European Journal of Business and Management
ISSN 2222-1905 (Paper) ISSN 2222-2839 (Online)
Vol.18, No.3, 2026

Access To Horticulture Market Information - A Prerequisite for Integrated Horticulture Supply Chains: A Study of Zimbabwe Vegetable Horticulture Market

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Abstract

There is an increasing recognition of the importance of food access and security globally and Zimbabwe in general. The rationale to meet Sustainable Development Goals (SDGs) particularly SDG 2: zero hunger and SDG 12: responsible consumption and production in the horticulture industry have necessitated this research. The research aims at investigating access to information by horticulture supply chain members as an important driver for integrated horticulture supply chain. This study employs a qualitative exploratory design to collect comprehensive data from farmers, processors, wholesalers, and retailers in order to examine information exchange among horticulture stakeholders. One of the research findings reflects that there is lack of shared access to critical market information thus, (production price, selling price, markets, quantities required, among other factors). Recommendations to resolve these challenges in the horticulture sector are discussed in the paper to ensure food access and security nationwide.

Keywords: Integrated Horticulture supply chain, food access, food security, market information.

DOI: 10.7176/EJBM/18-3-07
Publication date: March 28th 2026

1. Introduction

With the increase in global population, natural disasters and climatic changes, agricultural supply chain faces a lot of challenges due to fluctuations in supply and demand of food crops required (Aji, 2020). These changes add pressure to agriculture supply chains, demanding that the process be more productive and efficient (Heijden and Vink, 2013). Empirical research by Joshi, et al., 2023; Mutemi and Sakwa, 2017, shows that access to food by individuals is often a greater constraint than the availability of food itself. A statement which also hold true in Zimbabwe where there is observed rotten produce in dump sites across cities and towns. UNCTAD report in (2015) states that, food security and access is set as a global commitment and is directed through agricultural national policies and programs to meet national levels of food production. Drechsler and Holzapfel (2022) contends that while there is enough evidence to show that horticultural produce is sufficient, the aspect of food access mainly depends on individual income, which is also influenced by access to produce, markets, prices, market channels, social markets, technology and government support.

As academics and researchers continue to analyse the subject of food security, it is no longer a mere narrow focus of food supplies but has now evolved to a wide range of access dimensions (Drechsler and Holzapfel 2022). Most research that has been undertaken in Africa horticultural markets have looked at community resilience, food security and lifting the livelihoods of rural farmers through horticultural projects (Zamasiya et al., 2014; Tegegn, 2013). It is only recently that horticultural supply chains have been examined to understand farm demographics, transport logistics and vendor practice (Rahman et al., 2021). What still remains unclear, is the availability of market information within the horticulture sector to enable integrated horticulture supply chain for food access and security in Zimbabwe.

Agriculture is the mainstay of Zimbabwe's economy, as some Zimbabweans still live in rural areas and rely on agriculture and other rural economic activities for a living. Agribusiness operations employ 60 to 70 percent of the people, produce 60 percent of the resources required by the manufacturing sector, account for 40% of the total export revenues and contribute to over 17% of the nation's total GDP (FAO, 2017). The Zimbabwean agricultural sector is a mixture of food and cash crops. Grains such as maize, sorghum and cotton have dedicated

markets where supply is aggregated to stabilize supply chain vulnerabilities. However, horticultural produce such as flowers, vegetables, nuts, other green produce are not regulated, leading to a free flow of goods and prices. The absence of regulated horticulture markets has resulted in supply inconsistences and loss of revenue within the sector. Given the absence of regulated markets and supply inconsistence being experienced in the sector it was critical for the researchers to assess the nature of relationships and information exchange between horticulture supply chains. Integrated horticulture supply chain is conceptualised in this study as an access dimension that facilitates information exchange and strengthens food access nationwide.

2. Integrated Horticulture Supply Chain

Horticulture is defined as the science and art of growing fruits, vegetables, flowers, or ornamental plants (Tigchelaar and Foley, 1991). The definition of horticulture encompasses (i) plants, thus the multitude of "products" (food, medicine) essential for human survival; and (ii) people, whose active and passive involvement with the garden brings benefits to them as individuals and to the communities and cultures. Integration of horticulture supply chain depicts a portfolio of interventions which are meant to allow members in the horticulture sector to integrate and provide local smallholder farmers with market information so that they supply fresh fruit and vegetables in the country and internationally (Matanda and Schroder 2002).

Siddh et al., (2022) postulates that integrated horticulture market incorporates the major elements of market aspects (price, quantities) and marketing aspects (market channels, payment requirements, packaging, quality) with supply chain management techniques. Where market information basically consists of data on prices and (sometimes) quantities, whereas marketing information is a much wider concept, which includes details on potential market channels, payment requirements, packaging, quality and a whole host of information required by a producer to make a successful sale, including market information.

According to Mashapa et al., (2014) an IHSC system can result in the development of an effective value chain marketing system that enables the connection between smallholder farmers and consumer needs. Focusing on consumer needs promotes continuous innovation among farmers as they receive feedback from key actors in the horticultural value chain. An efficient value chain system leads to market power and profitability especially for horticulture farmers. Therefore, it is important to integrate the different stages of horticulture supply chain to ensure that production of vegetables aligns precisely with consumer demand, resulting in improving food access and livelihoods (Vidanagamachchi and Ginige et al., 2016).

Various studies by Acquah, (2023); Alves et al., (2019); Broek et al., (2019), also address the dynamic facets of how IHSC in promoting market access resulting in value chain development, enhanced information sharing as well as help in the adoption of technology in horticulture farming. IHSC also looks at sustainability of horticulture activities as well as environmental considerations to pave way for future generations. It is, however, important to note that, the absence of an IHSC have resulted in most farmers incurring losses between harvesting and access to markets. Research by Underhill et al., (2020) shows that Tonga's horticulture market suffered from postharvest losses due to inadequate market information and storage. The findings from this research suggest that farmers in Tonga should formulate strategies to strengthen supply chain integration through responsiveness to end-market requirements, including product quantity, pricing, and delivery schedules, with the aim of improving efficiency and mitigating postharvest losses. Thus, understanding these dynamics underscores the importance of having a holistic approach to IHSC addressing the inconsistences in-between farm to fork.

Though IHSC may seem to be a solution to horticulture supply chain inconsistencies it can be noted that some challenges still exist within the framework that threatens its efficiency. Chaudhuri et al., (2020) postulates that transparency and visibility are key for efficient IHSC, however, numerous horticulture supply chains continue to face challenges of information imbalance and insufficient coordination between partners. To this end, the authors propose that horticulture supply-chain stakeholders implement a multi-agent systems approach to strengthen information sharing and interoperability across the chain.

2.1 Multi-Agent System

To ensure that the IHSC is successful the horticulture sector can adopt the multi-agent system which promotes coordination among members in the chain. According to Fauzan et al., (2023); Sultana (2022); Reardon and Zilberman (2017) multi-agent system in supply chain usually transition towards vertical coordination and has led to improved efficiency in buyer and supplier relationships. The multi-agent system framework emphasizes that

each horticulture agent, for instance farmers, distributors, retailers, play an important role in supply chain, hence there is need for collaboration and communication among supply chain stakeholders. Consistency is fundamental to the multi-agent system; consequently, farmers (as agents) must align their production and delivery practices with distributor and wholesaler requirements to meet consumer demand and optimize the flow of agricultural products. Therefore, the primary objective is to formulate a contract that reconciles the interests of both supplier and buyer, thereby addressing the needs of each agent throughout the transaction. Stahl (2022) argues that achieving supply-chain efficiency requires a more stringent, well-coordinated contract that is harmonized across all supply-chain actors.

3. Research Methodology

This research took a qualitative exploratory survey approach. According to Rahi (2017) qualitative research method is the most preferred method when a researcher wants to uncover the feelings and emotions of study participants which quantitative research methods usually neglect. Creswell (2007) also says qualitative research is particularly important when a researcher wants to understand and observe the environment in which the phenomenon is taking place. Exploratory research method was preferred in this research as it provided insights that could further explain integrated horticulture supply chain phenomenon and the vulnerabilities that are being currently experienced in the horticulture sector of Zimbabwe. The research results were very important in addressing the imminent problems that horticulture supply chain members are facing and helps in suggesting various strategies that can be used to resolve supply chain inefficiencies.

Therefore, to understand the opinions and feelings of horticulture supply chain actor's semi-structured in-depth interviews were conducted with (farmers, input suppliers, processors and, wholesalers). Table 1 below shows the profile of research participants.

Table 1. Datasheet of research participants

Participant	Age	Gender	Education	No. of years in the field	Profession
1	35 to 25	Female	Diploma	4	Wholesaler
2	45 to 55	Male	Diploma	10	Farmer
3	45 to 55	Female	Certificate	15	Farmer
4	25 to 35	Male	Bachelors	4	Wholesaler
5	45 to 55	Male	Masters	16	Processors
6	55 to 65	Female	Masters	10	Processors
7	55 to 65	Female	Bachelors	20	Input Supplier
8	35 to 45	Female	Bachelors	10	Farmer
9	35 to 45	Female	Masters	5	Farmer
10	45 to 55	Male	Diploma	20	Farmer
11	35 to 45	Male	Masters	10	Input Supplier

Profiles of research participants

Purposive sampling and census were the most appropriate methods used, as data that was collected required knowledgeable participants provide concise information on horticulture and the supply chain in Zimbabwe. Martínez-Mesa et al. (2016) support that it is better to use a census when the area of study is nationwide or found in all regions, rather than selecting a sample to represent the population under study.

4. Findings

The researchers generated four themes after analysing data from interviews, which the authors systematised in Nvivo 15 Pro. The four themes identified are as follows; (i) producer price and selling price are not known, (ii) lack of information on supply chain (SC) contracts (iii) insufficient IT application (vi) unavailability of market information.

The first theme identified was that most players in the horticulture supply chain do not know the selling price and producer price. The majority of the farmers interviewed communicated that the major challenge is lack of information on price of produce in the market before planting and even after harvesting. Most farmers communicated that when they plant their produce, they do not know how much it will fetch in the market. The farmers and buyers both agreed that currently price of produce is determined on spot and would depend on the quantity currently in the market and quality of produce. Therefore, the farmers cited that price of produce is determined by the buyers not farmers. Additionally, farmers cited that they are always worried each planting season if there would be able to recover the cost incurred during planting and make a profit when they sale. As such, some participants have resorted to subsistence farming to avoid taking such huge risks due to the amount of uncertainty in the market.

It was upon the researcher's interest to probe further to understand if horticulture members could use previous season's prices to guide them in making their budgets. Horticulture members alluded to the fact that it was difficult to determine the selling price as demand and supply parameters come into play as well as location of markets. The researchers also observed that when there is an influx, for example, the demand for tomatoes becomes low, and this would push the price of tomatoes to $5USD-$8USD per crate. Whereas, in periods of scarcity the same quantities of tomatoes would be sold at a range 25USD-30USD per crate. This scenario drastically affects the ability of the farmers to make any profits if prices drop but also make triple the profit if there is scarcity in the market.

A statement by one of the farmers expressed below underscores the importance of knowing the price of produce in decision-making:

"If I know in advance the available markets and prices, then I will be able to produce products for a ready market and also produce according to the quality required".

The participant's sentiments are well documented in literature were research findings from Chen (2011) shows that sharing demand information can increase profits for supply chains, and it is crucial for horticultural producers to rely on accurate market data to make informed decisions about production and distribution. Additionally, current research by Lee and Kim (2023) shows that the sharing of information in horticultural supply chains is an essential factor as it enhances operational efficiency, adaptability, and overall effectiveness of supply chains. The findings of this research are very important for policy makers in Zimbabwe to spearhead the integration of horticulture supply chain and provide adequate information to help SC members to make informed decisions and meet operational efficiencies.

The second theme raised was the unavailability of information on offtake contracts or contract farming procedure in the horticulture sector. Horticulture members shared their views saying most companies especially buyer (processors/wholesalers/retailers) shy away from addressing the issue of offtake contracts in order to minimise risk suppose crops fail due to uncontrollable factors like floods, heat waves or drought seasons. In most cases, farmers bear the risk of failure, and other supply chain players just go ahead with their business as normal. However, food processors within the industry also cited that they now find importing crops cheaper than buying from local farmers or contracting them. Food processors indicated that Zimbabwe is using a stronger currency; hence, the cost of production becomes high, pushing the prices of commodities up compared to commodities produced in countries such as Zambia. A notable example given by one of the respondents was that the current exchange rate of USD: ZMW was 1: 28.86 (as of December 2025). Now, at the time of research, the price of a kg of tomatoes in Zimbabwe was $ 0.88 USD, and in Zambia, it was 16.49 ZMW. If the $0.88 were to be converted to Zambian Kwacha, the price of tomatoes would be 25.39, making Zimbabwean tomatoes more expensive by 8.94 ZMW. As such, when the processors realised this gap, they started to import, leaving Zimbabwean farmers stranded with their produce.

The research also noted that they exist a practical gap between farmers and buyers due to lack of offtake contracts. The researchers went on further to investigate how the horticulture industry was managing this gap. The research findings showed that input companies especially seed companies were adversely being affected by lack of offtake contracts for farmers. The seed companies shared that to resolve the issues they have now resorted to backward and forward integration. Thus, seed companies have managed to secure offtake contracts with both food processors/wholesalers and smallholder farmer because of their relations and financial capacity. The method they allude to be working well for them however, further investigation is warranted to quantify the nature of contribution to business performance. The seed companies had to take this initiative because once farmers stopped production of horticulture produce; these companies will incur huge losses with possibility of closure.

Another theme that also emerged from this research was limited use of information technology (IT) among supply chain members. The researchers discovered that some research participants, such as input suppliers, processors, wholesalers and retailers, have to some extent, implemented electronic data interchange and electronic point of sales, which they said, have facilitated efficient information exchange within the organisation. Therefore, though they seemed to have some adoption of IT in the horticulture industry it's however, interesting to note from interviews conducted that supply chain members are still not willing to share all the information with other members previous prices, quantity, quality or trends of the produce. Most members would only share information on quantities required and within two weeks of delivery, yet most crops take two to three months to ripe. Additionally, these players did not share possible ordering prices they wait until the day of delivery, which does not benefit the industry in terms of IT use. One of the farmers shared their view saying:

"It would be reasonable to have retail outlets share the ordering price for the produce so that we agree on a reasonable selling price, but this was never possible".

These research findings are in line with Engel et al., (2014), who postulates that the exchange of information is an essential tactic for achieving enhanced performance gains in supply chains, but many organisations only limit information sharing to transactional data. This research revealed that the primary cause for the inconsistent supply of horticultural produce is the inability of farmers to receive correct information, at the appropriate time and in a suitable format, such that they can adequately prepare the required produce when needed and IT can do all this instantaneously. For instance, suppose there is a ceremony that needs to be performed in two months, and this function requires some cabbages for salads. A farmer who is contracted to plant this product will select a variety that will be ripe in two months, like Fabiola, rather than taking Majesty that requires three months to ripe. Hence, if all farmers had such information at hand, like the time a product is required, the place, quantities, as well as price horticulture sector in Zimbabwe will be booming and significantly contributing to the GDP of the country significantly.

The fourth theme that was raised by participants was that there is not enough information on the type of produce that are consumed in a specific market. One of the respondents eluded that the horticulture market is so complex and dynamic for instance, a market in Victoria Falls would require unique produce to cater for tourists who come from different countries and have their special type of foods they consume, compared to other places in Zimbabwe that will be consuming traditional, known horticultural produce. One of the horticulture members expressed the following:

"*For horticulture, it is about producing the right product for a market, e.g. farmers produce table potatoes without market information, just as they do for most field crops, then try and sell to fast food establishments who make French fries. Most of horticulture requires that the primary focus be on the quality requirements of the markets, and better still, securing the market first before production [...]. By its nature, there is a lot of dynamism in the horticulture sector, and without up-to-date information, a farmer may produce a product which has gone out of fashion".*

Another cause of concern that some participants raised was that the organisations that collect useful information on prices, markets, and quality require some membership fees which can go as high as $1000USD/ per year. Smallholder farmers commented that it is a lot of money for them. They said, with that same amount of money they could grow two or three different crops and realise some income than pay such huge amounts of fees. Access to information is identified as the major inhibit for the sector continued supply chain inconsistences in this research. Therefore, it is important to understand what customers desire, where, when, at what cost, and in what amounts, to assist in providing accurate, prompt responses while minimising supply chain vulnerabilities in the horticulture sector and ensuring food access in the country.

5. Discussion

Susanto et al., (2023) envisage that information sharing is very important in precision agriculture as it is vital for boosting productivity, sustainability, and market adaptability. Chen (2011) research on dynamics of information exchange in supply chains facing demand asymmetry showed that exchanging demand information can enhance profits. Thus, horticultural producers depend on precise market data to make knowledgeable choices regarding production and distribution. These findings are in-line with the concepts of precision agriculture, where decisions based on data are crucial for enhancing resource efficiency and boosting production. Chen (2011) research findings are very significant in horticulture, where market demand can change swiftly, and up-to-date information is crucial for growers and sellers to make knowledgeable choices. Recent research by Susanto et al., (2023) also showed that collaborative networks within Indonesia's fresh vegetable supply chain performed much

better because of information sharing, and this resulted in enhanced performance outcomes.

The exchange of information in horticultural supply chains is a vital element that improves operational efficiency, responsiveness, and overall performance of supply chains. Literature offers significant proof regarding the value of efficient information sharing methods between supply chain partners in the horticultural industry. Zhang et al., (2011) highlight the importance of integrating information among supply chain companies to minimize uncertainty and effectively manage risks. The authors contend that, exchanging knowledge and resources among supply chain participants is crucial for guaranteeing seamless operations and improving overall performance. This is especially pertinent in horticulture, where prompt information can greatly influence production and distribution choices. Additionally, Williams et al., (2013) agrees that information sharing can enhance supply chain visibility and help improve responsiveness.

6. Conclusion

The specific objective of this paper was to understand access of market information among horticulture supply chain members to resolve food access and supply chain vulnerabilities in Zimbabwe. This research concludes that most horticulture players are unaware of the producer price and selling price prior to commodity production. As such these findings demonstrate that farmers usually start production of commodities without any information of where to sell their produce, the quantities that may be required as well as the quality assessment criterion that will be used. In most cases, processors, wholesalers and retailers are the ones that determine the producer's price for vegetable products, which at the end of the day is not feasible given that they are not familiar with the production price for vegetables.

During research, it was also noted that other players in the horticulture supply chain were not willing to offer offtake contracts to farmers because of various risks that are involved in farming. Some processors pointed out that it is now expensive to engage farmers locally in Zimbabwe, hence they did not find it feasible to use local farmers. With lack of support by other supply chain players, farmers are left to take the risk alone resulting in them being affected the most if a crisis occurs. This conclusion is supported by Abegunde et al., (2019) who proposes that climate extremes negatively impact farmers' capacity to ensure consistent income via agricultural methods, potentially causing processors to be reluctant in establishing offtake agreements.

It is the researcher's view that horticulture supply chain members should come together and form partnerships to develop a supply chain system that is efficient and known with minimal disruptions as horticulture produce is perishable in nature. Supply chain players need to support each other and provide offtake contracts to farmers, provide inputs as well as financing options that are flexible to ensure the smooth flow of the SC process. Figure 1 below is a diagram of horticulture player in Zimbabwe.

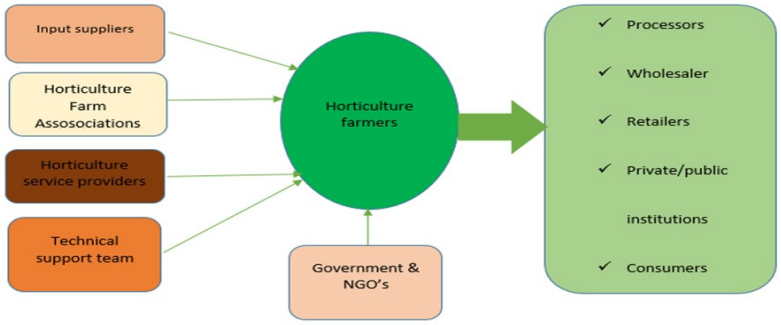

Figure 1: Zimbabwe Horticulture Supply Chain Members

Horticulture farmers are at the center hence are the pillars for a successful integrated horticulture supply chain process. Service providers (input suppliers, financing companies, farm associations among others) should support farmers with resources, while end users (processors, wholesalers and retailers) should provide farmers with offtake contracts and even support like transport to collect produce and storage facilities. As researcher we believe that these players can come together and implement an IHSC to drive food security and access in Zimbabwe.

7. Limitations And Future Research

The study has limitations in that it focused on vegetable production only hence more research could be done to look at other horticulture produce like flowers, nuts, shrubs, ornamental trees. Also, this study provides insights on access to information in horticulture supply chain from one country in Sub-Saharan Africa which is Zimbabwe. A similar study can also be done in other countries given the differences that exists with markets and agriculture dynamics. This study also used a qualitative approach; hence a similar study could use a mixed method approach to uncover the actual performance in terms of sales for various supply chain members.

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