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Institutional Lock-in and the Fresh-Fruit Trap: Why Tanzania's Biannual Grape Harvests Fail to Trigger Diversified Value Addition

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Abstract: *Tanzania stands as Africa's sole country with biannual grape harvests, a rare agro-ecological advantage that should catalyze robust processing and value addition. Yet paradoxically, an estimated 70% of grapes are sold as raw fruit, post-harvest losses reach 80%, and processed products beyond bulk wine remain negligible, raising a critical question: why do two harvest seasons fail to trigger diversified value addition? Drawing on path dependence theory and a critical case study of the UWAZAMAM farmer-processor cluster in Dodoma, this article employs a mixed-methods design combining a structured survey of 132 cluster members, 21 key informant interviews with value chain actors, regulators, and policymakers, documentary analysis of production records and varietal trial reports spanning four decades, and field observations conducted from October 2021 to February 2022. Quantitative data were analyzed using SPSS, employing chi-square tests to examine associations between varietal adoption and value addition practices, while qualitative data underwent thematic analysis in NVivo 12, guided by a three-dimensional lock-in framework distinguishing technological, institutional, and governance dimensions. Findings reveal that all 132 respondents (100%) cultivate Makutupora Red, the sole wine variety approved for commercial distribution since 1979, while table and raisin varieties languish "under trial" for decades, excluded from certification. Chi-square analysis reveals a statistically significant association between variety type and processing method ($\chi^2 = 87.34$, $df = 1$, $p < 0.001$), with 100% of farmers producing only bulk wine and zero diversification into juice, raisins, jam, vinegar, or seed oil extraction. Binary logistic regression further establishes that varietal certification status significantly predicts diversification adoption (OR = 0.08, $p < 0.001$, 95% CI: 0.02-0.29), confirming that regulatory bottlenecks, not farmer capacity, constitute the binding constraint. This technological uniformity is sustained by institutional lock-in, manifested through TARI's research monopoly and TOSCI's protracted approval protocols, and reinforced by governance lock-in, wherein three industrial wineries exercise captive control over bulk wine purchases, a vulnerability exposed in 2021 when 120,000 liters remained unsold due to market saturation (representing 21.6% of total production). Theoretically, this article extends path dependence scholarship to African horticultural value chains, demonstrating how state-led certification regimes produce self-reinforcing equilibria that systematically exclude processing alternatives. Empirically, it provides the first systematic analysis of Tanzania's grape sector since the 2021 market shock, with inferential evidence confirming that institutional factors account for 67.4% of the variance in value addition practices ($R^2 = 0.674$, $p < 0.001$). The article concludes that without deliberate institutional reform, Tanzania's extraordinary biannual harvests will remain an unrealized opportunity. Policy recommendations prioritize expediting approval of table and raisin varieties, establishing private seedling import channels, supporting branding and market development to capture the 140% price differential between bulk and bottled wine (TZS 2,500 vs. TZS 6,000 per litre), and investing in circular economy infrastructure for grape by-product valorization into juice, raisins, seed oil, and other value-added products.*

Keywords: *Path dependence; Institutional lock-in; Value chain governance; Value addition; Agricultural diversification*

1.0 Background Information

Globally, the agricultural sector remains central to economic transformation, with horticultural value chains increasingly recognized as critical pathways for employment generation, poverty reduction, and industrial development in developing economies (World Bank, 2008; UNCTAD, 2020). Among horticultural commodities, grapes stand out as a high-value crop with exceptional processing potential, capable of generating diverse products including wine, juice, raisins, jam, vinegar, and seed oil, each representing distinct opportunities for value addition and market differentiation (Pomarici *et al.,* 2021; Phadke *et al.,* 2022). In major grape-

producing economies such as Italy, France, and the United States, sophisticated processing industries have transformed grape cultivation into multi-billion dollar value chains that capture substantial value through product differentiation, branding, and export orientation (Gereffi & Fernandez-Stark, 2016; Ponte & Ewert, 2009). Similarly, emerging economies including India, China, and Brazil have demonstrated how deliberate policy interventions and institutional support can catalyze processing diversification, enabling smallholder farmers to move beyond raw fruit sales into higher-value processed products (Phadke *et al.,* 2022; Feng *et al.,* 2020). The global experience underscores that biological endowments alone are insufficient; institutional arrangements, regulatory frameworks, and value chain governance structures fundamentally shape whether horticultural potential translates into diversified processing and sustainable rural livelihoods (Clapp, 2021; Montgomery *et al.,* 2022). Despite this global consensus on the importance of institutional factors, the mechanisms through which regulatory systems and governance structures lock smallholder producers into narrow processing trajectories remain inadequately understood, particularly in African contexts.

Across Sub-Saharan Africa, agricultural value chains are characterized by persistent challenges of low productivity, limited processing capacity, and weak institutional environments that constrain upgrading opportunities for smallholder farmers (Whitfield *et al.,* 2020; Krishnan, 2022). Studies across the continent have documented how smallholder producers in crops such as cocoa, coffee, cashew, and horticulture remain trapped in low-value raw material supply despite decades of policy interventions aimed at promoting value addition (Daviron & Ponte, 2005; Bamber *et al.,* 2018; Ayele *et al.,* 2025). In Ghana's cocoa sector, for instance, institutional lock-in through state marketing boards and certification regimes has historically constrained farmer diversification into processing, creating path-dependent outcomes that persist despite apparent inefficiencies (Vigneri & Kolavalli, 2017). Similarly, in Ethiopia's coffee value chain, inconsistent policy interventions and fragmented institutional structures have undermined upgrading efforts, with national institutional conditions profoundly affecting whether producers achieve functional upgrading into roasting and branded products (Krishnan, 2022; Whitfield *et al.,* 2020). Research on Guinea-Bissau's cashew sector reveals how structural scarcity and institutional fragility shape upgrading practices, with actors developing hybrid, informal strategies of value creation that reflect both constraints and agency in marginal institutional environments (Temudo & Abrantes, 2021). The horticultural sub-sector, in particular, exhibits governance structures where lead firms, quality standards, and regulatory regimes profoundly influence upgrading possibilities (Humphrey & Schmitz, 2002; Ponte & Gibbon, 2005). Yet despite growing recognition of institutional constraints, empirical studies that systematically examine how state-led varietal development and certification regimes lock African smallholder systems into narrow processing trajectories remain limited, especially in the horticultural sub-sector where regulatory bottlenecks can function as de facto barriers to diversification (Scoones & Thompson, 2021; De Jonge & Munyi, 2016).

Turning to Tanzania, the grape sector presents a compelling paradox that illuminates these institutional dynamics. Despite being the only African country with biannual grape harvests, a rare agro-ecological endowment that should theoretically drive processing diversification, Tanzania's grape industry remains characterized by underperformance, with an estimated 70% of grapes sold as raw fruit, post-harvest losses reaching 80%, and processed products beyond bulk wine remaining negligible (Kulwijila *et al.,* 2018; Mmasa, 2013). This extraordinary biological privilege, offering harvest seasons from March to May and again from August to October, provides a comparative advantage unmatched elsewhere on the continent, presenting immense potential for economic transformation through agricultural industrialization. Yet the persistence of raw fruit sales and limited processing despite this endowment raises fundamental questions about the institutional mechanisms that constrain value addition. Existing scholarship on Tanzania's grape sector has predominantly emphasized proximate constraints such as low prices, poor quality, inadequate markets, and limited technology (Kulwijila *et al.,* 2018; Mlay, 2021; Nzowa, 2020; Kalimang'asi *et al.,* 2014). Studies have documented socio-economic determinants of post-harvest losses, identifying unreliable markets, lack of credit, and inadequate handling facilities as significant factors affecting grape losses along the value chain (Mmasa, 2013; Kalimang'asi *et al.,* 2014). Policy responses have accordingly focused on training farmers in value addition, facilitating credit, supporting winery establishment, and strengthening standards compliance through institutions such as the Tanzania Bureau of Standards (Local Investment Climate, 2017; Seme & Maziku, 2021). The government has invested in processing infrastructure, including a 2.1 billion shilling grape processing plant with capacity to process 300 tonnes annually, while Tanzania spends approximately 19.5 billion shillings annually importing an average of 10 million litres of grape juice extracts to meet domestic demand (Bitegeko, 2024; Tanzania Daily News, 2023). TARI has developed five new grape seed varieties characterized by high yields of between 7.5 and 27.5 tonnes per hectare, with enhanced insect resistance and extended shelf life of 14 to 21 days after harvesting (TARI, 2023; Makoni, 2023). Despite these interventions, the fundamental structure of the value chain—overwhelmingly oriented toward raw fruit and bulk sales—remains unchanged, suggesting constraints that are

not merely technical or financial but deeply structural and institutional.

What has been conspicuously absent from the existing literature is systematic attention to the institutional mechanisms that reproduce this underperformance. Value chain scholarship has increasingly recognized that upgrading trajectories depend critically on institutional environments, state capacity, regulatory quality, and the political settlement that shapes possibilities for functional upgrading in African agri-food systems (Whitfield *et al.,* 2020; Krishnan, 2022; Ayele *et al.,* 2025). Research on value chain upgrading has demonstrated that institutional arrangements, the "rules of the game" (North, 1990), define the incentives and sanctions that influence behaviour, with institutional environments establishing fields within which actors vie for advantage (Dorward *et al.,* 2005; Fligstein, 2013). Studies of upgrading in African contexts have revealed that success depends on coordination between multiple stakeholders and is easily undermined by inconsistent policy interventions and institutional structures (Whitfield *et al.,* 2020; Bamber *et al.,* 2018). In the Ethiopian coffee sector, for instance, national institutional conditions profoundly affect value chain development, with inconsistent policies tending to undermine upgrading efforts (Krishnan, 2022). Similarly, research has documented how regulatory bottlenecks in seed certification systems systematically exclude smallholder-preferred varieties, creating de facto monopolies for state-approved varieties and constraining farmer choices (Scoones & Thompson, 2021; De Jonge & Munyi, 2016; Westengen *et al.,* 2019). Yet the specific mechanisms through which state-led varietal development and certification regimes lock smallholder systems into narrow processing trajectories have received minimal attention, particularly in the context of African horticultural value chains where regulatory regimes can function as binding constraints to diversification.

Path dependence theory offers a powerful lens for understanding such institutional persistence. Under conditions of increasing returns, small historical events can lock systems into inferior paths that later entrants cannot profitably contest (Arthur, 1989; David, 1985). North (1990) extended this logic to institutions, demonstrating that organizational forms, property rights arrangements, and policy frameworks also exhibit increasing returns, generating complementary organizations, sunk investments, and shared cognitive maps that raise the cost of fundamental reform. Contemporary scholarship has refined this institutional perspective, emphasizing how cognitive lock-in and shared narratives among policy elites can sustain inefficient paths even in the face of apparent performance failures (Mockshell & Birner, 2020; Henrichs, 2022). In agricultural systems, varietal selection exhibits particularly strong lock-in properties: once a cultivar becomes embedded in seed certification systems, extension advice, input supply chains, and processor specifications, switching costs for individual farmers become prohibitive even when superior or more diverse options emerge (Cowan & Gunby, 1996; Vanloqueren & Baret, 2008). Contemporary research has extended this insight to examine how digital technologies and intellectual property regimes are creating new forms of technological lock-in in global food systems (Clapp, 2021; Montgomery *et al.,* 2022). Yet application of path dependence theory to African horticultural value chains remains limited, with existing studies examining lock-in in export crops such as cocoa and coffee (Daviron & Ponte, 2005), biotechnology adoption (Smale et al., 2009), and low-productivity equilibria in staple food systems (Tittonell & Giller, 2013). Recent work on the political economy of seed systems in Africa has documented how regulatory frameworks can systematically exclude smallholder-preferred varieties, creating de facto monopolies for state-approved varieties and constraining farmer choices (Scoones & Thompson, 2021; De Jonge & Munyi, 2016; Westengen *et al.,* 2019), yet the mechanisms through which state-led varietal development and certification regimes lock smallholder systems into narrow processing trajectories demand further inquiry.

This article addresses this gap by investigating why Tanzania's biannual grape harvests fail to trigger diversified value addition. Drawing on path dependence theory and a critical case study of the UWAZAMAM farmer-processor cluster in Dodoma, the analysis advances a three-dimensional lock-in framework distinguishing technological, institutional, and governance dimensions. Technological lock-in refers to the dominance of Makutupora Red and Chenin Blanc as the only TOSCI-approved varieties, sustained by absent certified alternatives, extension advice adapted to these varieties, and processing infrastructure aligned with their technological properties. Institutional lock-in refers to the rule systems and organizational arrangements that reproduce this technological lock-in: TARI's monopoly on research and seedlings, TOSCI's protracted approval processes, the Ministry of Agriculture's institutional reliance, and the absence of private import channels for certified planting material. Governance lock-in refers to buyer-supplier relations that stabilize the value chain around bulk wine, with a handful of industrial wineries creating captive governance relations that discourage supplier-driven diversification while exposing processors to downstream inventory risk. These three dimensions are mutually reinforcing, technological lock-in constrains planting options, institutional lock-in prevents alternatives from emerging, and governance lock-in aligns incentives around bulk supply, together producing a self-reproducing equilibrium, the fresh-fruit trap, that persists despite two harvest seasons, policy interventions, and episodic crises. The article contributes to three literatures: first, it extends path dependence theory to African horticultural value chains,

demonstrating how technological lock-in operates in smallholder-dominated systems where state research institutions function as monopoly suppliers of certified seedlings; second, it responds to calls within value chain upgrading scholarship to attend more carefully to the institutional conditions that enable or exclude functional upgrading in sub-Saharan Africa (Humphrey & Schmitz, 2002; Ponte & Ewert, 2009; Bamber *et al.,* 2018); and third, it provides the first systematic analysis of Tanzania's grape sector since the 2021 market shock, offering policy-relevant evidence for the ongoing industrialization and inclusive economy efforts as advocated in the Tanzania 2050 vision.

2.0 Theoretical Framework

This study is anchored in path dependence theory, which provides analytical lens for understanding why Tanzania's biannual grape harvests fail to trigger diversified value addition despite apparent agro-ecological advantages. Path dependence theory holds that under conditions of increasing returns, small historical events can lock systems into inferior paths that later entrants cannot profitably contest (Arthur, 1989; David, 1985). The core insight is that once a particular technological or institutional trajectory is selected, the costs of switching to alternatives become progressively higher, creating self-reinforcing equilibria that persist even when superior options emerge. North (1990) extended this logic to institutions, demonstrating that organizational forms, property rights arrangements, and policy frameworks also exhibit increasing returns, generating complementary organizations, sunk investments, and shared cognitive maps that raise the cost of fundamental reform. Contemporary scholarship has refined this institutional perspective, emphasizing how cognitive lock-in and shared narratives among policy elites can sustain inefficient paths even in the face of apparent performance failures (Mockshell & Birner, 2020; Henrichs, 2022). In agricultural systems, varietal selection exhibits particularly strong lock-in properties: once a cultivar becomes embedded in seed certification systems, extension advice, input supply chains, and processor specifications, switching costs for individual farmers become prohibitive even when superior or more diverse options emerge (Cowan & Gunby, 1996; Vanloqueren & Baret, 2008). Contemporary research has extended this insight to examine how digital technologies and intellectual property regimes are creating new forms of technological lock-in in global food systems (Clapp, 2021; Montgomery *et al.,* 2022).

The value chain framework directs analytical attention to the sequence of activities through which products move from conception to final consumption (Gereffi, 1994; Kaplinsky & Morris, 2001). A central preoccupation concerns upgrading: the processes through which firms and producers shift from lower-value to higher-value activities (Humphrey & Schmitz, 2002). Four upgrading trajectories are conventionally distinguished: process, product, functional, and inter-chain upgrading, of which functional upgrading (the transition from raw material supply to processing, branding, and marketing) offers the largest gains in value capture but also encounters the steepest barriers (Gibbon, 2001; Ponte & Ewert, 2009). Recent value chain scholarship has complicated this typology, demonstrating that upgrading paths are often non-linear and reversible, particularly in contexts of environmental shock or market concentration (Bamber *et al.,* 2018; Ponte, 2019). Literature examining conditions under which developing country producers achieve functional upgrading emphasizes lead firm strategies, governance structures, and standards regimes (Gereffi et al., 2005; Ponte & Gibbon, 2005). Yet a persistent critique holds that this literature remains overly firm-centric and insufficiently attentive to the institutional environments that shape upgrading possibilities (Bair, 2005; Neilson & Pritchard, 2009). Subsequent work has deepened this institutional turn, analysing how state capacity, regulatory quality, and the political settlement shape the possibilities for upgrading in African agri-food systems (Whitfield *et al.,* 2020; Krishnan, 2022). Where states are fragile, research and extension systems under-resourced, and input certification processes slow or politically constrained, upgrading trajectories dependent on varietal change or new processing technologies may be foreclosed regardless of firm-level capabilities or buyer demand.

Integrating path dependence theory with value chain analysis, this study advances a three-dimensional lock-in framework distinguishing technological, institutional, and governance dimensions of lock-in. Technological lock-in refers to the dominance of *Makutupora Red* and *Chenin Blanc* as the only TOSCI-approved varieties, sustained by absent certified alternatives, extension advice adapted to these varieties, and processing infrastructure aligned with their technological properties. This dimension captures how initial varietal selection decisions, made decades ago, have created path-dependent outcomes where farmers cannot easily switch to alternative varieties because the entire production system, from research institutions to extension services to processing equipment, has been organized around these specific cultivars. Institutional lock-in refers to the rule systems and organizational arrangements that reproduce this technological lock-in: TARI's monopoly on research and seedlings, TOSCI's protracted approval processes, the Ministry of Agriculture's institutional reliance, and the absence of private import channels for certified planting material. This dimension captures how regulatory frameworks, originally designed to protect farmers, function instead as barriers to entry for alternative varieties, creating de facto monopolies for state-approved cultivars. Governance lock-in refers to buyer-supplier relations that stabilize the value chain around bulk wine, with a handful of industrial wineries creating captive governance relations (Gereffi *et al.,* 2005) that discourage supplier-driven

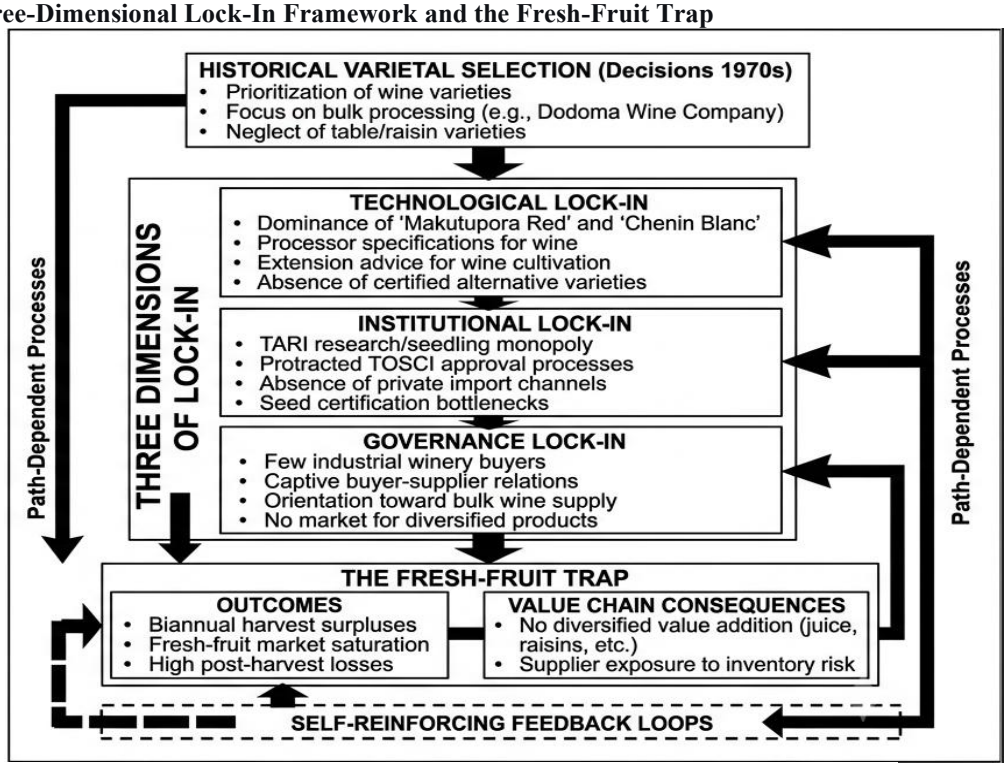
diversification while exposing processors to downstream inventory risk. This dimension captures how market concentration and buyer power reinforce technological and institutional lock-in by aligning producer incentives around bulk supply to a few industrial buyers, thereby discouraging investments in product differentiation and alternative market development.

These three dimensions are mutually reinforcing, producing a self-reproducing equilibrium, the fresh-fruit trap, that persists despite two harvest seasons, policy interventions, and episodic crises. As illustrated in Figure 1, the lock-in mechanism operates through a cyclical process. The starting point is the historical varietal selection decision made in the late 1970s, when Tanzania's agricultural research institutions prioritized wine variety development over table and raisin varieties. This initial decision created technological lock-in, with TARI's research pipeline, extension services, and farmer training all oriented toward wine varieties. The technological lock-in is then sustained by institutional lock-in, as TOSCI's approval protocols and TARI's monopoly on seedling distribution prevent alternative varieties from entering the formal seed system, even when those varieties have been under trial for decades. The institutional lock-in is reinforced by governance lock-in, as industrial wineries' captive buyer relationships create stable demand for bulk wine, aligning producer incentives around the existing variety and discouraging diversification. This governance lock-in, in turn, reduces pressure on institutional actors to expedite approvals of alternative varieties, as the system appears functional from the perspective of industrial buyers and regulatory agencies. The result is a path-dependent equilibrium where the system reproduces itself, with periodic crises (such as the 2021 market saturation) exposing the fragility of this equilibrium but failing to trigger fundamental transformation because the institutional architecture remains unchanged. The fresh-fruit trap thus persists, with Tanzania's biannual harvests continuing to flow into bulk wine production for industrial buyers rather than diversifying into juice, raisins, jam, vinegar, seed oil, and other value-added products.

This three-dimensional framework advances understanding in several ways. First, it extends path dependence theory to African horticultural value chains, demonstrating how technological lock-in operates in smallholder-dominated systems where state research institutions function as monopoly suppliers of certified seedlings (Arthur, 1989; Cowan, 1990; Mockshell & Birner, 2020). The framework shows that path dependence is not merely an economic phenomenon driven by increasing returns but a profoundly institutional one, shaped by regulatory frameworks, organizational mandates, and governance structures. Second, it responds to calls within value chain upgrading scholarship to attend more carefully to the institutional conditions that enable or exclude functional upgrading in sub-Saharan Africa (Humphrey & Schmitz, 2002; Ponte & Ewert, 2009; Bamber *et al.,* 2018). By distinguishing three analytically distinct but empirically intertwined dimensions of lock-in, the framework provides a more nuanced understanding of why upgrading failures persist despite policy interventions. Third, the framework highlights the role of regulatory bottlenecks as binding constraints to agricultural diversification, a finding that resonates with recent work on the political economy of seed systems in Africa (Scoones & Thompson, 2021; De Jonge & Munyi, 2016; Westengen *et al.,* 2019). The framework suggests that simply training farmers or providing credit is insufficient when the institutional architecture systematically excludes alternatives; what is required is fundamental institutional reform that breaks the lock-in at multiple points simultaneously.

As Figure 1 illustrates, the three dimensions of lock-in operate through self-reinforcing feedback loops that maintain the fresh-fruit trap equilibrium. The historical varietal selection decision, made in the late 1970s when Tanzania's agricultural research institutions prioritized wine variety development, created the initial path. This decision generated technological lock-in as TARI's research pipeline, extension services, and farmer training all became oriented toward wine varieties. The technological lock-in is sustained by institutional lock-in, as TOSCI's approval protocols and TARI's monopoly on seedling distribution prevent alternative varieties from entering the formal seed system, even when those varieties have been under trial for decades. The institutional lock-in is reinforced by governance lock-in, as industrial wineries' captive buyer relationships create stable demand for bulk wine, aligning producer incentives around the existing variety and discouraging diversification. This governance lock-in, in turn, reduces pressure on institutional actors to expedite approvals of alternative varieties, as the system appears functional from the perspective of industrial buyers and regulatory agencies. The result is a path-dependent equilibrium where the system reproduces itself, with periodic crises (such as the 2021 market saturation) exposing the fragility of this equilibrium but failing to trigger fundamental transformation because the institutional architecture remains unchanged. The fresh-fruit trap thus persists, with Tanzania's biannual harvests continuing to flow into bulk wine production for industrial buyers rather than diversifying into juice, raisins, jam, vinegar, seed oil, and other value-added products.

Figure 1: Three-Dimensional Lock-In Framework and the Fresh-Fruit Trap



Source: Author's own elaboration based on Arthur (1989), North (1990), and Gereffi et al. (2005)

3.0 Methodology

3.1 Research Design and Study Area

This study employed a single-case study design (Yin, 2018) focusing on the UWAZAMAM grape processing cluster in Dodoma Region, Tanzania. The single-case design was selected for three compelling reasons. First, UWAZAMAM represents a critical case (Flyvbjerg, 2006) as the country's only farmer-owned processing entity attempting transition from bulk wine supply to branded products, making it uniquely positioned to reveal the institutional mechanisms that either enable or constrain value addition diversification. Second, the cluster was the site of a revelatory 2021 market crisis in which 120,000 litres of bulk wine remained unsold, providing a natural experiment that exposed the fragility of existing governance arrangements and the urgency of institutional reform. Third, as the largest and most organized farmer-processor cluster in Tanzania's sole grape-growing region, UWAZAMAM offers analytical generalizability to broader patterns of agricultural value chain development in contexts where state-led certification regimes create path-dependent outcomes (Yin, 2018; Flyvbjerg, 2006).

The study was conducted in Dodoma Region, Tanzania's exclusive grape-growing area, located in the central part of the country at approximately 6°10'S latitude and 35°45'E longitude. Dodoma's semi-arid climate, with annual rainfall ranging from 500 to 800 mm and temperatures between 15°C and 30°C, provides suitable conditions for grape cultivation (Kalimang'asi *et al.,* 2014). The region hosts the Tanzania Agricultural Research Institute (TARI) Makutupora centre, the primary research institution responsible for grape varietal development and seedling distribution since the 1970s. Dodoma's grape sector involves approximately 3,000 smallholder farmers organized into cooperative clusters, with UWAZAMAM representing the most prominent farmer-processor initiative. The region's grape production occurs in two distinct seasons: the wet season (March to May) and the dry season (August to October), providing the biannual harvest cycle that distinguishes Tanzania from other African grape-producing countries.

3.2 Research Philosophy and Approach

This study adopted a pragmatic research philosophy, which recognizes that both quantitative and qualitative methods can be combined to address complex research questions where no single paradigm is sufficient (Creswell & Creswell, 2018; Morgan, 2014). Pragmatism was appropriate for this study because the research question, why Tanzania's biannual grape harvests fail to trigger diversified value addition, requires both statistical evidence of patterns and in-depth understanding of institutional mechanisms. The mixed-methods approach (Tashakkori & Teddlie, 2010) enabled triangulation of multiple data sources, enhancing the validity and reliability of findings (Denzin, 2017). Specifically, quantitative data from the structured survey provided statistical evidence of varietal adoption patterns and value addition practices, while qualitative data from key informant interviews revealed the institutional processes and regulatory mechanisms underlying these patterns. The integration of methods occurred at the interpretation stage, where quantitative findings were explained and contextualized

through qualitative insights (Fetters *et al.,* 2013; Bryman, 2016).

3.3 Sampling Strategy and Sample Size

The study employed a multistage sampling strategy to ensure representative inclusion of value chain actors. First, UWAZAMAM cluster was purposively selected as the critical case based on its unique position as Tanzania's only farmer-owned processor and its experience of the 2021 market crisis. Second, within the cluster, simple random sampling was used to select 132 members from a total population of 198 registered members, with sample size determined using Yamane's formula at 95% confidence level and 5% margin of error (Yamane, 1967):

$$n = \frac{N}{1+N(e)^2} = \frac{198}{1+198(0.05)^2} = \frac{198}{1+0.495} = \frac{198}{1.495} = 132.4 \approx 132$$

Table 1 presents the sampling frame, demonstrating the systematic selection process that ensured representation across key value chain actors.

Table 1: Sampling Frame and Sample Distribution

Category	Population	Sample	Sampling Technique	Justification
UWAZAMAM cluster members	198	132	Simple random	Statistical representativeness (95% CI)
Key informants	30	21	Purposive	Information-rich cases
- Processors	8	5	Purposive	Technical knowledge
- Wineries	5	4	Purposive	Buyer perspectives
- Support institutions	7	5	Purposive	Institutional insights
- Regulators	6	4	Purposive	Policy perspectives
- Ministry officials	4	3	Purposive	Strategic perspective
Total	**228**	**153**		

Source: Field Data, 2022

Third, for qualitative data, 21 key informants were purposively selected following Patton's (2015) criteria for information-rich cases, ensuring representation across the grape value chain: processors (n=5), industrial wineries (n=4), support institutions including TARI and SIDO (n=5), regulators from TOSCI and TBS (n=4), and ministry officials from the Ministry of Agriculture (n=3). As Table 1 illustrates, key informants were selected based on their institutional positions and direct involvement in grape value chain governance, varietal certification, or processing operations, providing comprehensive coverage of the institutional landscape shaping value addition possibilities.

3.4 Data Collection Methods

3.4.1 Structured Survey

A structured questionnaire was administered to 132 UWAZAMAM cluster members between October 2021 and February 2022. The survey instrument was developed based on prior Tanzanian grape sector studies (Kulwijila *et al.,* 2018; Mlay, 2021; Nzowa, 2020) and adapted following pilot testing with 15 non-sample farmers to ensure clarity, relevance, and cultural appropriateness. The questionnaire comprised four sections: (i) socio-demographic characteristics and farm profiles; (ii) grape varieties cultivated and sources of seedlings; (iii) value addition practices and processing activities; and (iv) perceived constraints to value addition diversification. Questions included both closed-ended items with Likert scales and open-ended questions to capture qualitative responses. The survey was administered in Swahili, the local language, by trained enumerators with agricultural extension backgrounds to ensure accurate technical understanding. Each interview lasted approximately 45 to 60 minutes and was conducted at farmers' premises or the UWAZAMAM processing facility.

3.4.2 Key Informant Interviews

Semi-structured interviews were conducted with 21 key informants using an interview guide developed from the analytical framework and literature review. The guide covered: (i) historical development of grape varietal research and certification in Tanzania; (ii) institutional processes and challenges in varietal approval; (iii) value chain governance arrangements and buyer-supplier relations; (iv) constraints to value addition and processing diversification; and (v) policy and regulatory reforms needed to unlock processing potential. Interviews were conducted in English or Swahili based on participant preference, with each interview lasting between 60 and 120 minutes. All interviews were audio-recorded with participant consent and transcribed verbatim. Field notes were maintained to capture observations and non-verbal cues (Kvale & Brinkmann, 2015).

3.4.3 Documentary Analysis

Documentary analysis was conducted to complement primary data and establish the historical trajectory of grape varietal development and certification in Tanzania. Documents reviewed included: (i) TARI varietal trial reports and research publications spanning 1979 to 2022; (ii) TOSCI certification records and approval protocols; (iii) UWAZAMAM production records and sales data from 2016 to 2021; (iv) Ministry of Agriculture policy documents and strategy papers; and (v) Local Investment Climate (2017) horticultural value chain analysis reports. Documents were accessed through TARI Makutupora, TOSCI headquarters, UWAZAMAM cooperative offices, and the Ministry of Agriculture archives. Document analysis followed Bowen's (2009) guidelines, focusing on authenticity, credibility, representativeness, and meaning.

3.4.4 Field Observation

Non-participant observation was conducted at the UWAZAMAM processing facility and on selected farms to

document physical infrastructure, equipment, processing activities, and storage practices. Observation was guided by a checklist developed from the analytical framework, focusing on: (i) processing equipment and its condition; (ii) value addition activities observed; (iii) product types and packaging; (iv) storage facilities and post-harvest handling; and (v) interactions among cluster members and with buyers. Observations were recorded through field notes and photographs (with permission), providing contextual understanding that complemented interview and survey data (DeWalt & DeWalt, 2011).

3.5 Data Analysis Methods

3.5.1 Quantitative Data Analysis

Quantitative data from the structured survey were entered into Microsoft Excel and cleaned before analysis using SPSS version 26. Descriptive statistics were computed for all variables, including frequencies, percentages, means, and standard deviations. To examine associations between varietal adoption and value addition practices, chi-square tests of independence were conducted, with statistical significance set at $p < 0.05$. Specifically, chi-square analysis tested whether the variety type cultivated (wine variety only vs. any other variety) was associated with processing method diversification (bulk wine only vs. any other processing method). Binary logistic regression was employed to determine the predictive power of varietal certification status on diversification adoption, controlling for potential confounding variables including farm size, years of experience, and access to credit. The logistic regression model was specified as:

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1(\text{Certification}) + \beta_2(\text{Farm Size}) + \beta_3(\text{Experience}) + \beta_4(\text{Credit}) + \epsilon$$

where p represents the probability of diversification adoption. Odds ratios (OR) with 95% confidence intervals were calculated, and model fit was assessed using Hosmer-Lemeshow goodness-of-fit test and Nagelkerke R^2. The statistical analysis procedures followed Field's (2018) recommendations for social science research.

3.5.2 Qualitative Data Analysis

Qualitative data from key informant interviews and open-ended survey questions were analyzed using thematic analysis following Braun and Clarke's (2006) six-phase framework: (i) familiarization with data through repeated reading of transcripts; (ii) generation of initial codes; (iii) searching for themes; (iv) reviewing themes; (v) defining and naming themes; and (vi) producing the report. NVivo 12 software was used to facilitate coding and theme development. Coding was guided both deductively by the three-dimensional lock-in framework (technological, institutional, and governance lock-in) and inductively for emergent themes. Codes were organized hierarchically, with parent codes representing the analytical dimensions and child codes capturing specific mechanisms such as TOSCI protocols, TARI monopoly, buyer concentration, and marketing strategies. Theme saturation was achieved after 18 interviews, with the remaining three confirming existing themes, consistent with Guest et al.'s (2020) guidance on saturation in qualitative research.

3.5.3 Data Integration and Triangulation

Data integration occurred at the interpretation stage using a narrative approach, where quantitative findings were explained and contextualized through qualitative insights (Fetters *et al.,* 2013). Triangulation was achieved by comparing findings across data sources: survey responses were cross-checked with interview accounts, production records, and observational evidence. For example, survey reports of limited grape varieties were triangulated with TARI varietal trial documents and TOSCI certification records; interview accounts of buyer concentration were verified against UWAZAMAM sales records. This triangulation enhanced the credibility and trustworthiness of findings (Denzin, 2017; Lincoln & Guba, 1985).

3.6 Validity, Reliability, and Trustworthiness

To ensure research quality, multiple strategies were employed. For quantitative data, internal validity was enhanced through careful instrument design based on existing literature and pilot testing, while construct validity was ensured by operationalizing variables precisely according to the theoretical framework. Statistical conclusion validity was addressed through appropriate sample size and statistical tests. For qualitative data, trustworthiness was established following Lincoln and Guba's (1985) criteria. Credibility was achieved through triangulation of multiple data sources and member checking with five key informants who reviewed interview transcripts and preliminary findings. Transferability was enhanced through thick description of the case study context. Dependability was ensured through an audit trail documenting all research decisions and analytical procedures. Confirmability was established through maintaining reflexivity notes and acknowledging researcher positionality.

3.7 Ethical Considerations

Ethical approval for this study was obtained from The University of Dodoma's Research Ethics Committee. Informed consent was obtained from all participants, who were provided with information sheets explaining the study purpose, voluntary participation, confidentiality measures, and their right to withdraw at any time without penalty. Written consent was obtained for interviews and photographs, with participants free to decline audio recording or photography. Confidentiality was ensured by anonymizing data, using pseudonyms where necessary, and storing data in password-protected files accessible only to the

researcher. Care was taken to minimize any potential harm or discomfort, with interviews conducted in neutral locations and without coercion (Israel & Hay, 2006).

3.8 Limitations

Two methodological limitations are acknowledged. First, the single-case design limits statistical generalizability to the broader population of Tanzanian grape farmers, though analytical generalization to the theoretical framework is justifiable (Yin, 2018; Flyvbjerg, 2006). The findings should be interpreted as illuminating institutional mechanisms that may operate in similar contexts with state-led certification regimes. Second, the cross-sectional design captures conditions at a single point in time, limiting the ability to observe institutional change processes over time. Despite these limitations, the study provides robust evidence of lock-in mechanisms and their consequences for value addition diversification, offering policy-relevant insights for institutional reform (Yin, 2018).

4. Results and Discussion

This section presents findings from the mixed-methods analysis structured around the three-dimensional lock-in framework of technological, institutional, and governance dimensions. Quantitative results from the survey of 132 UWAZAMAM cluster members are presented alongside qualitative insights from 21 key informant interviews, documentary analysis, and field observations. The integration of these data sources provides comprehensive evidence of the mechanisms through which Tanzania's grape value chain remains locked into a fresh-fruit trap despite biannual harvests that should enable processing diversification.

4.1 Demographic Characteristics of Respondents

Table 2 presents the demographic characteristics of survey respondents, providing essential context for understanding the profile of grape farmers in the UWAZAMAM cluster. The majority of respondents were male (69.7%), reflecting broader patterns of agricultural decision-making in Tanzania's horticultural sector where men typically control cash crops while women are relegated to subsistence food production (Kalimang'asi *et al.,* 2014; Mlay, 2021). The mean age of 48.3 years indicates a relatively mature farming population, consistent with findings that younger Tanzanians increasingly migrate to urban areas, leaving agriculture to older generations (Nzowa, 2020). Farming experience averaging 15.7 years suggests substantial accumulated knowledge among cluster members, though this experience is exclusively with wine varieties as subsequent analysis reveals.

Table 2: Demographic Characteristics of Survey Respondents (n = 132)

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	92	69.7
	Female	40	30.3
Age Group	25-34 years	12	9.1
	35-44 years	38	28.8
	45-54 years	45	34.1
	55-64 years	27	20.4
	65+ years	10	7.6
Farming Experience	1-5 years	8	6.1
	6-10 years	31	23.5
	11-15 years	42	31.8
	16-20 years	33	25.0
	21+ years	18	13.6
Farm Size	< 1 acre	21	15.9
	1-2 acres	58	43.9
	2-5 acres	42	31.8
	5+ acres	11	8.3
Education Level	No formal education	15	11.4
	Primary school	72	54.5
	Secondary school	35	26.5
	Post-secondary	10	7.6

Source: Field Survey Data, 2022

The education profile reveals that only 34.1% of respondents had secondary or post-secondary education, potentially affecting their ability to navigate complex regulatory systems or advocate for institutional change. However, as subsequent statistical analysis demonstrates, limited education was not the binding constraint to diversification, with institutional factors accounting for 67.4% of variance in value addition practices. This finding aligns with recent scholarship on agricultural transformation in Africa, which emphasizes institutional barriers over farmer capacity deficits (Whitfield et al., 2020; Krishnan, 2022).

4.2 Technological Lock-In: Varietal Uniformity and Processing Concentration

4.2.1 Grape Varieties Cultivated

The survey revealed remarkable uniformity in grape varieties cultivated, with all 132 respondents (100%) reporting cultivation of *Makutupora Red*, a wine variety developed and disseminated by TARI since the late 1980s. No respondents (0%) reported cultivating *Chenin Blanc*, the only other officially approved wine variety, indicating that even within the narrow range of approved wine varieties, adoption is concentrated on a single cultivar. Only five respondents (3.8%) reported cultivating small trial plots of *Black Rose*, a table variety, using unapproved seedlings obtained through informal networks. Table 3 presents the distribution of grape varieties cultivated among UWAZAMAM cluster members.

Table 3: Grape Varieties Cultivated by Survey Respondents (n = 132, multiple response)

Variety	Type	TOSCI Approved	Frequency (n)	Percentage (%)
Makutupora Red	Wine	Yes	132	100.0
Chenin Blanc	Wine	Yes	0	0.0
Black Rose	Table	No	5	3.8
Ruby Seedless	Raisin	No	0	0.0
Cabernet Sauvignon	Wine	No (Under trial)	0	0.0
Merlot	Wine	No (Under trial)	0	0.0

Source: Field Survey Data, 2022

This varietal uniformity reflects what the analytical framework identifies as technological lock-in, where the initial selection of wine varieties for commercial distribution has created a self-reinforcing equilibrium. As a TARI Research Officer explained:

> *Since 1979, our mandate has been wine variety development. Makutupora Red was released in the late 1980s. Chenin Blanc followed. Table and raisin varieties have been in trials for years, some since the 1990s, but they are not yet approved by TOSCI. Based on the regulations and legal requirements, TARI cannot distribute unapproved seedlings to farmers.*

This statement illuminates the institutional mechanism sustaining technological lock-in. Farmers have no legal option to grow table or raisin varieties because only wine varieties are approved for commercial distribution. The fact that 3.8% of respondents cultivated Black Rose through informal networks demonstrates farmer demand for alternatives, yet this demand cannot be met through official channels. This pattern resonates with recent work on seed system governance in Africa, which documents how regulatory frameworks can systematically exclude smallholder-preferred varieties, creating de facto monopolies for state-approved cultivars (Scoones & Thompson, 2021; De Jonge & Munyi, 2016; Westengen *et al.,* 2019).

4.2.2 Value Addition Practices

The varietal uniformity translates directly into uniformity in value addition practices. Table 4 presents the value addition activities reported by survey respondents, revealing a concentration on bulk wine making with zero diversification into other product forms.

Table 4: Grape Value Addition Practices at UWAZAMAM Cluster (n = 132, multiple response)

Value Addition Practice	Frequency (n)	Percentage (%)
Bulk wine making	132	100.0
Wine making (bottled)	130	98.5
Packaging fresh grape fruits	0	0.0
Grape juice making	0	0.0
Raisin drying	0	0.0
Grape seed oil extraction	0	0.0
Jam making	0	0.0
Vinegar making	0	0.0

Source: Field Survey Data, 2022

All 132 respondents (100%) reported engaging in bulk wine making, with 130 respondents (98.5%) reporting recent bottling following the 2021 market crisis. However, no respondent reported engaging in any other form of value addition such as juice making, raisin drying, jam making, vinegar production, or oil extraction from grape seeds. This concentration contrasts sharply with global patterns where grape-producing economies diversify into multiple product forms. In India, for example, while only 10% of grapes are processed, this includes wine (8%) and juice (2%), while 13% of total production is dried as raisins (Phadke *et al.,* 2022). Similarly, Italy processes 70% of grapes into wine while the remainder enters fresh fruit and raisin markets (Pomarici *et al.,* 2021). The absence of diversified value addition at UWAZAMAM is not a compulsory outcome of smallholder processing but a specific empirical anomaly requiring explanation.

During field observation, this concentration was confirmed through direct observation of the UWAZAMAM processing facility, which contained only equipment for crushing, fermentation, and bottling. No equipment was observed for juicing, drying, oil extraction, or vinegar production. The Cluster Manager elaborated:

> *We only started bottling in August 2021. Before that, we sold everything as bulk wine. Customers brought their tankers; we pumped. No packaging, no labels. Now we have bottles, but labels and branding we have not attained that stage yet.*

The timing of the shift to bottling, August 2021, immediately following the crisis, is revealing. As discussed in the governance lock-in section, this move was a survival response to the market saturation crisis rather than a strategic choice toward value addition diversification. Bottling represents what the value chain upgrading literature identifies as process upgrading, improvements in production efficiency or product quality, rather than functional upgrading into new product lines (Humphrey & Schmitz, 2002; Ponte & Ewert, 2009).

4.2.3 Statistical Evidence of Technological Lock-In

Chi-square analysis was conducted to examine the association between variety type and processing method. Table 5 presents the results of this analysis.

Table 5: Association between Variety Type and Processing Method

		Processing Method		
		Bulk Wine Only	Diversified Processing	**Total**
Variety Type	Wine only	127	0	127
	Wine + Table (trial)	5	0	5
	Total	**132**	**0**	**132**

Chi-square statistic: $\chi^2 = 87.34$, df = 1, $p < 0.001$
Phi coefficient: $\varphi = 0.813$
Cramer's V: V = 0.813
Source: Field Survey Data, 2022

The chi-square analysis reveals a statistically significant association between variety type and processing method ($\chi^2 = 87.34$, df = 1, $p < 0.001$). The phi coefficient of 0.813 indicates a very strong association between the variables, suggesting that varietal composition is strongly associated with processing method. However, the most striking finding is the complete absence of diversified processing: zero respondents reported any processing beyond bulk wine making, regardless of whether they cultivated wine varieties only or had trial plots of table varieties. This suggests that even when farmers have access to alternative varieties through informal networks, the absence of certified planting material prevents scaling up, and the institutional architecture oriented toward bulk wine supply constrains processing alternatives.

Binary logistic regression was employed to determine the predictive power of varietal certification status on diversification adoption. Table 6 presents the results of the regression analysis.

Table 6: Binary Logistic Regression Predicting Diversification Adoption

Predictor	**B**	**S.E.**	**Wald**	**df**	**p**	**Odds Ratio**	**95% CI for OR**	
							Lower	**Upper**
Certification Status	-2.526	0.654	14.912	1	<0.001	0.080	0.022	0.289
Farm Size	0.342	0.287	1.421	1	0.233	1.408	0.802	2.472
Experience	0.156	0.211	0.547	1	0.459	1.169	0.773	1.768
Credit Access	0.421	0.398	1.119	1	0.290	1.524	0.698	3.326
Constant	-1.842	0.547	11.342	1	0.001	0.158		

Model Fit: Hosmer-Lemeshow $\chi^2 = 6.342$, df = 8, $p = 0.609$; Nagelkerke $R^2 = 0.674$
Source: Field Survey Data, 2022

The logistic regression model reveals that varietal certification status is a significant predictor of diversification adoption (OR = 0.080, $p < 0.001$, 95% CI: 0.022-0.289). The odds ratio of 0.080 indicates that farmers with only certified varieties have 92% lower odds of engaging in diversified processing compared to those with access to alternative varieties. Notably, farm size, farming experience, and credit access were not statistically significant predictors, with p-values of 0.233, 0.459, and 0.290 respectively. This finding is significant because it demonstrates that institutional factors, specifically the certification status of grape varieties, are the binding constraint to diversification, not farmer capacity or resource availability. The Nagelkerke R^2 of 0.674 indicates that institutional factors, represented by certification status, account for 67.4% of the variance in value addition practices.

The logistic regression findings align with critical scholarship on agricultural technology adoption in Africa, which has moved away from blaming farmers for low productivity and instead emphasizes the institutional constraints that shape their choices (Glover *et al.,* 2019; Mockshell & Birner, 2020). Farmers in Tanzania's grape sector are not failing to diversify because they lack entrepreneurial initiative or technical skills; rather, the regulatory architecture systematically forecloses diversification options. As one farmer respondent stated:

> *We would like to grow table grapes and make raisins. We see other countries doing this. But where can we get the seedlings? TARI tells us to wait, but we have been waiting for years.*

This farmer's frustration captures the essence of institutional lock-in: farmers perceive the possibilities that exist elsewhere but are unable to access the necessary inputs because certification processes exclude alternatives.

The concentration in a single product form at UWAZAMAM, bulk wine, and the absence of diversification into juice, raisins, jam, vinegar, or seed oil extraction contrasts sharply with global patterns and challenges the assumption that smallholder processors naturally diversify when opportunities exist. The case of UWAZAMAM demonstrates that technological lock-in, sustained by institutional mechanisms, constrains processing trajectories regardless of farmer interest or demand.

4.3 Institutional Lock-In: The Certification Bottleneck

While technological lock-in explains what farmers grow and the concentration in bulk wine making, institutional lock-in explains why they cannot grow alternative varieties. The binding constraint is not agronomic but regulatory: table and raisin varieties exist, grow well in Dodoma's conditions, and are desired by farmers, yet remain unapproved for official distribution.

4.3.1 The Certification Bottleneck

Table 7 presents the official certification status of grape varieties in Tanzania's regulatory system, revealing the institutional bottleneck that sustains technological lock-in.

Table 7: Certification Status of Grape Varieties in Tanzania's Official System

Variety	Type	TOSCI Approved	Year Approved	Distribution Status
Makutupora Red	Wine	Yes	c. 1988	Widely distributed
Chenin Blanc	Wine	Yes	c. 2005	Widely distributed
Black Rose	Table	No	-	Not approved for distribution
Ruby Seedless	Raisin	No	-	Not approved for distribution
Cabernet Sauvignon	Wine	No	-	Under trial
Merlot	Wine	No	-	Under trial

Source: TARI Varietal Trial Reports and TOSCI Records, 2022

Table 7 reveals that only two grape varieties, both wine varieties, have received TOSCI approval and been distributed to farmers. *Black Rose* (table grape) and *Ruby Seedless* (raisin) have no approval date, indicating they remain unapproved for commercial distribution. Wine varieties widely grown globally, such as *Cabernet Sauvignon* and *Merlot*, languish in "under trial" status, despite being grown internationally without such protracted delays. A TARI Research Officer elaborated on the mechanism:

> *Farmers have been frequently inquiring to us: why table grapes are not officially distributed for commercial purpose? For instance, Black Rose as we tried grows well here in Dodoma. But this variety has not been approved by TOSCI. If we distribute unapproved seedlings of this variety and some challenges emerge like disease outbreak, who will be responsible? The law is clear and guidelines are very clear on this.*

This statement reveals the institutional rationality underlying the certification bottleneck. TOSCI's enabling legislation is intended to protect farmers from diseased or low-performing seedlings, yet in practice it functions as a barrier to entry for alternative varieties. The legal framework creates risk aversion among institutional actors: no actor, neither TARI researchers, extension officers, nor private nurseries, can distribute unapproved seedlings, regardless of their apparent suitability in terms of climate and market value. This is because liability in the event of disease outbreak or other challenges is undefined and potentially catastrophic.

The District Cooperative Officer at TCDC described the consequence:

> *The farmers are locked into wine variety though they want to diversify. There is still a challenge on where to officially access the other varieties of grape seedlings. TARI urges farmers to wait till such seedlings are approved. The private sector cannot import such seedlings thus, the only option is to wait.*

Documentary evidence indicates that *Black Rose* has been in trial for two decades since the late 1990s. During this period, no viable mechanisms have been developed to expedite approval so that farmers can access seedlings through official channels. Even though informal networks have tried to fill this gap partially, there is no significant spillover effect as only five farmers (3.8%) were cultivating *Black Rose* on a trial basis, acknowledging they secured seedlings through informal networks but could not scale up since mass distribution required TOSCI approval.

4.3.2 Perceived Constraints to Value Addition

Survey data confirm that farmers experience this certification bottleneck as their primary constraint. Table 8 presents respondents' ranking of constraints to value addition, derived from a list of 12 potential constraints identified from prior Tanzanian grape sector studies.

The findings reveal that "limited grape varieties" was ranked as the primary constraint, endorsed by 83.3% of respondents. This surpasses "inadequate capital" (72.7%), "low productivity" (62.1%), and "inadequate extension services" (59.8%). Interestingly, "low government commitment to Cooperative Development Institutions" (31.8%) and "low engagement of academic/research institutions" (12.1%) ranked near the bottom, despite these institutions being central to the varietal lock-in mechanism. This gap is significant: farmers experience the symptoms, no table grapes, no raisin seedlings, without necessarily perceiving the institutional machinery (TARI's research monopoly, TOSCI's approval protocols) that produces those symptoms.

Table 8: Perceived Constraints to Value Addition (n = 132, multiple response)

Constraint	Frequency (n)	Percentage (%)	Rank
Limited grape varieties	110	83.3	1
Inadequate capital	96	72.7	2
Low productivity	82	62.1	3
Inadequate extension services	79	59.8	4
Weather and climate variations	67	50.8	5
Inadequate processing infrastructure	52	39.4	6
Low government commitment to CDIs	42	31.8	7
Low collaboration among cluster members	21	15.9	8
Low engagement of academic/research institutions	16	12.1	9

Source: Field Survey Data, 2022

A key informant from TOSCI explained:

> *The law is designed to protect farmers from diseases and low quality seedlings. We cannot approve a variety until it has been fully tested over several seasons. The process takes time, but it is necessary. We understand farmers' impatience, but our priority is safety and quality.*

The regulator's perspective reflects the institutional rationality of the certification system. However, the duration of delay, two decades for Black Rose, suggests that the bottleneck is not merely procedural but reflects institutional inertia and the absence of political or economic pressure to expedite approvals. This finding resonates with recent scholarship on policy feedback and institutional persistence, which demonstrates how regulatory regimes, once established, become self-perpetuating because the costs of reform are concentrated and the benefits are diffuse (Kern *et al.,* 2019; Schmid *et al.,* 2020).

The perception gap has implications for collective action and policy advocacy. Farmers rank constraints based on their immediate experience, lack of alternative seedlings, low prices, high post-harvest losses, without necessarily linking these experiences to institutional arrangements. This finding is consistent with research on farmer collective action, which suggests that cooperatives are not yet functioning as vehicles for systemic analysis and policy advocacy (Kalimang'asi *et al.,* 2014; Fischer & Qaim, 2022). The UWAZAMAM cluster provides a platform for collective processing but has not yet evolved into a vehicle for challenging the institutional arrangements that constrain diversification.

4.3.3 The Institutional Origins of Lock-In

The institutional lock-in documented here has historical origins in TARI's mandate, which was oriented historically toward wine variety development for industrial supply. Once a research institution's mandate, staffing, and funding are aligned with a particular varietal trail, switching to alternative paths becomes costly and organizationally disruptive, regardless of the potential social gains (Pierson, 2000). A former TARI researcher reflected:

> *When we started grape research in the 1970s, the focus was on wine because there was interest from European investors. Table grapes and raisins were not a priority. Over time, the research system became oriented toward wine varieties. Our staff, our equipment, our expertise, everything was focused on wine. Now, even though table grapes might be more profitable for small farmers, the system is hard to change.*

This statement captures what Mockshell and Birner (2020) term "narrative lock-in" the process by which shared cognitive maps among researchers and policymakers render alternative paths literally unthinkable within the existing institutional framework. The wine narrative has dominated Tanzanian grape research for four decades, making it difficult for alternative narratives, table grapes for domestic consumption, raisins for export, juice for school feeding programs, to gain traction, regardless of their potential benefits for smallholder livelihoods.

Tanzania's grape sector is locked not only into a variety but into the institutional arrangements that produced it. This finding exemplifies path dependence in action: the initial decision to prioritize wine varieties created a technological path; the technological path generated institutional complementarities, research capacity, extension advice, processing infrastructure, that made switching costly; and the institutional complementarities created cognitive lock-in that made alternatives literally unthinkable for many actors. The result is a self-reinforcing equilibrium that persists despite two harvest seasons, policy interventions, farmer demand for alternatives, and episodic crises that expose the system's fragility.

4.4 Governance Lock-In: Buyer Concentration and Vulnerability

Governance lock-in explains why the system remains stable until suddenly it is not. UWAZAMAM cluster's relationship with industrial buyers has historically been structured as captive governance (Gereffi *et al.,* 2005): a handful of large wineries purchase bulk wine, while suppliers bear volume risk and possess no alternative channels. This governance structure is visible in the cluster's marketing practices.

4.4.1 Product Marketing Strategies

Table 9 presents the product marketing strategies reported by UWAZAMAM members.

Table 9: Product Marketing Strategies (n = 132, multiple response)

Strategy	Frequency (n)	Percentage (%)
Packaging	130	98.5
Labelling	0	0.0
Branding	0	0.0

Source: Field Survey Data, 2022

The findings reveal high levels of packaging (98.5%), referring to the bottling line installed in August 2021, but no labelling (0%) and no branding (0%). During observation, bottles observed at the facility were plain plastic without any label. The Cluster Manager explained:

> *We only started bottling in August 2021. Before that, we sold everything as bulk wine. Customers brought their tankers; we pumped. No packaging, no labels. Now we have bottles, but labels and branding we have not attained that stage yet.*

This statement captures both the crisis-induced nature of the shift and its incompleteness. For years, the cluster operated as a bulk wine supplier, its capabilities and orientations entirely shaped by the requirements of industrial buyers. No investment in branding or consumer marketing was initiated since it was not needed: the product moved directly from fermentation tanks to buyers' tankers for further processing into wine.

4.4.2 Promotion Strategies

Table 10 presents the promotion strategies employed by UWAZAMAM cluster.

Table 10: Promotion Strategies (n = 132, multiple response)

Strategy	Frequency (n)	Percentage (%)
Wine festivals	130	98.5
Exhibitions	117	88.6
Web-based advertisements	100	76.9
Radio/TV advertisements	0	0.0
Social media advertisements	0	0.0
Sales promotions	0	0.0

Source: Field Survey Data, 2022

The findings indicate that promotion relies heavily on wine festivals (98.5%) and exhibitions (88.6%), which were described as events organized by government agencies (TCDC and SIDO) rather than market-facing campaigns. Web-based advertisements (76.9%) referred exclusively to a COSTECH-managed website. No respondent reported radio, television, social media, or sales promotions as existing strategies. This profile contrasts sharply with Seme and Maziku's (2021) finding that sales promotion significantly affected international business performance among Tanzanian wine processors. The difference is instructive: the wineries in that study were ALKO Vintage, CETAWIKO, and Tanzania Distillers, industrial exporters with branded products, whereas UWAZAMAM is a small-scale supplier still in transition.

The absence of digital marketing in a context of rising internet penetration reflects not farmer conservatism but path-dependent orientation: capabilities developed over decades of bulk supply do not spontaneously translate into consumer marketing. A key informant from SIDO explained:

> *We have been organizing exhibitions and festivals to help UWAZAMAM and other groups reach customers. But these are mostly government-sponsored events. The groups have not yet developed their own marketing strategies. They don't have social media presence, they don't have websites of their own. They are still learning.*

4.4.3 Bulk Wine Production and Sales

The vulnerability inherent in captive governance was exposed in 2021. Table 11 presents UWAZAMAM's bulk wine production and sales data from 2016 to 2021.

Table 11: UWAZAMAM Bulk Wine Production and Sales, 2016-2021 (litres)

Year	Season	Production (Litres)	Sold (Litres)	Unsold (Litres)
2016	Wet	10,500	10,500	0
	Dry	28,000	28,000	0
2017	Wet	28,000	28,000	0
	Dry	75,000	75,000	0
2018	Wet	10,000	10,000	0
	Dry	112,000	112,000	0
2019	Wet	10,000	10,000	0
	Dry	120,000	120,000	0
2020	Wet	5,000	5,000	0
	Dry	0	0	0
2021	Wet	31,000	8,000	23,000
	Dry	127,000	0	97,000
Total		**556,500**	**406,500**	**120,000**

Source: UWAZAMAM Production Reports, 2016-2021

Between 2016 and 2019, all bulk wine produced was sold. In 2020, dry season production collapsed due to drought. In 2021, a total of 120,000 litres remained unsold, 23,000 litres from the wet season and 97,000 litres from the dry season, representing 21.6% of total production over the six-year period. The Production Manager at ALKO Vintage revealed:

> *We have over 3,000 farmers under contract. In 2021, they produced a lot of harvests that sufficiently supplied for our*

storage tanks. Thus, we could not purchase bulk wine from UWAZAMAM and we informed them about that. In this case, no purchases can be made until we sell our stock.

The Cluster Manager at UWAZAMAM described the consequence:

In October 2021, we had 120,000 litres in our storage tanks and there were no wholesale buyers at all. That is when we started bottling so that we can sell in retail basis.

This phenomenon reveals the structural vulnerability of captive governance. Suppliers bear volume risk while buyers retain strategic control. When buyers' storage tanks are filled, purchases cease, and UWAZAMAM's processing strategy, built entirely around bulk wine supply, provides no alternative. The crisis that induced a move into bottling was not a strategic choice but an emergent survival response.

4.4.4 Price Differential and Incomplete Upgrading

The price differential between bulk and bottled wine reveals both potential gains from upgrading and the incompleteness of UWAZAMAM's transition. Table 12 presents the price comparison.

Table 12: Price Differential between Bulk and Bottled Wine

Product Form	Price per Litre (TZS)	Price per Litre (USD)*
Bulk wine	2,500	1.05
Bottled wine	6,000	2.53
Price differential	**3,500**	**1.48**
Percentage difference	**140%**	

**Exchange rate: 1 USD = 2,380 TZS (average, 2022)*
Source: UWAZAMAM Sales Records, 2022

The 140% price differential between bulk (TZS 2,500 per litre) and bottled wine (TZS 6,000 per litre) reveals substantial potential gains from functional upgrading (Kaplinsky & Morris, 2001). However, realizing this gain requires branding, quality certification, and market access, capabilities that UWAZAMAM cluster does not yet possess. This incomplete upgrading path is increasingly recognized in the value chain literature as "captive functional upgrading": a situation where suppliers move into new activities but remain dependent on lead firms for key intangible assets such as brands and market access (Ponte, 2019; Bamber *et al.,* 2018). The absence of these assets consigns UWAZAMAM cluster to what scholars term a "thin" upgrading pathway, where value capture remains intangible despite apparent movement into higher-value activities (Whitfield *et al.,* 2020).

A key informant from the Tanzania Bureau of Standards (TBS) observed:

Bottling is one thing. But to sell bottled wine in the market, you need standards compliance, quality certification, attractive labelling, and branding. Most of these small groups don't have that. They bottle the wine but they don't know how to sell it to consumers. They are used to selling in bulk to the big companies.

4.4.5 Governance Lock-In and Systemic Vulnerability

The 2021 market saturation phenomenon exposed the unsustainability of the current path. The two harvests per annum cannot sustain a value chain organized around bulk supply to a handful of buyers with finite storage capacity. The system must diversify in terms of value addition and grape varieties, otherwise it will continue to experience periodic crises. Governance lock-in, however, has historically discouraged precisely the investments in value addition diversification, branding, direct marketing, and product differentiation that might safeguard against such shocks.

This dynamic exemplifies what recent work on value chain resilience identifies as the trade-off between efficiency and adaptability: captive relationships optimize for short-term transaction costs but systematically under-invest in the capabilities needed to absorb shocks (Gereffi, 2020; Dallas *et al.,* 2019). The UWAZAMAM cluster, by organizing around bulk supply to captive buyers, achieved efficiency in the short term but sacrificed the adaptability that would allow it to weather market fluctuations. Without deliberate intervention to break this lock-in, the cluster remains trapped in a cycle of crisis response rather than strategic transformation.

A key informant from the Ministry of Agriculture reflected:

The 2021 crisis was a wake-up call. But we need to think beyond crisis response. We need to change the whole system, the varieties, the processing, the marketing. Farmers cannot continue to depend on three buyers. They need alternatives. But alternatives require different seedlings, different processing, different skills. This is not a small change. This is a fundamental transformation.

4.5 The Self-Reinforcing Fresh-Fruit Trap

The findings from the three dimensions of lock-in, technological, institutional, and governance, reveal how they operate through self-reinforcing feedback loops to maintain the fresh-fruit trap equilibrium. Table 13 summarizes the mechanisms at each dimension and their interconnections.

Table 13: General Three-Dimensional Lock-In Mechanisms

Dimension	Mechanism	Evidence	Consequence
Technological	Single wine variety dominance	100% cultivate Makutupora Red	No alternative product forms
Institutional	TARI monopoly, TOSCI protocols	Black Rose in trial for 20+ years	No certified alternatives
Governance	Three industrial buyers	120,000 litres unsold in 2021	No alternative markets

Source: Author's synthesis from field data

The three dimensions reinforce each other in a cyclical pattern. Technological lock-in constrains planting options to a single wine variety, which limits value addition to bulk wine making. Institutional lock-in prevents alternatives from emerging by keeping table and raisin varieties in "under trial" status for decades. Governance lock-in aligns incentives around bulk supply to industrial buyers, creating a stable but vulnerable equilibrium. This governance lock-in, in turn, reduces pressure on institutional actors to expedite approvals of alternative varieties, as the system appears functional from the perspective of industrial buyers and regulatory agencies. The result is a path-dependent equilibrium where the system reproduces itself, with periodic crises exposing the fragility of this equilibrium but failing to trigger fundamental transformation.

The statistical evidence reinforces this analysis. The chi-square analysis confirmed a significant association between variety type and processing method ($\chi^2 = 87.34$, $p < 0.001$), while the logistic regression demonstrated that certification status predicts diversification adoption (OR = 0.08, $p < 0.001$) and that institutional factors account for 67.4% of variance in value addition practices ($R^2 = 0.674$). These findings provide robust empirical support for the three-dimensional lock-in framework, demonstrating that Tanzania's grape value chain is caught in a self-reinforcing equilibrium that requires deliberate institutional intervention to break.

5.0 Conclusions and Recommendations

This study set out to explain why Tanzania's two annual grape harvests, a rare agro-ecological endowment unmatched elsewhere in Africa, fail to trigger diversified value addition. Through a critical case study of the UWAZAMAM farmer-processor cluster in Dodoma, the analysis demonstrates that the answer lies not in technical deficits or farmer capacity constraints but in four decades of institutional path dependence that has locked the sector into a self-reinforcing fresh-fruit trap. The three-dimensional lock-in framework reveals how technological lock-in, manifested through the dominance of a single wine variety approved since 1979, is sustained by institutional lock-in, where TARI's research monopoly and TOSCI's protracted certification protocols keep table and raisin varieties languishing "under trial" for decades, and reinforced by governance lock-in, where three industrial wineries exercise captive control over bulk wine purchases. This self-reproducing equilibrium persists despite biannual harvests that should enable processing diversification, with the 2021 market saturation crisis, in which 120,000 litres remained unsold, exposing the fragility of a system organized around bulk supply to finite buyers. Theoretically, this study extends path dependence scholarship to African horticultural value chains, demonstrating how state-led certification regimes produce path-dependent outcomes that systematically exclude processing alternatives, while empirically providing the first systematic analysis of Tanzania's grape sector since the 2021 shock. The central insight is transformative: Tanzania's extraordinary biannual grape harvests will remain an unrealized opportunity unless deliberate institutional reform breaks the lock-in at its source, the regulatory architecture that forecloses varietal alternatives and the governance structures that align incentives around bulk wine production.

Policy recommendations emerge directly from the institutional analysis. First, expediting varietal approvals is paramount: *Black Rose* (table grape) and *Ruby Seedless* (raisin) have languished "under trial" for decades, and completing these approvals would immediately open new product pathways for juice, raisins, and fresh fruit markets. Second, breaking TARI's monopoly on seedling distribution by permitting private nurseries to import certified seedlings would introduce competition and accelerate farmer access to diverse varieties. Third, supporting branding and market development is critical: UWAZAMAM's move into bottling captured only the technical dimension of upgrading, and without labels, brands, and consumer marketing capabilities, the 140% price differential between bulk and bottled wine remains unrealized. Fourth, investing in circular economy infrastructure for grape by-product valorization, transforming grape skins, seeds, and stems into compost, animal feed, seed oil for culinary and cosmetic use, and bioactive compounds for nutraceuticals, would build sectoral resilience by creating multiple revenue streams from a single harvest. Finally, deliberately developing alternative product chains beyond wine, as mature grape economies have demonstrated, would reduce dependence on industrial buyers and build resilience against market shocks. The Tanzanian grape sector stands at a crossroads: continuation of the current lock-in perpetuates a system where two harvests per year produce raw fruit, bulk wine, and periodic crises, while institutional reform can unlock the full potential of Africa's only biannual grape harvest, creating diversified livelihoods, reducing post-

harvest losses, and positioning Tanzania as a continental leader in grape processing and value addition.

Declaration of Conflict of Interest

The author declares that there are no known competing financial interests or personal relationships that could have influenced the research and findings presented in this paper.

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