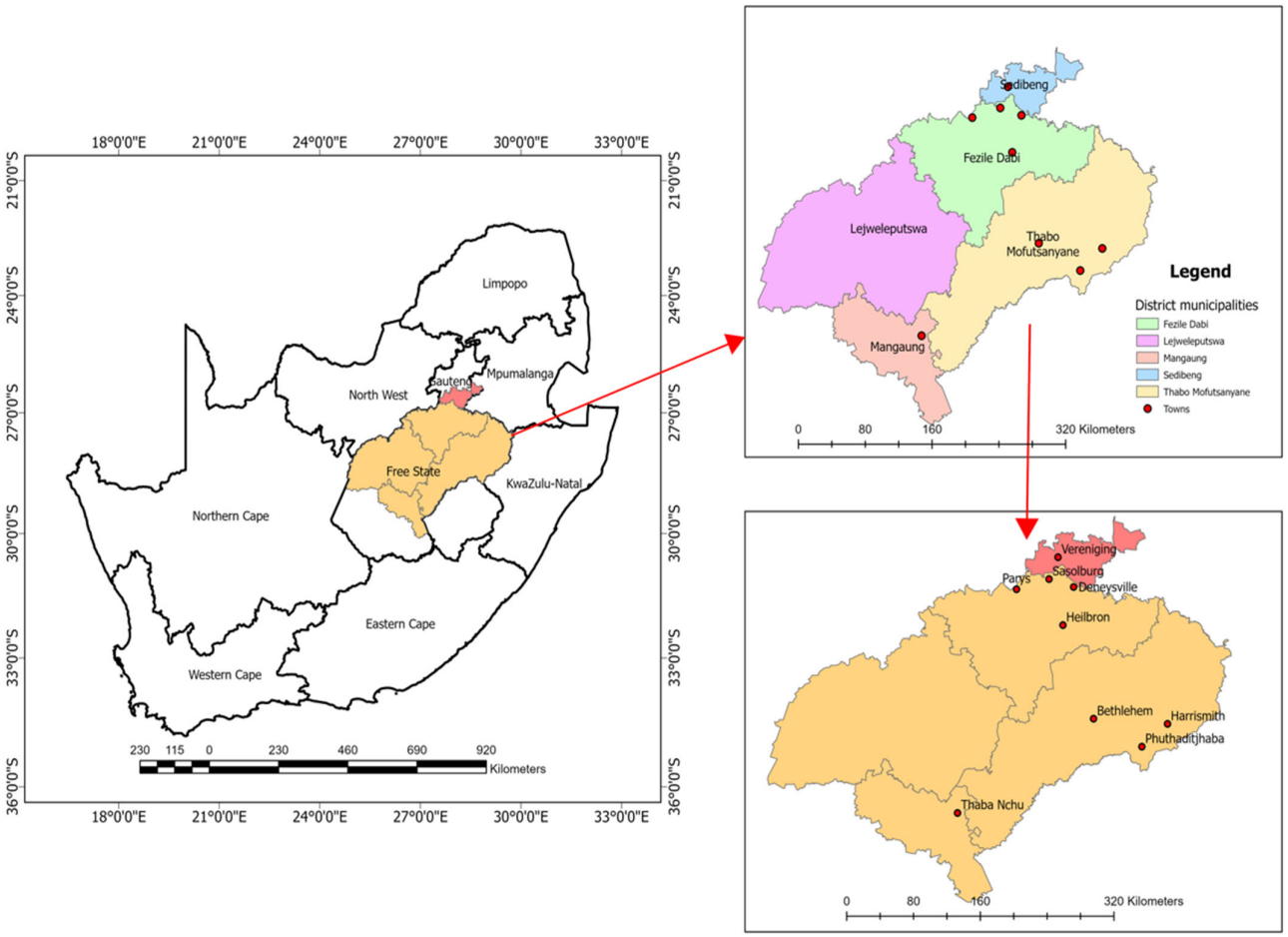

Figure 1. Study area. Sources: Authors.

2.2. Research Design and Sampling Strategy

The paper employed a mixed-methods approach that integrated quantitative and qualitative analysis to assess the performance of agro-processing SMMEs purposively selected for this study in the Free State province of South Africa. This methodology provided a comprehensive understanding of the business support needs and guided the development of a strategic intervention framework.

The approach employed problem tree analysis as the primary diagnostic tool to map firm-level challenges across mechanisation, financing, capacity building, and market networks, while simultaneously examining policy responses within value chains that demonstrate significant SMME participation gaps. This methodological stance enabled cross-sectional investigation of multi-actor perspectives (farmers, SMMEs, development partners, government agencies). It facilitated the identification of evidence-based intervention strategies targeting both micro-level firm operations and macro-level ecosystem support structures in South Africa's Free State agro-processing sector.

Identifying and examining the problem were crucial stages for the key informant interviews, as they enabled all stakeholders and sector experts to map the problem situation. A problem tree, which stakeholders could validate during the policy development process, was used to examine and map the problem situation—the positioning of the integrated business support framework guided by Manasoe et al. [17]. The study put forward a hypothesis that there is a large, untapped reservoir of transformation opportunities in the agro-processing sector and modern agrobusinesses in South Africa. Significant gaps exist in

implementing comprehensive, inclusive support policies that target firm-level investments and capacity to improve SMME performance.

Several areas within the agro-processing system have not been adequately tapped to unlock opportunities for enhanced performance for SMMEs. To understand these, the problem framework was therefore guided by the need to explore challenges in operations (at the firm level) while also acknowledging policy or programme responses that support agro-processing systems in South Africa. This implied tracking the thematic areas identified in the preliminary review: challenges, aspirations, and opportunities.

Indicative conceptual issues that the study further explored within the framework of capacity included key firm-level variables, namely mechanisation, financing, capacity building, and market networks. These thematic problem areas would also inform potential business development and the capacity-strengthening regions presented in the data collection tools. Conceptualising these tools in the business development framework of the SMMEs was essential since this would enable the study to envisage and recommend potential strategies and intervention areas, not only for the SMMEs, but for other supporting partners, including the national and provincial government of South Africa, especially in the Free State province, the private sector, and financing organisations.

Data collection involved stakeholder consultations and technical deliberations, achieved through key informant interviews and targeted forums, to examine further the status, causes, and strategies to address agro-processing issues faced by SMMEs in South Africa. The targeted stakeholders interviewed included farmers, farmer organisations, SMMEs (including cooperatives and private companies), food companies, development partners, and government agencies. These consultations and interviews were based on selected value chains and SMMEs prior to the consultations. A preliminary analysis informed this selection, and particular attention was given to value chains with significant gaps in SMME participation in agro-processing.

Ethical clearance for the protocol was approved by the Research Ethics Committee at the University of the Free State in accordance with the General/Human Research Ethics (GHREC) guidelines and regulations, reference number UFS-HSD 2023/0773. Participants volunteered after the ethical principles were publicly announced. All participants were informed, and they completed and signed a consent form before actively participating in the study.

Using Equation (1) of Krejcie and Morgan [20], determine the sample size and validate using a sample size table:

$$n = \frac{X^2 * N * p(1-p)}{\left(ME^2 * (N-1)\right) + X^2 * p(1-p)} \quad (1)$$

where

n = sample size;

X^2 = chi-square for the confidence interval (CI) of 95% at 1 degree of freedom (3841);

N = population size (number of registered SMMEs), determined to be approximately 125, and thus an infinitely small population;

p = population proportion (assumed to be 0.5 since this would provide the maximum sample size);

ME = Margin of Error (0.5%).

Therefore, the actual sample size for this study was determined using a contingency/attrition rate of 5%, applied to account for non-respondents.

$$n = \frac{1.96^2 * 250 * 0.5(1-0.5)}{(0.05^2 * (250-1)) + 1.96^2 * 0.5(1-0.5)} = \frac{120.05}{1.2704} \quad (2)$$

This results in 94.5 respondents, rounded to 95, for the agro-processor survey. However, given the nature of the smallholder agricultural sector in South Africa, where small businesses engage in multiple livelihood activities, and field-related constraints, including limited willingness to participate among some farmers, data were collected from 88 farmers. Despite this reduction, the sample remains representative of the affected farming population. To assess the impact of this sample reduction, a post hoc bootstrap confidence interval analysis (with 1000 resamples) for key estimates was conducted following Efron and Tibshirani's procedures using the Bias-Corrected and Accelerated (BCa) method, which indicated acceptable precision, confirming that the sample is representative for analysis.

The results were analysed for agreement and disagreement, and a specific statement needed to achieve ≥85% consensus from the expert participants on the response options of must have/essential, good to have/functional, and unnecessary. Each statement also had a free-writing comment section to gather qualitative responses. In relation to the free-text comments, a thematic approach was used to analyse the data by identifying concepts and categories. To ensure authenticity, the supervisors evaluated the groupings and categories [21].

The quantitative analysis focused on the performance data of 88 agro-processing SMMEs across 18 business dimensions. Key metrics were then subsequently derived from this data, including the average agreement scores and the identification of performance gaps. The average agreement score across all dimensions was intended to reflect the average percentage of respondents who agreed or strongly agreed with each dimension's success. This metric was instrumental in categorising dimensions into three performance tiers, as shown in Table 1.

Table 1. Business performance tier classifications.

Tier 1	Tier 2	Tier 3
Excellence Zone, ≥85% agreement	Improvement Zone, 80–84.9% agreement	Critical Intervention Zone, <80% agreement

Sources: Authors' compilations.

A performance gap was also calculated by comparing the highest-performing dimension, equipment selection, with the lowest-performing dimension: operational cost management. This approach highlighted the most critical areas requiring immediate intervention, employed triangulation, and developed a business support framework to translate the findings into a strategic, actionable plan. This framework considered firm-level performance drivers and strategic pillars for integration to guide interventions. Based on the performance tiers, a tailored approach was designed to address specific needs. For instance, the Tier 1 dimensions were assigned the strategy of "Maintain and leverage existing strengths", while Tier 2 was assigned "Targeted enhancement programmes".

In contrast, the critical Tier 3 dimension was assigned a "Crisis Intervention Programme". The strategic actions, such as "Build customer loyalty programmes" for high performers or "Intensive support and funding" for struggling agro-processing SMMEs, provided a roadmap for implementing the findings. This integrated approach ensured that data-driven insights directly led to practical, targeted, and comprehensive support strategies for agro-processing SMMEs. Performance gaps were calculated by comparing the highest- and lowest-performing dimensions.

The three-tier system metric, as also employed by Turner [22] and van Lill and Taylor [23], was instrumental in categorising dimensions into three performance tiers, as shown in Table 1. These thresholds (≥85%, 80–84.9%, <80%) informed by Turner [22] and van Lill and Taylor [23] were established based on a programmatic logic for resource

allocation. They are designed to create a clear triage system: Tier 1 represents a 'maintain and leverage' zone where performance is strong; Tier 2 is an 'enhancement' zone signalling a need for targeted support to prevent decline; and Tier 3 is a 'critical intervention' zone requiring immediate, intensive resources to avert business failure. This approach ensures that support is strategically directed to where it can have the most significant impact.

3. Results

3.1. Summary Statistics for the Key Indicators

Table 2 provides an overview of the agro-processing SMMEs and dimensions analysed in the study. The study assessed 88 agro-processing SMMEs across 18 business performance dimensions, revealing key patterns. The overall average agreement score was 86.7%, indicating generally strong operational performance across the agro-processors in the Free State, notwithstanding limited national policy support. Of the 18 dimensions evaluated, 16 (88.9%) were classified within Tier 1 (≥85% agreement), one dimension (5.6%) in Tier 2 (80–84.9%), and one dimension (5.6%) in Tier 3 (<80%). Equipment selection emerged as the highest-performing dimension (90.3%), while operational cost management recorded the lowest score (76.1%), generating a performance gap of 14.2 percentage points. This gap represents the most marked disparity within the performance structure. While most firms demonstrate strong multidimensional capabilities, 21 firms (23.9%) reported significant weaknesses in operational cost management, whereas 76.1% displayed strong overall performance. This distribution suggests concentrated vulnerability rather than systemic sectoral failure, suggesting appropriate targeted intervention rather than universal intervention.

Table 2. Summary statistics.

Metric	Value	Percentage
Total agro-processing SMMEs analysed	88	100%
Total dimensions assessed	18	100%
Average agreement score	86.7%	–
Highest performing dimension	Equipment selection	90.3%
Lowest performing dimension	Operational cost management	76.1%
Performance gap	Equipment selection vs. cost management	14.2%
Dimensions in Tier 1	16	88.9%
Dimensions in Tier 2	1	5.6%
Dimensions in Tier 3	1	5.6%
Agro-processing SMMEs with cost management issues	21	23.9%
Agro-processing SMMEs with strong performance	67	76.1%

Source: Authors' analysis.

Table 3 outlines a three-tiered approach to support interventions, categorising dimensions by performance. Tier 1 (Excellence Zone): The 16 dimensions in this tier demonstrate strong performance across core business areas. Equipment selection (90.3%), customer responsiveness (89.8%), technology adoption (89.8%), and business support access (89.8%) are the top performers. These strengths provide foundations for competitive advantage and should be leveraged through market expansion, innovation leadership, and peer mentoring programmes. The allocation of 40% of resources to this tier reflects a strategic shift from deficit-focused approaches to performance optimisation.

Tier 2 (Improvement Zone): Maintenance requirements (84.1%) are the sole dimension in this tier, sitting at a critical threshold between adequacy and vulnerability. This dimension connects equipment selection excellence (Tier 1) to the cost management crisis (Tier 3), as poor maintenance accelerates depreciation and reduces efficiency. The 20% resource allocation enables preventive intervention through maintenance training, service provider networks, and digital tracking systems before performance declines further.

Tier 3 (Critical Intervention Zone): Operational cost management (76.1%) represents a fundamental sustainability threat despite excellence in other dimensions. The concentration of this vulnerability among 23.9% of firms (21 out of 88) indicates specific rather than universal risk. The 40% resource allocation, the highest across all tiers, reflects appropriate crisis prioritisation, targeting intensive financial management training, one-on-one mentorship, digital cost tracking with technical assistance, and business restructuring support.

Table 3. Performance tier classification.

Performance Tier	Strategic Considerations for Business Framework			
	Performance Tier	**Firms Affected**	**Intervention Type**	**Resource Allocation**
Tier 1: Excellent zone (≥85 agreement) Count: 16 dimensions Average agreement: 87.9%	Tier 1	88.9% of dimensions	Optimisation and leverage/maintain and leverage existing strengths	40% of resources
Tier 2: Improvement zone (80–84.9% agreement) Count: 1 dimension (maintenance requirement) Average agreement: 84.1%	Tier 2	5.6% of dimensions	Targeted enhancement	20% of resources
Tier 3: Critical intervention zone (<80% agreement) Count: 1 dimension (Operational cost management) Average agreement: 76.1%	Tier 2	5.6% of dimensions	Crisis intervention	40% of resources

Source: Authors' analysis.

3.2. Analysis of Key Business Dimensions of the Support Framework

The results in Figure 2 present an importance matrix plotting performance scores against strategic importance, enabling identification of areas requiring immediate attention versus those performing well. The results indicate that food safety (3.87/4.0) is the strongest-performing area, followed by customer responsiveness (3.84) and the scale of processing operations (3.83). These strengths suggest effective management of operational and quality-related aspects. The lowest-scoring variables are facility planning (3.56), targeted business support for facilities (3.69), and selecting suitable processing equipment (3.68), indicating challenges with infrastructure development and technology adoption.

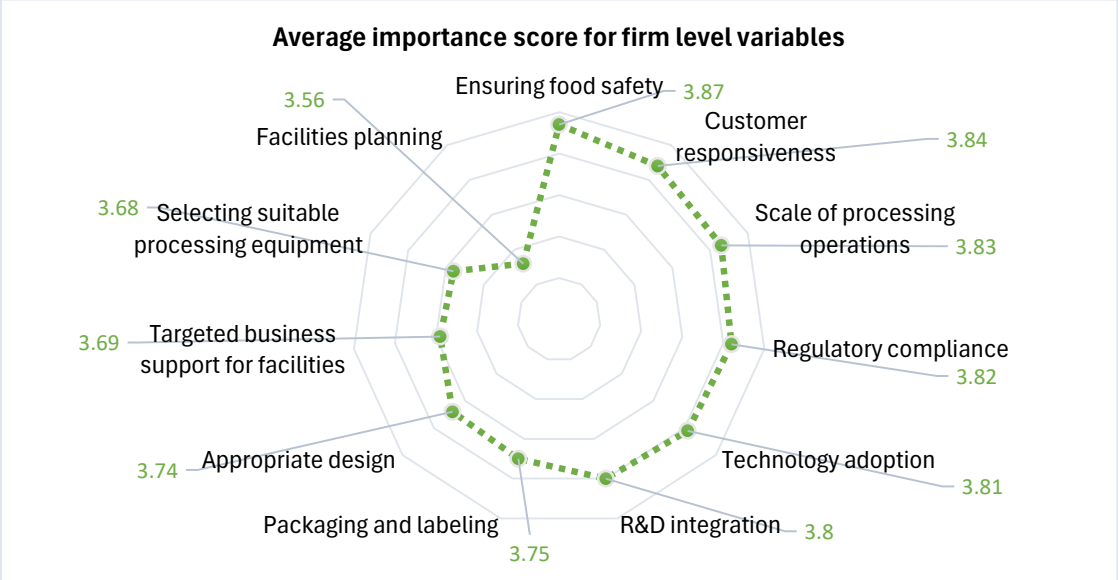

Figure 2. Importance matrix and score for the business development framework. Source: Authors' analysis.

Table 4 provides a comprehensive breakdown of all 18 dimensions, ranking them by their total agreement score. The table shows the distribution of scores for Strongly Agree (SA), Agree (A), and Disagree/Strongly Disagree (D/SD). This result is used to assign each dimension a performance tier and a strategic priority level, guiding specific actions for each area. The dimensions cluster into meaningful groups. Operational excellence dimensions (standards compliance, processing scale, food safety, packaging, business support systems: 87.5–88.6%) demonstrate strong technical and compliance capabilities. The innovation and efficiency dimensions (research and development (R&D) integration, regulatory compliance, and process efficiency: 85.2–86.4%) show solid performance with improvement opportunities. The vulnerable domain of maintenance requirements (84.1%) represents a preventive opportunity, while the critical crisis in operational cost management (76.1%) demands immediate intervention.

Operational cost management (76.1%) poses fundamental sustainability threats despite excellence in other dimensions. The 14.2% gap from equipment selection reveals that agro-processing SMMEs demonstrate sophisticated capital investment capacity but struggle with ongoing financial management. Concentration among 23.9% of agro-processing SMMEs indicates specific rather than universal vulnerability, demanding a differentiated crisis response through intensive financial management bootcamps, one-on-one mentorship pairing struggling agro-processing SMMEs with high performers, digital cost tracking with intensive technical assistance recognising technology alone as insufficient, business restructuring support including temporary subsidies or operational audits, and strategic purchasing training. The 40% resource allocation appropriately prioritises crisis intervention, but production excellence cannot compensate for poor cost management, threatening individual sustainability and broader economic transformation goals.

3.3. Strategic Roadmap for Supporting Agro-Processing SMMEs

Table 5 provides a strategic roadmap for supporting agro-processing SMMEs based on their performance level. The concentration of high performers (67–79%) demonstrates substantial entrepreneurial capacity, enabling reasonable multidimensional performance. The moderate segment (11–24%) requires targeted interventions to prevent stagnation. The struggling concentration (10–24%) represents a specific vulnerability requiring intensive, personalised support. This triage approach ensures that immediate crisis intervention prioritises imminent failure risks (allocating 40% of resources to Tier 3), while strategic enhancement targets high performers for market expansion and innovation leadership.

3.4. Business Support Framework and Matrix

Figure 3 visually represents the overall business support framework. It shows how firm-level considerations (individual, organisational, and institutional) and strategic integration pillars lead to firm-level drivers of performance. The framework concludes with a strategic action plan consisting of three phases: targeted interventions, performance tracking, and collaborative refinement. The ultimate goal was to create resilient and competitive agro-processing SMMEs.

The three-level structure, integrating individual (human resources, technical capacities, leadership), organisational (financing, research, infrastructure), and institutional (policy advocacy, monitoring) dimensions, recognises that SMMEs' performance depends on capabilities across micro-, meso-, and macro-levels.

The five pillars of facility planning, equipment selection, food processing procedures, food safety, and packaging correspond to top-performing dimensions, validating their centrality to competitiveness; equipment selection enables technology adoption, and food safety provides premium market advantages.

Table 4. Overall scores by dimension of the business support framework.

Rank	Dimension	SA (%)	A (%)	Total (%) Agreement	D/SD (%)	Tier	Priority Level	Strategic Action
1	Equipment selection	79.5	10.8	90.3	9.7	Tier 1	Maintain excellence	Leverage for competitive advantage
2	Customer responsiveness	78.4	11.4	89.8	10.2	Tier 1	Leverage strength	Build customer loyalty programmes
3	Technology adoption	78.4	11.4	89.8	10.2	Tier 1	Innovation leader	Digital transformation initiatives
4	Business support access	78.4	11.4	89.8	10.2	Tier 1	Network advantage	Expand support network utilisation
5	Industry standards compliance	75	13.6	88.6	11.4	Tier 1	Competitive edge	Maintain certification excellence
6	Processing scale	76.1	12.5	88.6	11.4	Tier 1	Scale optimisation	Capacity expansion planning
7	Food safety	75	13.6	88.6	11.4	Tier 1	Market differentiator	Premium market positioning
8	Packaging and labelling	73.9	13.6	87.5	12.5	Tier 1	Brand development	Brand enhancement programmes
9	Business support systems	73.9	13.6	87.5	12.5	Tier 1	System strength	Process optimisation
10	Research and development integration	71.6	14.8	86.4	13.6	Tier 1	Innovation base	Innovation partnerships
11	Regulatory compliance	71.6	14.8	86.4	13.6	Tier 1	Legal security	Compliance monitoring systems
12	Overall process efficiency	71.6	14.3	85.9	14.1	Tier 1	Process excellence	Lean manufacturing adoption
13	Productivity enhancement	67.0	18.2	85.2	14.8	Tier 1	Output optimisation	Productivity improvement programmes
14	Facility planning	67.0	18.2	85.2	14.8	Tier 1	Infrastructure ready	Facility optimisation
15	Energy efficiency	67.0	18.2	85.2	14.8	Tier 1	Sustainability gap	Green energy transition
16	Cost effectiveness	69.3	15.9	85.2	14.8	Tier 1	Financial efficiency	Cost optimisation strategies
17	Maintenance requirements	67.0	17.1	84.1	15.9	Tier 2	Operational reliability	Preventive maintenance systems
18	Operational cost management	52.3	23.8	76.1	23.9	Tier 3	Critical Priority	Crisis intervention programme

Source: Authors' analysis.

Table 5. Strategic business framework foundational analysis.

Firm Performance Level	Firms Affected (%)	Immediate Actions	Medium-Term Strategy	Long-Term Vision	Support Type Needed
High performers (SA responses)	67–79%	Market expansion planning	Innovation leadership roles	Export market development	Advanced business support
Moderate performers (A responses)	11–24%	Process optimisation	Peer learning programmes	Technology upgrading	Targeted training programmes
Struggling firms (D/SD responses)	10–24%	Crisis intervention	Basic business training	Stability and growth	Intensive support and funding

Note: SA = Strongly Agree; A = Agree; D/SD = Disagree/Strongly Disagree. Source: Authors' analysis.

Figure 3. Framework for extending business development support. Source: Authors' analysis.

The three drivers, namely operational and financial efficiency, human capital and talent management, and compliance and quality assurance capture dimensions requiring

enhancement or crisis intervention, addressing Tier 3 cost management crisis workforce development challenges, and regulatory compliance maintenance.

The three-phase plan, with targeted interventions, performance tracking, and collaborative refinement, reflects adaptive management that requires iterative learning and operationalizes differentiated, tiered support.

Dual focus integrates resilience (withstanding shocks from supply chain vulnerabilities and climate risks) with competitiveness (capturing opportunities in concentrated value chains), contrasting single-dimension frameworks and recognising that resilience without competitiveness yields stagnation while competitiveness without resilience yields vulnerability.

Guided by the business support framework, this study proposes a conceptual, six-functional, and operational-level intervention framework to guide support for agro-processing SMMEs in the Free State province of South Africa (Table 6). The results show the specific interventions, their target groups, timelines, and expected impacts. It confirms that cost management support is an immediate priority for almost a quarter of agro-processing SMMEs facing this issue. Other interventions, like energy efficiency programmes and maintenance system development, are considered medium-term priorities. Innovation networks and quality certification support are identified as long-term or ongoing efforts.

Table 6. Intervention framework.

Intervention Type	Target Group	Timeline	Expected Impact	Resource Requirement	Success Metric
Cost management support	23.9% of firms	Immediate (0–6 months)	Reduce firm failures	High	Improved cost ratios
Energy efficiency programme	14.8% of firms	Medium-term (6–18 months)	Sustainability gains	Medium	Energy cost reduction
Maintenance system development	15.9% of firms	Medium-term (6–12 months)	Operational reliability	Medium	Reduced downtime
Innovation networks	All firms	Long-term (12–36 months)	Competitive advantage	Low	Innovation adoption rates
Quality certification support	All firms	Ongoing	Market access	Medium	Certification achievements
Technology optimisation	All firms	Medium-term (6–24 months)	Productivity gains	High	Technology utilisation rates

Source: Authors' analysis.

The intervention framework requires shifting from universal to differentiated support policies, prioritising 40% of resources for cost-management crisis intervention targeting 23.9% of vulnerable agro-processing SMMEs. Implementation relies on a coordinated system and robust governance structure.

Delivery mechanism: service delivery will be a coordinated effort involving multiple stakeholders through a hub-and-spoke model, establishing regional business support hubs in key agro-processing clusters across the Free State Provinces of South Africa. These hubs will serve as central points for in-person support and coordination. To reach remote areas, the hubs will be complemented by mobile support units. A digital platform will provide virtual support, enabling remote access to services, training materials, and communication channels. This multi-channel approach ensures broad accessibility and efficiency.

Partnership network: no single entity can execute this framework alone. A network of partnerships is essential for leveraging expertise and resources. Key partners include government agencies such as the Small Enterprise Development Agency, the Small Enterprise Finance Agency, and DALRRD, as well as private-sector entities such as equipment suppliers and technology providers. Academic institutions and research institutes will contribute through research partnerships, while industry associations will facilitate peer learning. This integrated ecosystem will provide comprehensive support services.

Service delivery teams: The framework's success depends on differentiated service delivery teams, with specialists assigned to each tier. Tier 1 agro-processing SMMEs will receive strategic guidance from senior consultants and industry specialists. Tier 2 SMMEs will work with mid-level advisors and process improvement specialists to address performance gaps. Tier 3 SMMEs in crisis will work with crisis intervention specialists and business trainers to stabilise operations. This approach ensures appropriate expertise for specific needs.

3.5. Performance Monitoring and Evaluation Framework

A robust, continuous monitoring framework is critical to the long-term success of this initiative. The framework uses a combination of key performance indicators (KPIs) and regular reviews to measure effectiveness and inform resource allocation.

(a) Key performance indicators

Within this business support framework for agro-processing SMMEs, success shall be measured differently across tiers, reflecting their distinct objectives.

Tier 1 success is measured by metrics such as targeted annual revenue growth, market expansion into new international markets, and the adoption of new technologies and certifications.

Tier 2 success is defined by a firm's progression to Tier 1 performance, an improvement in operational efficiency, and a reduction in downtime and maintenance issues.

Tier 3 success is gauged by crisis resolution, specifically the movement of agro-processing SMMEs from critical to moderate performance ratings, achievement of at least 12 months of sustained operations, and a reduction in costs.

(b) Monitoring framework

The framework incorporates a multi-level monitoring system to ensure constant feedback and adjustment. Monthly tracking will focus on financial indicators, operational efficiency metrics, and programme participation rates to catch issues early. This paper proposes quarterly reviews that will involve the more comprehensive performance of tier assessments and evaluations of programme effectiveness to inform resource allocation adjustments. Finally, an annual evaluation will provide a high-level impact assessment of the entire framework, including firm graduation and progression rates. It will be used to develop policy recommendations for the sector. This data-driven approach is a critical success factor for the framework.

(c) Strategic implementation phases and vision

Though not articulated in this paper, due to challenges in accessing finance data, the financial model of the framework shall be designed to be sustainable and impactful, with strategic budget allocation and clear expected returns on investment. The implementation of this framework will be phased to manage resources and address the most critical needs first.

Phase 1: Crisis intervention (months 1–6). The first six months will focus on a rapid, targeted response to the most vulnerable agro-processing SMMEs. This phase will involve launching the Tier 3 cost management programme and deploying rapid response teams.

Phase 2: System establishment (months 7–18). This phase will see the full deployment of all three-tiered programmes. The partnership network will be activated, and the comprehensive monitoring system will be fully implemented to begin tracking performance.

Phase 3: Optimisation and scaling (months 19–36). Once the framework is fully operational, this final phase will focus on programme refinement based on real-world results. Successful models will be replicated, and sustainability planning will begin to ensure a long-term, lasting impact.

(d) Expected outcomes

This framework is projected to deliver significant outcomes over a three-year horizon. At the firm level, this includes revenue growth for Tier 1 agro-processing SMMEs, a high graduation rate from Tier 2 to Tier 1, and a high stabilisation rate for agro-processing SMMEs in crisis. At the sector level, the framework is expected to increase average performance scores and reduce the percentage of agro-processing SMMEs in critical zones by an average of 3%. This will enhance the Free State's agro-processing sector's global competitiveness and export growth. The economic impact will be substantial, with projections of new jobs and increased agro-processed exports, which will significantly contribute to rural development and economic activity in the province.

4. Discussion

The predominance of dimensions in Tier 1 (88.9%) demonstrates that Free State agro-processing SMMEs possess functional operational capabilities across most business areas. This finding aligns with Manasoe et al. [17], who found entrepreneurship significantly influences SMME performance in South Africa, but contrasts with contexts characterised by widespread operational deficiencies [8] or critical resource constraints [24]. This suggests targeted interventions for the 11.1% of lower-tier dimensions would be more efficient than blanket support programmes.

The 14.2% performance gap between equipment selection (90.3%) and operational cost management (76.1%) reveals that SMMEs excel at capital investment decisions but struggle with ongoing efficiency. This finding directly contradicts Nkosi et al. [25], who found that in Mpumalanga province, South Africa, entrepreneurs perceive Fourth Industrial Revolution equipment as unsuitable for small-scale operations, suggesting regional variations across South African provinces. The weakness in cost management echoes Chitonge [5], who noted declining output in labour-intensive agro-processing due to operational inefficiencies. Policy should therefore maintain effective equipment support programmes while prioritising financial management training and technology-enabled cost tracking systems [2,26].

The concentration of cost management challenges among 23.9% of agro-processing SMMEs indicates specific vulnerability rather than systemic failure, contrasting with Jenane et al. [27], who found African agro-food processors face constraints across multiple domains simultaneously. This aligns with Manasoe et al. [17], who identified production decision making and resource access as critical empowerment domains, implying that foundational elements enable reasonable performance despite specific weaknesses. The tiered support approach aligns with recommendations for tailored business frameworks supporting entrepreneurs with different capacity levels [17], contrasting with universal pathway approaches [28].

Tier 1 Excellence Zone: The 16 dimensions in Tier 1 (average 87.9% agreement) demonstrate that Free State SMMEs possess strategic capabilities that distinguish them from typical African contexts, where agro-processing SMMEs face significant technology and financial constraints [13,16,25]. Food safety (88.6%) emerged as the strongest performer, paralleling findings that technical expertise and market orientation significantly influence SMME performance [29]. This strength-based approach aligns with research demonstrating that innovation capabilities drive competitiveness more effectively than deficit remediation alone [15,30]. Unlike dualistic structures in which only large factories meet export standards [29], Free State SMMEs occupy a strategic middle ground, where existing strengths can be amplified through targeted support. Policy implications include leveraging these strengths through market linkages, digital transformation initiatives that build on equip-

ment selection capabilities [2,26,31], and innovation leadership programmes that connect SMMEs to global value chains [4].

Tier 2 Improvement Zone: Maintenance requirements (84.1%) as the sole Tier 2 dimension sits precariously between excellence and crisis, linking equipment selection excellence (90.3%) to cost management challenges. This gap differs from contexts where equipment access remains primary [25], suggesting successful acquisition but inadequate upkeep capacity. The preventive approach through maintenance training, service provider networks addressing rural isolation [32], and digital tracking systems [33] proves more efficient than post-breakdown crisis management common in agro-processing support [34].

Tier 3 Critical Intervention Zone: Operational cost management (76.1%) poses fundamental sustainability threats despite excellence in other dimensions. This echoes systemic constraints to agricultural finance documented across developing countries [10,33] and cost pressures despite production capabilities [5]. The concentration among 23.9% of agro-processing SMMEs demands a differentiated crisis response through intensive financial management training [35], one-on-one mentorship pairing struggling agro-processing SMMEs with high performers, digital cost tracking with technical assistance [36], and business restructuring support [37,38].

The high-performer concentration (67–79%) demonstrates entrepreneurial capacity, enabling reasonable multidimensional performance. Policy should shift from remedial to strategic enhancement: immediate market expansion connecting agro-processing SMMEs to premium markets [4,39]; medium-term innovation leadership positioning SMMEs as peer mentors [16]; and long-term export development with advanced certification support [5]. The moderate segment (11–24%) requires targeted interventions through process optimisation [29] and peer learning leveraging high performers as knowledge sources [32]. The struggling segment (10–24%) requires intensive crisis intervention, acknowledging resource constraints that prevent self-correction [13,16].

The proposed framework's multi-level integration architecture addresses firm-level, organisational, and institutional dimensions simultaneously, in contrast to firm-only frameworks that neglect enabling environments. This approach recognises that success depends on overcoming systemic constraints in finance, infrastructure, and institutions that have historically limited African agro-processing competitiveness [5,14]. The ultimate objective transcends survival to transform SMMEs into resilient and competitive economic actors that contribute to employment and development [14,40], integrating climate resilience and sustainability imperatives [41]. Long-term competitiveness requires both defensive capabilities that withstand shocks and offensive capabilities that capture premium opportunities in concentrated global value chains [4,42–44].

As a case study, the findings from the Free State provide a methodological outline that can be adapted in other provinces and comparable developing-economy contexts. While the specific performance scores may differ, the approach of using data-driven diagnostics to design a tiered support system is transferable. The framework's emphasis on leveraging existing strengths while targeting critical vulnerabilities is a universally applicable principle for SME support. Moreover, unlike single-dimensional frameworks focusing on finance [4] or technology [25], the proposed framework adopts an integrated architecture that addresses interconnected firm-level dimensions, as evidenced by correlations among cost management, maintenance, and process efficiency. The framework incorporates phased implementation and continuous monitoring as an adaptive system. This blend of a strength-based orientation, empirically grounded tiering, integrated multidimensionality, and adaptive dynamism represents a departure from existing paradigms.

This study, theoretically, contributes to innovation systems research by operationalising multi-level, multi-actor support architectures; extends entrepreneurial ecosystem

theory by integrating micro-, meso-, and macro-level determinants; and provides a nuanced perspective on capability development that recognises both strengths and vulnerabilities. Practically, it offers a replicable methodology for evidence-based resource allocation, operationalises preventive support approaches, provides detailed intervention specifications, incorporates robust governance mechanisms, and enables adaptive management through continuous monitoring. By advancing beyond deficit-focused, one-size-fits-all, single-dimension, and static models, the framework provides a comprehensive approach to fostering resilient and competitive agro-processing SMMEs that can contribute meaningfully to employment creation and economic development [4].

5. Conclusions

This study examined the performance of agro-processing SMMEs in South Africa's Free State province and developed a data-driven, tiered business support framework based on empirical diagnostics. The findings highlight a sector with robust multidimensional operational capacity, achieving an overall average agreement score of 86.7% across 18 business dimensions. Specifically, 89% of these dimensions fall within the excellence zone ($\geq$85%), indicating that most agro-processing SMMEs have functional capabilities in areas such as equipment selection, customer responsiveness, food safety, and technology adoption. However, the analysis also uncovers a critical vulnerability in operational cost management, revealing a significant 14.2% performance gap compared to the highest-performing dimension (equipment selection). This weakness is concentrated among 23.9% of agro-processing SMMEs, suggesting a targeted rather than systemic issue. The coexistence of operational strength and financial management weakness indicates that production capability alone is insufficient for long-term sustainability and competitiveness. By translating these diagnostics into a structured Three-Tier Business Support Architecture, the study advances beyond descriptive assessment to actionable policy design. The proposed framework differentiates support by performance level: maintaining and leveraging strengths (Tier 1), targeted enhancement (Tier 2), and crisis intervention (Tier 3). This differentiated approach ensures efficient resource allocation and avoids the inefficiencies of uniform, one-size-fits-all SME policies.

These findings call for policy support for agro-processing SMMEs in the Free State to adopt a differentiated, performance-based approach rather than uniform interventions. Immediate priority should be given to strengthening operational cost management through targeted financial training, digital cost-monitoring tools, and structured mentorship for vulnerable agro-processing SMMEs. Meanwhile, moderate-performing areas such as maintenance systems require preventive and efficiency-enhancing programmes to prevent future decline. High-performing dimensions, including technology adoption, food safety compliance, and customer responsiveness, should be strategically leveraged to promote market expansion, export readiness, and innovation-led competitiveness. Institutionalising a tier-based monitoring and evaluation system is essential to track firm progression, ensure adaptive resource allocation, and maximise policy impact. Collectively, this structured approach promotes sustainable growth, efficient public investment, and long-term sectoral resilience.

The study also calls for the launch of a "crisis intervention program" targeting operational cost management; the development of a three-tiered business support architecture; the establishment of a preventive maintenance systems programme; the initiation of innovation and technology adoption programmes; and the creation of market expansion and brand enhancement initiatives.

This study presents three primary limitations that constrain generalizability and interpretation of findings. Firstly, the geographic specificity of the Free State province limits the transferability of the results to other South African provinces or African contexts. Secondly,

the cross-sectional design, which captures performance at a single time point, precludes understanding of the dynamic progression pathways by which agro-processing SMMEs naturally transition between struggling, moderate, and high-performing categories. Finally, the sample size of agro-processing SMMEs, while statistically adequate for the estimated population, may inadequately capture heterogeneity across value chains, firm sizes, ownership demographics, and geographic districts within the Free State Province of South Africa.

Based on the above limitation, this research suggests that further longitudinal studies should be conducted to investigate the root causes behind the critically low performance in operational cost management, to track the impact of the proposed three-tiered support architecture, and to also investigate how the strengths of high-performing dimensions, such as equipment selection and customer responsiveness, can be scaled and replicated across the entire agro-processing sector. This could involve case studies of successful agro-processing SMMEs to identify best practices and determine how they can be institutionalised through policy and advanced business support. Further studies should also conduct pilot tests to validate the proposed three-tiered support architecture empirically. This would involve implementing the framework with a cohort of agro-processing SMMEs and rigorously tracking its impact on key performance indicators over time, thereby moving from a conceptual model to an evidence-based intervention.

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Abbreviations

The following abbreviations are used in this manuscript:

A	Agree
CI	Confidence Interval
D	Disagree
DALRRD	Department of Agriculture, Land Reform and Rural Development
GHREC	General/Human Research Ethics
KPIs	Key Performance Indicators
R&D	Research and Development
SA	Strongly Agree
SD	Strongly Disagree
SMMEs	Small, Micro-, and Medium Enterprises

References

1. Sangadji, M.N.; Edy, N.; Rahman, A.; Haryanti, T.; Latifah, A.; Krisnamurti, R.M.; Maiwa, A.; Megasari, D. Collaboration of stakeholders in the development of micro enterprises for sustainable food security in Teluk Bintuni Regency. *Agroland Agric. Sci.* **2024**, *11*, 101–114. [CrossRef]
2. Boru, E.M.; Hwang, J.; Ahmad, A.Y. Governance and Institutional Frameworks in Ethiopian Integrated Agro-Industrial Parks: Enhancing Innovation Ecosystems and Multi Stakeholder Coordination for Global Market Competitiveness. *Economies* **2025**, *13*, 79. [CrossRef]
3. Dhar, A.R. Building climate-resilient food systems through the water–energy–food–environment nexus. *Environments* **2025**, *12*, 167. [CrossRef]
4. Bowman, A. Supermarketisation, agro-industrial concentration and the food system's shrinking interstices: Insights from South African agro-processing. *Glob. Netw.* **2025**, *25*, e12521. [CrossRef]
5. Chitonge, H. The agro-processing sector in the South African economy: Creating opportunities for inclusive growth. In *PRISM Working Paper 2021; Policy Research on International Services and Manufacturing*; University of Cape Town: Cape Town, South Africa, 2021.
6. Ali, K.; Arslan, H.M.; Mubeen, M.; Azeem, H.; Zhen-Yu, Z.; Yushi, J.; Miao, M. From reporting to responsibility: Investigating the influence of sustainability disclosure on earnings management. *Environ. Dev. Sustain.* **2025**, *27*, 30431–30464. [CrossRef]
7. DALRRD (Department of Agriculture, Land Reform and Rural Development). Leveraging Public−Private Partnerships Towards Scaling up Food Systems Solutions in South Africa During and Beyond COVID-19. Pathways to Sustainable Food Systems in South Africa: National and Provincial Food Systems Dialogues. August 2021. Available online: https://www.unfoodsystemshub.org/docs/unfoodsystemslibraries/national-pathways/south-africa/2021-09-01-en-draft-pathway-to-sustainable-food-systems-31-august-2021.pdf?sfvrsn=18492e64_1 (accessed on 2 March 2025).
8. Ejeh, A.O.; Abah, E.A. Microbial safety and entrepreneurial opportunities in agri-food processing among small-scale farmers in Benue State, Nigeria. *BSP J. Multidiscip. Res.* **2025**, *2*, 81–96.
9. Geza, W.; Ngidi, M.S.C.; Slotow, R.; Mabhaudhi, T. The dynamics of youth employment and empowerment in agriculture and rural development in South Africa: A scoping review. *Sustainability* **2022**, *14*, 5041. [CrossRef]
10. Assan, N. Socio-cultural, economic, and environmental implications for innovation in sustainable food in Africa. *Front. Sustain. Food Syst.* **2023**, *7*, 1192422. [CrossRef]
11. Augustine, J.; Umoh, O.J. Reimagining Nigeria's productive economy: A policy review of industrialization, agricultural transformation, and innovation pathways. *Socio-Econ. Policy Stud.* **2025**, *5*, 24–34. [CrossRef]
12. Solangi, Y.A.; Alyamani, R.; Magazzino, C. Assessing the drivers and solutions of green innovation influencing the adoption of renewable energy technologies. *Heliyon* **2024**, *10*, e30158. [CrossRef]
13. Krishnan, A.; Das Nair, R. Supporting Inclusion of Small, Medium, and Micro Enterprises (SMMEs) in Foodtech in South Africa. IDTT Extended Research Brief: Version 1. 2021. Available online: https://www.compcom.co.za/wp-content/uploads/2021/07/CCRED_Foodtech-Brief_29-April-2021_Version-1.docx.pdf (accessed on 15 April 2025).
14. Mabugu, R.E.; Hlongwane, N.W. Modelling South Africa's economic transformation and growth: A prospective and retrospective analysis. *Economies* **2025**, *13*, 191. [CrossRef]
15. Ahimbisibwe, G.M.; Ecel, A.; Nuwagaba, D.; Nakigudde, R.; Mpiriirwe, R.F.; Kiplangat, L. Innovation capabilities and international competitiveness of agro-processing firms in Uganda. *Compet. Rev.* **2025**, *35*, 837–857. [CrossRef]
16. Bowman, A.; Chisoro, S. Inclusive agro-industrial development and sectoral systems of innovation: Insights from South Africa. *Innov. Dev.* **2024**, *15*, 285–314. [CrossRef]
17. Manasoe, B.; Mmbengwa, V.M.; Lekunze, J.N. The influence of capacity building on small-scale agro-processors in South Africa: Lessons for agricultural extension advisory services. *S. Afr. J. Agric. Ext.* **2024**, *52*, 55–84. [CrossRef]
18. Jacobs, P.T.; Mbanda, V.; Mtyapi, S. Funding South Africa's food and nutrition policy: Estimates for the 2018–2022 funding cycle. *S. Afr. J. Sci.* **2025**, *121*, 20502. [CrossRef]
19. Mbatha, B. Digital divide: A phenomenon of unequal adoption of technology by SMMEs in the agribusiness sector in South Africa. *Commun. J. Commun. Sci. S. Afr.* **2024**, *43*, 64–75. [CrossRef]
20. Krejcie, R.V.; Morgan, D.W. Determining Sample Size for Research Activities. *Educ. Psychol. Meas* **1970**, *30*, 607–610. [CrossRef]
21. Sapkota, M. Debating research philosophy in political science: A critical outlook. *Int. Res. J. Multidiscip. Scope* **2025**, *6*, 497–508. [CrossRef]
22. Turner, W.P., IV; Pe, J.H.; Seader, P.E.; Brill, K.J. *Tier Classification Defines Site Infrastructure Performance*; Uptime Institute: New York, NY, USA, 2006; pp. 1–19.
23. van Lill, X.; Taylor, N. The validity of five broad generic dimensions of performance in South Africa. *SA J. Hum. Resour. Manag.* **2022**, *20*, 1844. [CrossRef]

24. Chitja, J.; Schmidt, S.; Ojo, T.; Tamako, N.; Ndlovu, P.; Mudau, F.N.; Mthuli, N.; Dlamini, S.; Ndwalane, S. *Entrepreneurial Risk Linked to Water Quality, Water Security for Urban-Based Farming And Agro-Processing*; WRC Report No. 2024, 3150/1/24; Water Research Commission: Pretoria, South Africa, 2024.
25. Nkosi, M.; Agholor, A.I.; Olorunfemi, O.D. Agro-investments among small farm business entrepreneurs in the era of the fourth industrial revolution: A case in the Mpumalanga province, South Africa. *Adm. Sci.* **2024**, *14*, 85. [CrossRef]
26. Das Nair, R.; Nontenja, N. Digital Technology Adoption in Agro-Processing Value Chains. CCRED-IDTT Work. Pap. 2022/07. Centre for Competition Regulation and Economic Development, University of Johannesburg. 2023. Available online: https://static1.squarespace.com/static/52246331e4b0a46e5f1b8ce5/t/6459fb205f1a892fe32d11e2/1683618599943/Working+Paper+7+Digital+Technology+Adoption+in+Agro-processing+Value+Chains_05+May+2023.pdf (accessed on 24 October 2025).
27. Jenane, C.; Ulimwengu, J.M. Agro-parks as drivers of the African food processing sector: Review of conditions for success. In *ReSAKSS ATOR 2022*; Jenane, C., Ulimwengu, J.M., Tadesse, G., Eds.; AKADEMIYA2063: Kigali, Rwanda; International Food Policy Research Institute (IFPRI): Washington, DC, USA, 2022; pp. 92–106.
28. Anihouvi, S.E.L.; Ganyo, K.K.; Kpadonou, G.E.; Edoh, R.; Sogbui, C.M.; Lamien, N. Strategic pathways for applying food processing principles in the implementation of nutrition-smart and nutrition-sensitive agriculture in West Africa. *Proceedings* **2025**, *118*, 18. [CrossRef]
29. Kwaku, A.R.; Hui, X.; Samuel, A. Unlocking opportunities in agro-industrialization and agro-processing for inclusive growth in Ghana. *Cogniz. J. Multidiscip. Stud.* **2024**, *4*, 357–395. [CrossRef]
30. Kamau, J.W.; Wandiga, E. An empirical survey on the effect of strategic resources on performance of agribusiness companies listed at the Nairobi Securities Exchange in Kenya. *Int. Acad. J. Innov. Leadersh. Entrep.* **2025**, *2*, 382–403.
31. Smidt, H.J.; Jokonya, O. A framework to develop technopreneurs in digital agriculture value chains in South Africa. *J. Foresight Thought Leadersh.* **2023**, *2*, 13. [CrossRef]
32. Kele, T.; Dzansi, D. Exploring the entrepreneurial micro-ecosystem: Agribusiness among youth in rural South Africa. *Int. J. Appl. Res. Bus. Manag.* **2024**, *5*, 243–256. [CrossRef]
33. Neboh, N.D.; Mbhele, T.P. Supply chain design dimensions for supply chain resilience in the South African fast-moving consumer goods retail industry. *Afr. J. Manag.* **2021**, *7*, 58–81. [CrossRef]
34. Thaba, S.C.; Seseni, L.; Mbohwa, C.; Madonsela, N. The state of emerging agro-processors in South Africa: A Case of Limpopo Province. In Proceedings of the 14th Annual International Conference on Industrial Engineering and Operations Management (IEOM), Dubai, United Arab Emirates, 12–14 February 2024.
35. Khan, F.U.; Nouman, M.; Negrut, L.; Abban, J.; Cismas, L.M.; Siddiqi, M.F. Constraints to agricultural finance in underdeveloped and developing countries: A systematic literature review. *Int. J. Agric. Sustain.* **2024**, *22*, 2329388. [CrossRef]
36. Inuwa, M.L.; Ali, H.Y. Assessment of CRM and E-marketing strategies on agri-SMEs performance in Bauchi State, Nigeria. *Afr. J. Manag. Bus. Res.* **2024**, *14*, 10–24. [CrossRef]
37. Nazifi, B.; Muhammad, A.A.; Aliyu, A.; Musa, M.B. Agribusiness Enterprise Performance in Developing Countries: Review of Dimensions and Determinants. *Afr. J. Manag. Bus. Res.* **2025**, *19*, 414–427. [CrossRef]
38. Worku, M.A.; Debela, K.L.; Mudde, H.L. Do existing competitiveness models comprehensively assess the competitiveness context of the contemporary agribusiness sector? A systematic review. *Cogent Bus. Manag.* **2024**, *11*, 2389466. [CrossRef]
39. Manafe, M.W.N.; Rizani, A.; Purnawati, E. Analysis of the influence of technical expertise, market orientation, social capital, and innovation on the performance of micro and small businesses in the technology sector. *Int. J. Bus. Law Educ.* **2024**, *5*, 983–995. [CrossRef]
40. Sihlobo, W.; Kapuya, T. Recasting the Jobs Debate in South Africa's Agricultural Sector. Brenthurst Found. Discuss. Pap. 02/2025, Johannesburg, South Africa. 2025. Available online: https://www.thebrenthurstfoundation.org/uploads/e7c45966-d256-46fa-833e-3ada82040ad1.pdf (accessed on 24 June 2025).
41. Olarewaju, O.O.; Fawole, O.A.; Baiyegunhi, L.J.; Mabhaudhi, T. Integrating sustainable agricultural practices to enhance climate resilience and food security in sub-Saharan Africa: A multidisciplinary perspective. *Sustainability* **2025**, *17*, 6259. [CrossRef]
42. Shafi, A.A.; Muchie, M.; Sedebo, G.T. South Africa's agro processing trade in value added, global value chains (GVCs) perspective. *Afr. J. Sci. Technol. Innov. Dev.* **2022**, *14*, 852–861. [CrossRef]
43. Khan, M.; Behrendt, K.; Papadas, D.; Arnold, L. Strategic sustainable development: The role of intermediaries in managing the sustainability compliance of a multi-tier crop agri-food supply chain. A developing economy perspective. *Sustain. Dev.* **2025**, *33*, 992–1013. [CrossRef]
44. Gray, H. The role of regional demand in pathways of agro-industrialization: Evidence from small maize milling firms in Tanzania. *Glob. Netw.* **2025**, *25*, e70020. [CrossRef]