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Abstract

The study focused on the assessment of the factors influencing onion's supply chain in Singida Urban District. The aim was to examine the impact warehousing operations on onions supply chain. A cross-sectional survey design was employed. Data was collected from 100 respondents; whereby farmers, whole sellers and retailers filled the questionnaires. The interviews were conducted to key informant respondents who work with agriculture division of the district and village leaders. The study found that about 66.7% of respondents agreed that there is a small percentage of facilities available for storage of onions harvest while about 70% of respondents agree that the warehouses are very expensive to rent. Results from two-way ANOVA suggested that, high standard procedures and high storage costs are the major factor that influenced variability of supply chain supported by statistical evidence. The study recommended that District management could review and formalize policies and regulations that guide and support supply chain actors in onions business interaction with farmers to avoid price increases, create awareness and fair play in onions supply chain and assuring transparency in the process. Besides, it is imperative that the local government actively invest in research and development initiatives focused on onion production and supply chain optimization. Collaborating with agricultural research institutions and universities, the government can support research projects aimed at developing improved onion varieties with enhanced shelf life and disease resistance. These research efforts should also explore innovative and cost-effective post-harvest technologies to reduce onion losses during storage. By fostering a culture of innovation and research in onion farming practices, the local government can contribute to long-term sustainability and competitiveness in the onion supply chain in the urban district.

Keywords: *Warehouse operations, supply chain management, Singida Urban District, Tanzania*

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1.0 Introduction

In Tanzania, the supply chain of fresh vegetables has not yet established its own identity as a standalone horticulture sector, despite support from both government and non-government organizations to empower the sector. The aim is for it to produce vegetables on an international commercial scale. However, vegetable cultivation is primarily done by small farmers, who rely on local markets. These markets are limited by inadequate storage facilities and cumbersome transportation, making it difficult to move perishable crops to distant markets (see Mwagike and Mdoe 2015; Weinberger and Msuya, 2004). Farmers often find themselves at a disadvantage in negotiations with traders. The vegetable markets also underperform externally because they are dominated by women, who are typically in a low financial status and need to cultivate high-value market vegetables. Furthermore, most farmers come from households with low levels of education, making it hard for them to adapt to new technological changes in agriculture and harvesting techniques (Mbembela & Nyamanisa, 2018).

The aspiration of vegetable growers is to produce vegetables for global business purposes, but the sub-sector is lagging behind due to the disorganization and complexity of supply chain functions between farmers and overseas markets. An effective supply chain structure must support farmers and their prospective stakeholders. Cooperation between these groups should be committed to providing a broad variety of market options, an appropriate level of risk and reward profiles, and information sharing (Bhattarai et al., 2013). As suggested by Rais and Sheoran (2015), horticultural marketing is very complex and risky due to the perishable nature of plants, their bulkiness, and seasonal availability.

Thus, the study aimed to examine the impact of warehouse operations on the onion supply chain management in Singida Urban District. The focus was on understanding how warehousing activities, such as storage and distribution, affect the overall efficiency and effectiveness of the onion supply chain. By analyzing these factors, the study hoped to identify potential areas for improvement and suggest solutions to streamline the supply chain, enhance product quality, and ultimately benefit both producers and consumers. The research intended to offer actionable recommendations that could help optimize the warehouse operations, thereby improving the overall effectiveness of the onion supply chain. This would not only help stabilize prices but also ensure a more consistent quality of onions, ultimately benefiting both producers and end consumers.

1.1 Statement of Problem

The United States Agency for International Development (USAID) (2013) noted that most vegetables have a short shelf life, complicating their quality maintenance in supply chain management. However, Kilimo Trust (2017) advocated that onions from the western regions of Tanzania are purported to be of higher quality and longer lifespan than those from neighboring countries. Nevertheless, there is still a need for effective and efficient supply chain management to reduce losses and costs along the supply journey. Other studies, such as those by Bray et al. (2000) and Kader (1992), posited that it is inevitable to incur losses of fresh vegetables in the supply chain due to uncontrollable environmental variables where plants grow; however, organizations and individuals are striving to minimize these losses to some extent. Kader (1992) proposed that losses of onions could be reduced if farmers possess adequate biological knowledge and exercise caution in

handling onion crop practices. Gustavsson et al. (2011) argued that losses of fresh vegetables typically occur during post-harvest activities such as harvesting, storing, and transporting the crops to distant areas.

Numerous studies conducted in Tanzania have revealed that supply chain management is affected by transaction costs incurred from the production stage to transportation activities (Mkenda and Campenhout, 2011; Mwasha and Leijdens, 2013). Moreover, there is insufficient storage capacity, and most supply chain actors find it either unaffordable to own or costly to hire such facilities. As a result of these high costs, onions are traditionally stored, leading to moisture accumulation and shrinkage (Agri Pro Focus, 2016). Supply chain management activities are further compromised by a lack of collateral to support financial accessibility, disorganized chain activities, and suboptimal road and market infrastructures (HODECT, 2010). Given these multifaceted challenges, there is a compelling need for further study on supply chain practices, such as harvesting processes, warehouse operations, and distribution activities, in Singida Urban District. This additional research will facilitate improvements in horticultural productivity, cost reduction, mitigation of post-harvest losses, and the enhancement of onion crop quality within the supply chain, thereby improving livelihoods.

1.2 Objectives of the Study

The objective of the study was to examine the impact of warehouse operations on the onions supply chain management in Singida Urban District.

2.0 Theories and Concepts of the study

2.1 Transaction Cost Theory

Transaction Cost Theory was first proposed by Ronald Coase in 1937, who emphasized transaction activities associated with various costs such as information searching, negotiation, decision-making, contract enforcement, and policy formulation. Expanding upon this, Williamson (1970) presented empirical results focusing on optimal contractual arrangements, addressing the complexities of interrelationships between contractual parties and determinants for transaction costs and asset specificity. In relation with the study, the supply chain actors should be aware of the costs associated by each one as decided to play individual roles as independent or plays in integrated roles of the chain. Independently means that, farmers should take into account all costs in harvesting process such as the cost of harvesting (root up the crops), drying the onions, storage facilities and equipment's, transportation (searching, arranging and expediting) of the produces until it reach the targeted market and over all losses costs to the produces or an asset. All the costs are bearable by the farmer, seen as overburdened with the cost, as most growers are smallholders (Williamson, 1970). Shepherd (2007) argued that, farmer-buyer dyad is common marketing network used by small farmers. Every chain starts with a farmer and the relationship sustains when created reward and risk levels to share for themselves as dyad, (Lee 2004, Narayanan and Raman, 2004). When farmers decide to enter into contractual relationship with other actors in a supply chain, they should be aware of the determinants associated to the interrelationship costs, such as uncertainties, rational bonded, specificity assets, frequency, and complexity (Williamson, 1981; Jaffee, 1995; Poulton and Lyne, 2009)

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2.2 Warehousing Operations Warehousing

Warehousing is the process of storing goods in safe custody until they are requisitioned for their intended purpose (Arnold et al., 2008). The warehouse is a vital function in logistics of the material or goods flow. The essential warehouse operations are such as receiving, picking packing and issuing. After the onions have been dried, sent to warehouse to be stored until they are required either by customers. The functions undertaken in the warehouse of onions are, sorting and grading onions in three levels as proposed by- (i) Grade 1; large size, round, well dried with no injure, (ii) Grade 2; medium size, dried, and twinning shapes (iii) Grade 3; tiny size not dried well and injured (Kilimo Trust, 2014). Another operation in onion warehousing is packing the onions according to the market needs, which protected the crops from falling, rotting and shrinking due to temperature and heights, (Rawat and Ansari, 2009). Handling onions, loading, offloading, accounting and management are importance of warehousing operations for successful supply chain performance.

2.3 Conceptual Framework Model

A conceptual framework model is a structured representation that illustrates the relationships between key concepts or variables in a study. The relationship between effective supply chain and warehouse operations can be elucidated by considering their respective components. Effective supply chain entails activities such as value addition, flexibility, cost reduction, and quality control. Warehouse operations, on the other hand, are influenced by factors like the availability and quality of facilities, warehouse procedures, and storage costs. These elements collectively contribute to the overall efficiency and success of the supply chain and the relationship is presented in Figure 1

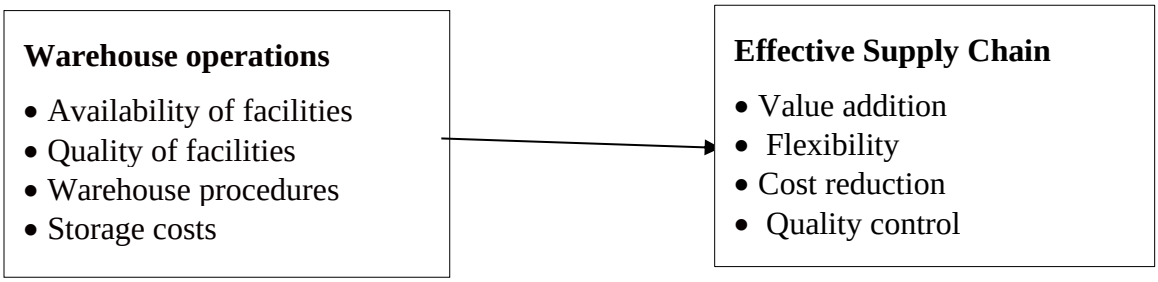

Figure 1: conceptual framework

3.0 Research Methodology

In the research design and approach, a cross-sectional survey design was employed to gather data simultaneously in April 2019 from farmers and onion traders in Singida Urban District, Tanzania. This cross-sectional research design involved examining data from a population at a specific point in time, aimed at comprehensively understanding the dynamics of the onion supply chain (Mazengo and Mwaifyusi, 2021). The study utilized both quantitative and qualitative research approaches, combining interview and questionnaire methods to ensure the reliability of findings. Data were collected from various stakeholders, including wholesalers, farmers, retailers, customers, and key informants such as cooperative union officers, agricultural officers, and trade officers. The study was conducted in Singida Urban District, a significant hub for onion farming in

Tanzania, although onions are also produced in other regions like Arusha, Mbeya, Kilimanjaro, Manyara, and Njombe. The target population encompassed warehouse operators, farmers, retailers, distributors, consumers, and key personnel engaged in onion production within the study area. The sample size of 100 respondents was determined based on the proportion of stakeholders involved in the onion supply chain, using a probability sampling technique, with confidence level set at 95% and a margin of error at 6%. The respondents were selected from clusters representing different segments of the supply chain, ensuring a comprehensive representation of the study population.

4.0 Presentation Of Research Findings

4.1 Availability of Facilities

One of the key components of onion supply chain is the warehouse, where the products are stored for short or long term prior to taken to the market. In many ways warehousing does affects the supply chain as well as the farmers, retailers and distributors due to various factors. Table 1 displays the findings pertaining to the availability of facilities within the onions supply chain.

Table 1: Availability of Facilities in Onions Supply Chain

	Frequency	**Percentage**
High	46	46
Small	58	58
Total	100	100

Source: Researcher (2019).

As shown in a table 1, 58% of respondents agreed that there is a small percentage of facilities available for storage of onions after harvest. On the other hand, 46% of respondents agreed that facilities are available. This result suggests lack of storage facilities is one of the issues facing stakeholders in onion farming to be efficient in adding value to the supply chain. The fact that 58% of respondents acknowledged the limited availability of storage facilities for onions after harvest highlights a concerning bottleneck within the onion supply chain. It underscores the challenge faced by stakeholders in the onion farming industry when it comes to ensuring efficient post-harvest processes and value addition. The shortage of storage facilities not only impedes the capacity to preserve onion quality but also restricts the ability to meet market demands effectively. Conversely, the 46% of respondents who reported that some facilities are available indicate that there is a partial infrastructure in place. However, this still falls short of the ideal situation required for efficient supply chain operations. To address these implications, it is essential for stakeholders and policymakers to prioritize investments in storage infrastructure to enhance the efficiency and competitiveness of the onion supply chain, ultimately benefiting both producers and consumers.

4.2 Warehouses Costs, Quality and Procedures and Onions Supply Chain

Table 2 provides an overview of the respondents' feedback concerning warehouse costs, quality, and procedures in the context of the onion supply chain.

Table 2: Respondents Results on Warehouses Costs, Quality and Procedures and Onions Supply Chain

	Costs		**Quality**		**Procedures**	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
High	70	70	45	45	65	65
Small	30	30	55	55	35	35
Total	**100**	**100**	**138**	**100**	**138**	**100**

Source: Researcher (2019).

The study revealed, the costs renting warehouses, quality and procedures also affected onion supply chain. 70% of respondents agreed that warehouses are expensive to rent, while 55% agreed that they have a low quality and lastly 65% of respondents agreed that the procedures for renting a warehouse are high to meet after renting a warehouse. These results suggested that the storage facilities have an impact to supply chain such that the farmers as well as distributors fail to manage the costs, while the quality of product deteriorates affected the price of onions sold to consumers. The implications of the results are profound and shed light on critical challenges within the onion supply chain. First, the finding that 70% of respondents perceive warehouse rental costs as high underscores a significant financial burden for stakeholders in the supply chain. High rental costs can erode profit margins for both farmers and distributors, potentially limiting the affordability of storage facilities and impacting overall supply chain efficiency. Secondly, the observation that 55% of respondents believe the quality of warehouses is low raises concerns about the preservation and quality control of stored onions. Low-quality storage facilities can lead to spoilage, which not only results in financial losses but also affects the price and marketability of onions sold to consumers. Lastly, the fact that 65% of respondents find warehouse rental procedures to be onerous suggests administrative complexities in accessing these facilities. Cumbersome procedures can deter farmers and distributors from utilizing storage solutions effectively, further exacerbating post-harvest losses and inefficiencies in the supply chain. In light of these implications, it is imperative for stakeholders, including policymakers and industry players, to address these challenges by exploring solutions such as cost-effective warehouse options, quality assurance measures, and streamlining rental procedures. These efforts are essential to enhance the overall competitiveness and sustainability of the onion supply chain, ultimately benefiting both producers and consumers.

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4.3 Two Way Anova Analysis of Warehouse Operations and It Is Relationship to Onions Supply Chain

The two-way ANOVA between groups was conducted to check how the variability of supply chain influenced by the warehouse ‟s operations of onions such as availability of storage facilities, quality of warehouses, procedures to abide when storing onions in available warehouses. Prior to analysis, the total score for the indicators of supply chain in onion farming was obtained from the farmers with regards to supply chain indicators. This included the value addition, flexibility, cost reduction and quality control. Prior to analysis the internal consistency of the variables used to obtain scores was investigated using Cronchbach alpha test to see how well the variables hang on together. Results where 0.7 value for Cronchbach alpha which is above or equal the threshold 0.7 which suggest we can proceed with the analysis since the variables agreed with one another (Pallant, 2003). The results of the two-way Anova are presented In Table 3

Table 3: **Results from Two Way Anova**

	Df	Sum of	Mean	F value	p-value
Availability of facilities	1	10.32	23.30	0.44	0.56
Qualities of facilities	1	12.12	0.07	0.28	0.55
Warehouse procedures	1	75.78	15.02	5.15	0.03
Storage costs	**1**	**13.43**	**4.82**	**3.91**	**0.00**

Source: Researcher, (2020).

Results suggested that, availability of facilities and quality of facilities were not statistically significant [F (1, 100) =0.44, p=0.56] and [F (1, 100) =0.28, p=0.55] respectively respondents who agreed that availability and quality of facilities is high compared to those that agreed it was low. This suggested that for the two attributes mentioned, there is no statically evidence that supply chain is affected. On the other hand, warehouses procedures and storage costs harvesting costs was revealed to be statistically significant [F (1, 100) =5.15,p=0.00] and [F (1, 100)= 3.91,p=0.00] respectively for respondents who agreed that warehouse procedures and storage costs are high compared to those that agreed it was low. This suggests that only high standard procedures and high storage costs are the major factors that influence variability of supply chain supported by statistical evidence.

4.4 Discussion of the Findings

Findings from the study revealed that the availability of facilities for storage of onions after harvest is another major challenge facing farmers in the Singida urban district. This was selected by 64% of farmers who agree to have a small availability of facilities for storing onions after harvest. Also, about 50% of onion farmers depend on renting storage facilities in order to store their crops. This suggests that farmers are not adequate in having

the supportive supply chain management for them to prosper in their farming. The study by Musa and Adlan, (1973) on onions storage in Sudan after harvest forced farmers to rent warehouses as they cannot afford to build on their own facilities due to lack of finances. Furthermore, renting warehouses sometimes do not yield expected results as some lack necessary equipment to maintain the freshness of the onions. On top of that, results in this study reveal that warehouse costs are high and strict procedures are required to be followed when rented by onion farmers which in turn increase financial burden among farmers. This challenges the onions supply chain management to farmers that it is not building towards farmers farming prosperity. The study of supply and value chain in Ethiopia by Daniels & Hors, (2015) found similar experience among onion farmers in the region. The big scale farmers with financial muscles who can afford the costs of renting or build their own storage facilities found to have improved supply chain of onions after storage compared to small scale farmers.

Also, results from the two ways ANOVA which was also performed to check on how variability of supply chain is influenced by the different factors of warehouse operations revealed that only the warehouse procedures and warehouse storage costs were the statistically significant variables in warehousing operations that affected the onions supply chain. These findings were also congruent with the findings from Dome &Prusty, (2016) in analysis of vegetable supply chain in the Arusha region which confirms that the storage costs are higher for small scale farmers to afford and feel the value of supply chain to their advantages. In general, this part reveals that lack of financial capital as part of production costs before the onions have been sold for profit hinders the farmers in reaching their farming goals. This is due to the high costs of storage which impede the farmer's ability to bring the onions to the market in good conditions so that they can secure good prices for their produce. In addition, in Onion market analysis report by a local investment Climate project in Mpwapwa Dodoma reveals that due to this challenge most farmers resort to storage of onions by using local methods such as covering the onions with dry grasses to slow down deterioration rate of onions which it works but it is usually associated with less produce as still some deteriorates in quality anyways to be good for consumption.

5.0 Conclusion

In conclusion, 66.7% of respondents agreed there is a small percentage of facilities available for storage of onions harvest after harvest. These results are consistent with the type of use of warehouses, about 50% respondents depends on the renting the storage facilities while about 33.3% depends on the middle man to provide facilities and lastly about 16.7% have their own storage facilities. The study also revealed that about 70% of respondents agreed that the warehouses are very expensive to rent, while 55% agreed that they have a low quality and lastly about 65% of respondents agreed that the procedures for renting warehouses are very high to meet after renting the warehouse. These results suggest that the storage facilities have an impact to the supply chain such that the farmers as well as distributors fail to manage the costs, while the quality deteriorates which affects the price of onions final to consumers. In addition, about 90% of respondents agreed that the storage facilities do not have special equipment to handle the quality of onions to maintain the freshness during storage. This suggests that warehousing pose a great challenge to a supply chain of onions famers and stakeholders within the Singida urban

district. Lastly, results from two-way ANOVA analysis on the variability of warehousing operations attributes on the supply chain suggested that only high standard procedures and high storage costs are the major factor that influences variability of supply chain supported by statistical evidence. These findings emphasize the urgency of strategic interventions to enhance storage infrastructure and streamline rental processes in the onion supply chain, ultimately improving efficiency, product quality, and accessibility for all stakeholders.

6.0 Recommendations

The study recommends that farmers should seek advice from agricultural experts and not domestic unqualified people in the urban district. Thus, they can gain right information on how to integrate with existing supply chain and see the value and efficiency of onion with supply chain in the urban district. In addition, the study recommends that all stakeholders involved in onions supply chain should be registered by the local authorities, so that they get assistance as a group when there is a need to do so by the local government rather than every person being assisted individually. This will ensure the warehouse operations are utilized for the benefits of the many in the local area other than for few individuals. Besides, it is imperative that the local government actively invest in research and development initiatives focused on onion production and supply chain optimization. Collaborating with agricultural research institutions and universities, the government can support research projects aimed at developing improved onion varieties with enhanced shelf life and disease resistance. These research efforts should also explore innovative and cost-effective post-harvest technologies to reduce onion losses during storage. By fostering a culture of innovation and research in onion farming practices, the local government can contribute to long-term sustainability and competitiveness in the onion supply chain in the urban district.

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