

Supply chain bottlenecks and farmer profitability: A dynamic capabilities and value chain analysis of Zimbabwean horticulture

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Abstract: *Purpose.* Horticultural farmers in Mashonaland East Province, Zimbabwe, operate within a supply chain widely acknowledged as inefficient, yet prior research has treated individual bottlenecks such as transport, storage, or market access as isolated problems. This study addresses that gap by providing a holistic, context-specific analysis of how interrelated supply chain failures jointly undermine farmer profitability. *Methodology.* A qualitative multiple-case study design was adopted, in which 20 purposively selected farmers, each treated as an individual case, were interviewed using semi-structured protocols. Primary data were triangulated with a systematic review of 34 policy and grey literature documents. Interview transcripts were thematically analysed in NVivo 12 following Braun and Clarke's six-phase method, guided jointly by Dynamic Capabilities Theory (DCT) and Value Chain Analysis (VCA). *Results.* The analysis identifies six interlocking constraints: unreliable transportation networks, near-total absence of cold storage, high and volatile operational costs, severe market information asymmetry, intensifying climate change impacts, and limited adoption of modern farming technology, that reinforce one another rather than operating independently. Together they form a self-perpetuating cycle that erodes profit margins and steadily depletes farmers' capacity to adapt. *Theoretical contribution.* The study shows that combining dynamic capabilities theory with value chain analysis yields more explanatory power than either framework alone: VCA identifies precisely where value is lost along the chain, while DCT clarifies why farmers lack the sensing, seizing, and reconfiguring capacity to respond, revealing how meso-level systemic failures constrain micro-level adaptability and profitability. *Practical implications.* For policymakers, the findings support coordinated investment in rural infrastructure, decentralised cold storage, and digital market

platforms rather than single-sector interventions. For practitioners and extension services, they point to the need for climate-smart training and market-literacy programs delivered together, not separately. For rural communities, addressing these constraints has direct implications for household income stability, reduced postharvest waste, and food security. The study also offers development agencies a diagnostic framework for identifying which combinations of constraints most urgently require simultaneous, rather than sequential, intervention.

Keywords: horticulture, supply chain management, farmer profitability, dynamic capabilities theory, value chain analysis, postharvest losses, climate-smart agriculture

Sustainable Development Goals (SDGs): **SDG 1:** No poverty; **SDG 2:** Zero hunger; **SDG 8:** Decent work and economic growth; **SDG 9:** Industry, innovation and infrastructure; **SDG 12:** Responsible consumption and production; **SDG 13:** Climate action

1. Introduction

The horticultural sector in Zimbabwe reflects the country's agricultural potential, as it has been a major contributor to gross domestic product (GDP) and a vital source of foreign currency earnings (Muzondo & Pashapa, 2025). At the centre of this are local smallholder farmers, who play an indispensable role in producing a wide array of fruits and vegetables for local consumption and niche export markets (Muzondo et al., 2025). Their economic viability, however, depends on the functional efficiency of the supply chain links which coordinate the flow of highly perishable produce from farm gate to final consumer (Albarracín-Gutiérrez et al., 2024).

The horticulture supply chain forms complex, time-sensitive networks of value-added activities such as input procurement, production, postharvest handling, transportation, storage, and marketing (Yu & Nagurney, 2024). Each link can significantly enhance or reduce farmer profitability. For example, easy access to good-quality seeds and fertilisers is a prerequisite for good yields; similarly, cold-chain logistics remain non-negotiable for maintaining product quality and reducing postharvest losses, which can be catastrophic (Kilelu et al., 2024). On the other hand, Mhona et al. (2025) also argue that weak and fragmented supply chain links invariably translate into higher transaction costs and significant deterioration of horticultural products, which ultimately erodes the narrow margins available to local farmers.

Despite this latent potential, horticultural farmers in Zimbabwe have continued to operate in an environment characterised by persistent, systemic constraints. A critical review of recent literature highlights challenges such as limited access to finance, inadequate infrastructure, and severe asymmetries in market information, among other barriers (Muzondo & Pashapa, 2025; Tamene, 2020). Other countries face similar challenges. However, further research is needed on how these factors interact within Zimbabwe's specific socio-economic environment and vegetable value chains. Much prior work has been fragmented, focusing on isolated bottlenecks such as transport or storage inefficiencies without developing an overarching analytical framework that links these failures to local-level farmer profit outcomes.

This study addresses that gap through a holistic, system-wide analysis of the interrelated supply chain elements that determine economic resilience for farmers in Mashonaland East Province, which is a major vegetable production hub in Zimbabwe. The central research question guiding the inquiry is: How do particular supply chain links and their interaction influence the profitability and economic resilience of local horticultural farmers in Mashonaland East Province, Zimbabwe?

This paper is organised as follows: a review of relevant literature; a description of the theoretical framework; a detailed methodology; an integrated presentation and discussion of findings, supported by a summary analytical table; conclusions; and integrated recommendations for policy, practice, and theory.

2. Literature review

2.1. Conceptualising supply chain links in horticulture

The supply chain links, as operationally defined in this study, involve the sequential and parallel activities, processes, and actor relationships involved in transforming and delivering horticultural products from raw material to the end consumer (Yu & Nagurney, 2024). In this context, these elements form a fluid network that includes, but is not limited to, agricultural input supply, on-farm cultivation practices, harvesting, postharvest handling, sorting, grading, packaging, transportation, storage (including the cold chain), and multi-tier marketing and retail (Muzondo et al., 2025). However, managing it is not solely a logistics concern; it is a strategic imperative for ensuring the seamless flow of perishable goods, preserving intrinsic quality, minimising physical and economic losses, and ultimately capturing value (Shi, Zhang & Qin, 2024). In this context, the attributes underpinning efficient supply chain links include cost optimisation, consistent quality maintenance, and equitable market access, supported by robust risk-mitigation mechanisms (Burgess et al., 2023). Inefficiency within any single link, for instance, poor road infrastructure, creates negative externalities that ripple throughout the entire chain, an acute phenomenon in developing economies (Wudad, Naser & Lameso, 2021).

2.2. Deconstructing local farmer profitability

For this study, local farmer profitability is defined operationally as the net financial return a farmer earns from his or her horticultural enterprise after fully accounting for all attendant direct and indirect costs of production, logistics, and marketing. According to Muhoyi & Mbonigaba (2022), it represents the most important indicator of economic viability and sustainability for the farming household. This profitability does not rely on a single variable; a complex matrix of interrelated factors influences it. Included in these are unstable and high production costs, access to lucrative markets, availability and cost of finance and credit, the rate of adoption of modern and appropriate farming techniques, access to timely and correct market intelligence, and the reliability of transportation networks (Waweru & Olweny, 2023; Olwande & Mathenge, 2020). Farmers who are integrated into robust and well-functioning supply chains are demonstrably better positioned to access higher-value markets, ensure the timely delivery of fresh, high-quality produce, and negotiate fairer prices, thereby building a positive feedback loop which enhances profitability and incentivises reinvestment (Nyakudya et al., 2024; Bellemare & Novak, 2022).

2.3. Identifying the research gap

While the individual challenges facing Zimbabwean farmers are well-acknowledged-such as those documented by Mugambiwa (2025) on climate and Mhona et al. (2025) on logistics- the literature often treats these as discrete issues. Research that employs a holistic, system-level framework to analyse how challenges such as poor transport, storage deficits, information asymmetry, climate stress, and technological stagnation interact to constrain profitability remains scarce. This study bridges this gap by using dynamic capabilities theory and value chain analysis not as separate lenses, but as integrated tools to diagnose the systemic nature of the problem in the under-researched context of Mashonaland East's horticulture sector.

3. Theoretical framework

To capture the complexity of the problem, this study is grounded in two interconnected frameworks: Dynamic Capabilities Theory (DCT) as the overall theoretical paradigm and Value Chain Analysis (VCA) as the supporting analytical framework.

3.1. Dynamic capabilities theory

The Dynamic Capabilities Theory proposed by Teece, Pisano, and Shuen (1997) offers a strong account of how smallholder farm businesses can build, reconfigure, and combine internal and external

capabilities to navigate and flourish amid rapid change. This theory is pertinent when analysing Zimbabwean smallholder farmers, who operate amid hyper-volatility, including economic volatility, climate shocks, and extremely volatile market trends (Muzondo & Pashapa, 2025). The theory states that sustainable competitive advantage and profitability derive not from fixed resources in themselves, but from the micro-foundations of dynamic capabilities: (1) sensing capability to identify opportunities and threats (e.g., identifying market trends, predicting climate patterns), (2) seizing capability to exploit these opportunities (e.g., marshalling resources to adopt a new technology or sign a new contract), and (3) reconfiguring capability to rearrange tangible and intangible assets to remain competitive (e.g., switching crops, forming cooperatives) (Teece et al., 1997). This paper applies this theory to describe how breakdowns in the supply system, such as information blackouts and poor infrastructure, directly undermine these basic capabilities, ensnaring farmers in a cycle of low profitability and resilience.

3.2. Value chain analysis (VCA)

Value chain analysis (VCA), as developed by Porter (1985), was used as an integrative analytical model to break down the horticultural supply chain into discrete but interlinked value-adding activities. VCA provides a methodical way to identify where and how value is created and, more importantly, where it is eroded or captured by other actors, thereby reducing farmer profits (Albarracín-Gutiérrez et al., 2024). The model fits perfectly with the systemic perspective of this study, as it enables the investigation of the interdependencies among the different actors: input suppliers, farmers, transporters, wholesalers/retailers, along with the overarching systemic factors: physical infrastructure, policy environment, and technology platforms that bear jointly on competitive advantage (Nyakudya et al., 2024). By mapping the primary activities of a firm inbound logistics, operations, outbound logistics, marketing and sales, and service- and the support activities technology development, human resource management, firm infrastructure, and procurement VCA provides a detailed framework through which specific bottlenecks, such as inefficient transportation systems in outbound logistics or inadequate cold chains in technology development, disproportionately impact the profit maximisation drives of farmers in Mashonaland East. Integrating VCA with dynamic capabilities theory enabled a structurally detailed diagnosis through VCA and an explanatorily powerful account of actors' adaptive potential within that structure through dynamic capabilities.

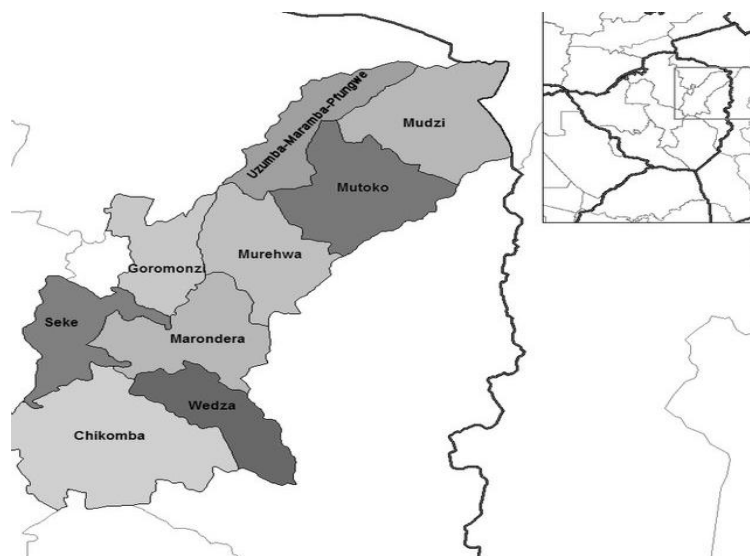
4. Methodology

4.1. Research philosophy and design

This study is rooted in an interpretivist philosophical stance, which holds that social phenomena such as farmer decision-making and supply-chain experiences are best understood through the meanings and interpretations that participants themselves attach to their circumstances (Saunders et al., 2018). Consistent with this position, the study adopted a qualitative, multiple-case design (Yin, 2018). In this study, each of the 20 participating farmers constitutes an individual case, selected to represent diverse supply-chain configurations, agro-ecological conditions, and market-access situations across the province. This case-level granularity enables both within-case depth and cross-case comparative analysis, which is appropriate for exploring how supply-chain dynamics play out differently across varying horticultural and logistic environments. The study is cross-sectional and captures conditions during the 2023–2024 horticultural season.

4.2. Study area

Figure 1: Ecological and administrative map of Mashonaland East Province, Zimbabwe, showing the six study districts (Marondera, Murehwa, Mutoko, Hwedza, Chikomba, and Goromonzi)



Source: Internet (2025)

The study was conducted in Mashonaland East Province, Zimbabwe, a province nationally renowned for its contribution to the country's horticultural output. The province's varied agro-ecological conditions allowed for a rich comparative analysis of ecological and agro-economic conditions that support different crops. These areas, including Marondera and Murehwa, have nutrient-retentive clay loam soils ideal for leafy greens and tomatoes, while areas such as Goromonzi and Mutoko have free-draining sandy loams suitable for root vegetables like potatoes and carrots (Zimbabwe Meteorological Services, 2023). Ecological diversity thus provided an ideal setting to explore how supply chain dynamics play out across different horticultural products and logistical environments.

4.3. Sampling strategy and participant selection

This study sought to include active horticultural farmers based in Mashonaland East Province with at least five years of experience in their business operations. Purposive sampling was used for the selection of 20 participants and inclusion in this study because they were required to fulfil the following explicit inclusion criteria: (i) a minimum of five years of hands-on commercial horticultural farming experience; (ii) active involvement in multiple stages of the supply chain, from production to at least the first point of sale; and (iii) operation within one of the six key horticultural districts, which are Marondera, Murehwa, Mutoko, Hwedza, Chikomba, or Goromonzi. The sample size was not determined through statistical power but through data saturation, whereby new interviews no longer yielded new thematic insights or categories, which is usually reached between 15-20 interviews among homogeneous groups (Saunders et al., 2018).

4.4. Data collection

Primary data collection involved conducting semi-structured and in-depth interviews from December 2023 to March 2024. Findings from the literature review and the theory guided the interview schedule. The interviews explored input sourcing, production challenges, postharvest handling, transportation logistics, market access, information sources, and perceived climate change impacts. We conducted interviews in the participants' mother tongue, Shona, and they lasted between 45 minutes and one hour. With participants' permission, we recorded, transcribed, and translated all interviews

into English. We cross-checked the transcripts for accuracy and supplemented them with detailed field notes capturing non-verbal cues and contextual observations.

We gathered secondary data through a systematic documentary analysis of grey and academic literature to strengthen credibility and contextual robustness. Searches were conducted across Google Scholar, Scopus, JSTOR, and African Journals Online using terms including horticulture supply chain Zimbabwe, postharvest losses Zimbabwe, smallholder farmer profitability Africa, and digital agriculture Sub-Saharan Africa. The search was delimited to publications from 2018 to 2025 to ensure contemporaneity. The study also reviewed policy documents from Zimbabwe's Ministry of Lands, Agriculture, Fisheries, Water, and Rural Development, as well as thematic reports from FAO, the World Bank, and IFAD (Hussein & Suttie, 2022). For the documentary analysis, 34 documents were included based on their relevance to the six identified thematic areas; these are integrated analytically throughout the findings and discussion sections using concurrent triangulation.

4.5. Data analysis

Data collection and analysis were an iterative process, conducted side by side. Thematic analysis of interview transcripts was informed by Braun and Clarke's (2006) systematic six-phase method, which includes: (1) familiarisation with the data through a process of repeated, active reading of the transcripts; (2) initial coding from the raw data; (3) collation of codes into broader patterns; (4) review and refinement of preliminary themes; (5) definition and naming of themes that capture the essence of the meanings; and (6) writing the report in a manner that integrates interpretive narratives with quotations that illustrate the argument. NVivo 12 software was employed to manage, code, organise, and retrieve qualitative data systematically, enhancing auditability.

Secondary data were analysed using qualitative content analysis to identify overlapping themes, policy positions, and contextual evidence, which were then integrated with primary findings through concurrent triangulation. Specific information, for example, on unaffordable transportation costs given by farmers, was supported with additional evidence related to inconsistency in fuel prices and poor road networks (Wudad, Naser & Lameso, 2021; Burgess et al., 2023). Academic literature on digital exclusion and market information systems also strongly supported farmers' frustration with information asymmetry (Nyakudya et al., 2024; Gumbi, Gumbi & Twinomurinzi, 2023). Triangulating research methodologies enabled a holistic and authentic appraisal of challenges faced by horticultural value chains that a single research strategy could not have achieved, resulting in a high level of evidence integration.

4.6. Trustworthiness and rigour

Multiple procedures ensured the trustworthiness of the qualitative findings. Credibility was strengthened through prolonged field engagement over four months, concurrent triangulation of primary and secondary data, and member checking, in which the researcher shared a summary of preliminary findings with five key participants for validation. Thick descriptions of the research environment and participant selection criteria support transferability, allowing readers to judge the extent to which the findings can be generalised to similar contexts. The study's dependability is supported by an audit trail that included the raw data, codebooks, and all memos stored in NVivo. The study's confirmability was supported by the researcher's reflexive journal, which reflected his positionality in the Zimbabwean agricultural context. Intercoder reliability was assessed through independent coding of a 20% random sample of transcripts by a second researcher, achieving a Cohen's kappa coefficient of 0.79, indicating substantial agreement.

4.7. Ethical considerations

The appropriate institutional review board approved the ethical conduct of this research before data collection. All participants provided written informed consent, were assured of their right to withdraw at any time without penalty, and were made aware of the intended use of their contributions. This paper guarantees anonymity through pseudonyms, referring to participants only by the district where they reside (for example, "A farmer from Murehwa"). Audio recordings and transcripts are stored

securely and will be destroyed five years after publication, in accordance with institutional data governance protocols.

5. Findings and discussions

This section presents an integrated analysis of the six crucially interlinked constraint categories that emerged from the data analysis. Theme development drew on direct quotes from participants' interviews, supported by a literature review, and interpreted through the DCT and VCA frameworks. The discussion makes explicit connections between empirical results and theory; specifically, the thematic structure reflects these connections. This section concludes with a summary analytical table (Table 1).

5.1. Poor transportation networks: The primary artery of commerce clogged

Transportation inefficiencies emerged as a key constraint crippling the first mile of supply. Farmers constantly reiterated that dilapidated road infrastructure, specifically the prevalence of degraded gravel and earth roads in remote farming areas, causes longer travel times, increased costs related to maintaining vehicles, and, finally, high freight charges. A farmer based in Uzumba-Maramba-Pfungwe elaborated:

"The Murewa–Madicheche road is a death trap for our produce. A trip to Harare that should take two hours, takes over four hours and the transporters charge us almost double because of the constant wear and tear on their vehicles. This comes straight out of our pockets."

These sentiments align with secondary evidence that poor road conditions and long distances to market consistently delay transport, raise costs, and reduce the capacity to move produce at profitable scales (Shi, Zhang & Qin, 2024; Tamene, 2020). From a value-chain perspective, this reflects a breakdown in outbound logistics – one of the core primary activities. From a dynamic capability perspective, unreliable transportation erodes farmers' ability to respond promptly to emerging market opportunities. As a result, most are pushed into a weak bargaining position, where circumstances often force them to sell their produce locally at low prices or lose lucrative urban markets altogether (Olwande & Mathenge, 2020). Uniquely, this study found that the problem is compounded in Mashonaland East by the simultaneous weakness of multiple district-level roads, creating a province-wide bottleneck rather than isolated local failures, which is a systemic dimension not fully captured by prior single-district studies in Zimbabwe

5.2. Limited storage infrastructure: The perishability paradox

Another important finding was the complete absence of cold storage facilities in most cases, resulting in huge losses after harvesting, particularly for perishable foods such as tomatoes, leafy vegetables, and berry fruits. Without such facilities, farmers' plans to store food crops in preparation for sale at higher off-season prices remain out of the question. As one of the respondents in Murewa noted:

"We harvest our tomatoes knowing that without a proper cold room, a big proportion of them is bound to be soft or rotten even before we negotiate for the price. The only place we store them is a grass-thatched hut, which gives us shade but no cooling. It is heart-aching when you see your hard work and investment just rotting away."

This observation is strongly supported in the literature, which identifies poor cold-chain logistics management as one of the greatest inhibitors of achieving horticulture benefits and a major contributor to food loss and wastage in Sub-Saharan Africa (Kilelu et al., 2024; Jambo & Mwambi, 2021). The problem is not confined to rural areas, as the study found that even in major urban markets like Mbare Musika, infrastructure is grossly inadequate. A vendor reported:

"We sleep next to our tomatoes and covo to guard them from theft, but the lack of cooling means the quality deteriorates drastically overnight. By dawn, we are already at a disadvantage, forced to lower prices."

As Waweru and Olweny (2023) note, this issue affects both the marketability and longevity of the produce. In terms of VCA, cold storage is a critical technology-support service, and its absence leads to systematic value destruction. In terms of dynamic capabilities theory, farmers' inability to store produce becomes an obstacle to reconfiguring their sales process to market conditions; they are forced to sell their produce under duress. This interaction between infrastructure absence and adaptive incapacity represents a locally specific form of the supply-chain-profitability nexus that the existing literature has not yet fully articulated.

5.3. High operational costs: The profit margin erosion

All farmers mentioned ever-increasing operating costs. These rising costs stem from several factors, including the high cost of imported inputs, volatile fuel prices, and higher transport costs due to poor roads, as mentioned earlier. A farmer in Mutoko made a very revealing statement:

"The maths is simple and brutal. After I pay for fertiliser, pesticides, packaging, and transport, there is very little profit left, if any. Most seasons, I am just toiling to break even. There is no capital to expand or even to try a new crop."

Secondary information shows that highly fragmented value chains and intermediaries increase costs and reduce the final price paid to the primary producer. As Mhona et al. (2025) and Mmbando et al. (2016) note, more intermediaries raise transaction costs and ultimately press prices down. Zimbabwe's macroeconomic context, characterised by economic instability and sharp currency volatility, compounds this further: input prices can escalate dramatically within a single season, creating financial risks that render cost-benefit planning unreliable (Muzondo & Pashapa, 2025). From a DCT perspective, this cost volatility directly undermines sensing: farmers cannot meaningfully evaluate future input costs or production scenarios, precluding rational planning. In contrast to prior studies that treat cost pressures as primarily exogenous, this study finds that the supply-chain structure itself amplifies them, particularly the transport inefficiencies documented in Section 5.1, suggesting that infrastructure investment would generate compounding returns across multiple constraint domains.

5.4. Market information asymmetry: Navigating in the dark

The study confirmed that, because of a sudden lack of up-to-date, accurate, and accessible market information, farmers cannot regularly make rational production and marketing decisions. Power imbalances caused by information asymmetry lead power-hungry intermediaries and traders to exploit farmers brutally. A farmer from Murehwa had this to say:

"We plant what we know, not what the market needs. We then spend money to get our produce to Harare, and then find out that there is an oversupply in the market and prices have fallen through the ground. The customers coming to the farm know all this and make us very low offers, which we cannot do anything about."

This corroborates the findings of Nyakudya et al. (2023) and Zeng et al. (2020), which concluded that digital exclusion and poor information flows result in high value leakage, with producers receiving prices 20 to 40% lower than the prevailing market average. This was estimated to be a critical barrier, since weak network coverage, high data costs, and digital illiteracy are blamed for the limited penetration and adoption of ICT-based market platforms such as EcoFarmer in rural areas (Choruma et al., 2024; Tadesse & Bahiigwa, 2015). In DCT, this poses a serious obstruction that disrupts the sense-making process, as farmers fail to recognise market conditions and therefore miss opportunities. One unique outcome of this study is identifying information asymmetry as a double barrier: it hinders strategic decision-making while enabling the other party to reap gains. This suggests that market

information interventions should be designed not only to improve farmer access, but also to restructure the power dynamics within which that information is used.

5.5. Climate change: The pervasive risk multiplier

Climate change became an omnipresent risk multiplier, worsening virtually all other threats rather than being just one risk among others. First, farmers noticed more irregular rainfall patterns, mid-season droughts, and increased diseases and pests. As one farmer from Hwedza stated, in a very clear-cut way:

"The traditional rain calendar is now useless. The rains start late and end abruptly. We plant according to the old patterns and crops fail because of moisture stress at critical stages."

These statements confirm observations from secondary sources that, over the past two decades, rainfall patterns in Zimbabwe have worsened, and temperatures have increased. These climatic changes introduce serious uncertainty into planting cycles and result in considerable yield losses in major horticultural crops (Mugambiwa, 2025). Farmers also said they were spending an increasingly large share of their income on pesticides to control pests such as the fall armyworm, whose distribution and intensity are linked to climate change (Aryal et al., 2020; Ntwari et al., 2024). Within DCT, this constantly reactive posture demands adaptation to novel threats rather than proactive resilience-building, which directly depletes seizing and reconfiguring capabilities. A key contribution of this study is showing that climate change does not operate independently of supply-chain failures; it exploits pre-existing infrastructure weaknesses (inadequate irrigation, absent cold storage) to produce compounded losses. This interaction effect has been underappreciated in previous single-domain analyses of climate risk in Zimbabwean agriculture.

5.6. Lack of modern farming technology: Stuck in a traditional cycle

The high reliance on traditional, labour-based agriculture was perceived to be the major determinant of productivity, efficiency, and adaptive capacity limitations. Generally, farmers using hand power, bucket irrigation, and low-input tools are highly responsive to environmental shocks and limit their activities to a very small scale. A farmer in Marondera had this to say:

"When rains fail, we irrigate with buckets from shallow wells. It is backbreaking and inefficient. We cannot afford drip irrigation or a pump, so our capacity is severely hampered. We simply pray for rain."

Secondary literature identifies poor adoption of improved technologies such as drip irrigation, mechanisation, and improved seed varieties as a key driver of low productivity and high unit production costs in smallholder agriculture (Mhona et al., 2025; Khonje & Manda, 2022; Dube & Guveya, 2020). Barriers to adoption include high initial capital costs, absence of knowledge-based financing products, and weak technical support (FAO, 2022; Masere & Worth, 2021). In relation to DCT, technological immobility limits the capacity to reconfigure systems, as farmers cannot restructure their agricultural operations or increase resilience to climate change and productivity. Critically, however, this research reveals that the technology obstacles not only coexist with but reinforce the five other constraint areas. For example, a lack of irrigation technology makes farmers more susceptible to climate change (Section 5.5), while insufficient digital literacy skills exacerbate information asymmetry in the marketplace (Section 5.4). This interconnection suggests that technology interventions must be bundled with complementary financial and extension support to generate meaningful impact.

5.7. Summary of findings

Table 1 below provides a consolidated summary of the six thematic areas identified in this study, presenting for each: the main empirical issue identified, a representative participant quotation, the theoretical interpretation through DCT and VCA lenses and the primary practical implication.

Table 1: Summary of findings: Supply chain bottlenecks, theoretical interpretations, and practical implications

Theme	Main Empirical Issue	Representative Quote	Theoretical Interpretation (DCT/VCA)	Practical Implication
Poor Transportation Networks	Dilapidated feeder roads cause delays, high freight charges, and restricted market access.	"The Murewa–Madicheche road is a death trap for our produce. A trip to Harare that should take two hours takes over four."	Undermines outbound logistics (VCA) and erodes seizing capability (DCT).	Rehabilitate feeder roads; establish PPP-funded transport hubs.
Limited Cold Storage	Near-total absence of cold chain infrastructure triggers catastrophic postharvest losses.	"We harvest our tomatoes knowing that without a proper cold room, a big proportion will rot before we negotiate a price."	Fails VCA technology support activity; collapses reconfiguring capability (DCT).	Develop solar-powered, decentralised cold storage hubs in production zones.
High Operational Costs	Multiple intermediaries, imported inputs, fuel volatility, and currency instability erode margins.	"After I pay for fertiliser, pesticides, packaging, and transport, there is very little profit left, if any."	Raises transaction costs throughout the chain (VCA); disrupts sensing and planning capabilities (DCT).	Incentivise local input production; regulate intermediary chains; stabilise input pricing.
Market Information Asymmetry	Lack of real-time price data forces uninformed production decisions and leaves farmers as price-takers.	"We plant what we know, not what the market needs. By the time we arrive in Harare, prices have fallen through the ground."	Systemic value leakage in marketing/sales (VCA); blocks sensing capability (DCT).	Scale ICT-based market platforms; expand rural mobile network infrastructure.
Climate Change Impacts	Erratic rainfall and new pests disrupt planting cycles and increase input expenditure.	"The traditional rain calendar is now useless. The rains start late and end abruptly."	Exogenous shock amplifying all other VCA bottlenecks; forces reactive rather than proactive DCT responses.	Reorient extension services towards climate-smart agriculture; subsidise weather insurance.
Limited Technology Adoption	Reliance on manual methods and traditional inputs restricts productivity and climate resilience.	"When rains fail, we irrigate with buckets from shallow wells. We cannot afford drip irrigation."	Weak technology support (VCA) prevents capability reconfiguration (DCT).	Develop accessible financing for irrigation and mechanisation; strengthen technical extension.

Source: Authors' own construction from field data and theoretical analysis.

6. Conclusion and recommendations

The integrated theoretical framework proved particularly well suited to capturing this complexity: VCA precisely identifies the links where value is lost, while DCT explains why farmers lack the adaptive capacity to counteract these structural failures. Together, they demonstrate that the core problem is not simply what farmers face, but why they are systemically unable to respond, a

contribution that advances the theoretical treatment of supply-chain-profitability dynamics in developing-economy agrifood systems.

What distinguishes the Mashonaland East case from comparable contexts in the African literature is the province-wide, simultaneous nature of multiple bottlenecks, which forecloses the partial adaptive strategies such as switching transport routes or adjusting planting calendars that farmers in settings with fewer concurrent constraints can employ. This finding underscores that single-intervention approaches are likely to be insufficient, and that effective policy must address multiple constraint domains concurrently.

6.1. Policy and practice recommendations

The following integrated recommendations are based on the findings:

6.1.1. Coordinated infrastructural investment

Policymakers should invest in integrated rural infrastructure in a coordinated manner, not only rehabilitating key feeder roads but also creating public-private partnerships (PPPs) that lead to decentralised, renewable energy-powered cold storage hubs and irrigation infrastructure. For example, an investment in smallholder solar-powered drip irrigation should be treated as a complementary priority because of its cross-cutting role in addressing both technological stagnation and climate vulnerability.

6.1.2. Digital and financial inclusion

There is an urgent need to develop and scale up accessible digital platforms for real-time market information, weather forecasts, and advisory services (Ayim et al., 2022; Miine et al., 2023). At the same time, financial institutions must be incentivised to develop tailored products that address chronic credit constraints in asset financing for irrigation equipment and warehouse receipt systems among smallholder farmers (Balana et al., 2020; Coulter & Onumah, 2002).

6.1.3. Strengthening extension services

Agricultural extension needs to be reoriented towards farmer dynamic capability building: training in climate-smart agriculture (CSA) practices, digital literacy, financial management, and facilitating stronger market linkages, possibly through the promotion of farmer cooperatives (Olabanji & Chitakira, 2025; Baudron & Giller, 2022; Atinaf, Molla & Anteneh, 2021).

6.2. Theoretical and research recommendations

Future research using dynamic capabilities theory in smallholder agriculture should aim to develop and validate context-specific metrics for sensing, seizing, and transforming capabilities at the household level. Integrating VCA with institutional theory could further clarify how formal and informal institutions govern value chains and either enable or constrain the development of dynamic capabilities. Researchers should continue refining the integrated VCA and dynamic capabilities framework used here by testing its applicability in other agricultural subsectors and geographical contexts in order to enhance generalisability.

7. Study implications, limitations, and future research

7.1. Implications

These results have far reached implications. For policymakers, they underline that interventions in isolation are doomed to fail and that a multi-sectoral approach to agricultural development is required. For practitioners or non-governmental organisations (NGOs) and development agencies, the study underlines the need for programmes which can address multiple constraints simultaneously.

Socially, addressing these supply chain constraints is key to reducing poverty, improving nutrition, and supporting sustainable rural development. Theoretically, the research supports integrating firm-level strategy theory with sectoral economic analysis to diagnose development problems.

7.2. Limitations

The main limitation of the current study is its geographical focus on one province; thus, while it provides depth, generalisability to all regions of Zimbabwe cannot be assumed. Moreover, the qualitative design, although rich in explanatory power, cannot quantify the magnitude of relationships between variables, such as the specific percentage impact of transport cost on profitability.

7.3. Future research directions

Building on these limitations, future research should:

- Use a mixed-methods approach to compare agro-ecological provinces across Zimbabwe, quantifying challenges and regional variability.
- Research scalability and business models for low-cost, off-grid technologies such as solar-powered cold storage and mobile irrigation systems.
- Investigate emerging technologies, such as blockchain, to improve traceability, reduce information asymmetry, and increase smallholders' access to finance.
- Longitudinally study how the farmers' dynamic capabilities evolve as a consequence of particular policy interventions or technological innovations.

Addressing these interlinked challenges requires an integrated, theoretically driven approach that ensures Zimbabwe unlocks the full potential of horticulture for sustainable economic growth, improved livelihoods, and the attainment of broader national development aspirations.

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Data availability statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

AI Usage Declaration

Generative AI tools were used for language editing, formatting support, and manuscript-structure refinement. The author reviewed and approved all content and accepts full responsibility for the submitted work.

Conflicts of Interest

The authors declare no conflict of interest.

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