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Post-Harvest Losses for Urban Fresh Fruits and Vegetables Along the Continuum of Supply Chain Functions: Evidence From Dar es Salaam City - Tanzania

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Abstract

Despite the significance and efforts put forward to enhance fresh fruits and vegetables, post-harvest losses continue to threaten the supply chain of this trade. The study explores post-harvest losses of urban fresh fruits and vegetables along the supply chain continuum in Dar es Salaam. It further digs into understanding factors contributing to post-harvest losses for fresh fruits and vegetables in the context of supply chain functions of storage, transportation, value addition, and market services. A qualitative research design was adopted and data were drawn from 55 respondents who were selected by purposive and simple random sampling techniques. In-depth interviews, Focus Group Discussions, documentary review and non-participant observation were used in data collection. Findings showed that post-harvest losses for urban fresh fruits and vegetables along the supply chain functions are attributed to deficiencies inherent in the supply chain functions of storage, transportation, value addition and quality improvement as well as market services. Further findings indicate that low technology, inadequate communication and information, inadequate policies and institutions to mention just a few are the underlying factors leading to such loss. The study recommends stakeholders to collectively alleviate poor storage, transportation, value addition, and markets related challenges that lead to post-harvest losses in the sector. These findings contribute to the existing knowledge in the sector, pave policy inputs with regards to minimising post-harvest losses in the agricultural sector, thereby improving food security, traders and the government's income in general.

Key words: Post-harvest loss; Urban fruits and vegetables; Supply chain

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INTRODUCTION

The supply chain of Fresh Fruits and Vegetable (FFV) in urban settings is of paramount importance to individual livelihood and national income (Issa & Munishi, 2020). The business further contributes to poverty reduction as well as enhancing government revenue (Ahmad & Fehér, 2010; Deliya *et al.,* 2012). Health wise, the business ensures food safety & security for urban populations through provision of the required dietary fibres, minerals and vitamins and guarantees reduction of risks associated to non-communicable diseases (Moran, 2018; Mahajan *et al.,* 2014). The supply chain of FFV consists of agents, wholesalers, and retailers who directly or indirectly fulfil the customers' request of products or services (Ballou, 2004). Such services include but not limited to, new products development, marketing, operations, distribution, finance and customer services (Felea & Albăstroiu, 2013; Ruteri & Outsourcing, 2016). The agent collects goods directly from the farmer and sales them to the wholesaler. The wholesaler on the other hand, collects FFV from the agents and sells them to the retailers (Issa & Munishi, 2020). Finally, the retailers collect the goods from the wholesalers and delivers them to the customers (Chopra *et al,* 2013) The entire chain passes through the harvesting, storage, transportation, quality improvement and value addition, and provision of market and marketing services functions (Issa & Munishi, 2020).

On the other hand, supply chain management refers to a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses and stores so that products and services are produced as well as distributed to the right quantities, at the right locations, in a right time to the right quality so as to satisfy service level requirements to final consumers (Agrawal, 2018;Felea & Albăstroiu, 2013). In other words, supply chain management involves a coordination of material, information and financial flows among all the participants to ensure that the right product in the right place, at the right price, at the right time, and in the right condition are ultimately delivered to final consumers (Deliya *et al.,*2012).

However, as it stands, the supply chain of FFV experiences considerable post-harvest losses which jeopardize the consumers' health, traders' income and the entire food supply chain in the urban setting (MOA, 2019; Negi & Anand, 2015). Post-harvest loss has been earmarked as a serious challenge associated with the urban fruits and vegetables supply. This is because it occurs alongside the supply chain functional areas of any commodity (Rais &Sheoran, 2015;lack of temperature controlled vehicles, unavailability of cold chain facilities in various parts of country for preserving the produce, along with significant processing of the agricultural produce which results in immense losses to the nation. Hence a proper supply chain management in fruits and vegetables has to be improved in all the stages of the supply by adopting best global practices in storage, packaging, handling, transportation, value added service etc to meet the country's demand of fruits and vegetables. As per this paper important drawbacks of the current supply chain are high level of wastage, quality degradation, poor infrastructural facilities and high cost. Government and private operators have to join hands to improve the physical infrastructure, information sharing and the service required for quality improvement of the supply chain.","author":[{"dropping-particle":"","family":"Sheoran A","given":"Rais M","non-dropping-particle":"","parse-names":false,"suffix":""}],"container-title":"Journal of Food Processing & Technology","id":"ITEM-1","issue":"03","issued":{"date-parts":[["2015"]]},"title":"Scope of Supply Chain Management in Fruits and Vegetables in India","type":"article-journal","volume":"06"},"uris":["http://www.mendeley.com/documents/?uuid=beadd9ae-36cc-4fc1-b4d9-cc3e64f02374"]}],"mendeley":{"formattedCitation":"(Sheoran A, 2015 Negi & Anand, 2015a). It entails the loss of these commodities right from the harvest to the consumption stage (Zakaria *et al.,* 2014)889 tons of pieces of orange fruits are produced mainly by small holder farmers in the district per year and about 3.9 tons (39.7 percent. Evidence shows that post-harvest loss of fruits and vegetable takes place in the context of supply chain process particularly through retailers, wholesalers, transporters and agents. Likewise post-harvest loss can be traced at every supply chain functional areas of storage, transportation, value addition and quality improvement stages as well as at marketing services provision levels (Zakaria *et al.,* 2014;889 tons of pieces of orange fruits are produced mainly by small holder farmers in the district per year and about 3.9 tons (39.7 percent Mwagike & Mdoe, 2015; Mwagike, 2015; Negi & Anand, 2015)Tanzania. Semi-structured questionnaires were administered to 133 small vegetable farmers and 109 traders. Data analysis was done using descriptive statistics such as frequencies, percentage, chi-square and one way analysis of variance. The study revealed that majority (58%.

Based on the above realities, the government of Tanzania and various stakeholders have made a number of efforts aimed at preventing post-harvest losses country wide. These include improvement of urban market places and enacting regulatory frameworks for ensuring that supply chain of various products including the urban fruits and vegetable supply chain are well fixed (Moran, 2018;most developing countries accomplish this via attracting foreign direct investment into novel sectors. They use foreign investment to hook into global supply chains, and then build backward linkages to local firms and workers in the host economy. Prior research on foreign investment and supply chains in emerging markets has focused almost exclusively on the creation of international networks in manufacturing and assembly. This paper extends that research, looking beyond manufacturing into supply chain creation in horticulture—in particular, vegetables, fruits, and flowers, raw, packaged, processed—in Africa, Latin America, and other developing regions. How have some developing countries managed to break into the ranks of horticultural exporters, while others have not? What are the obstacles to entering international supply chains for horticultural exports? How can emerging market economies maximize positive impacts on rural employment, on gender employment, and on externalities for local communities? The paper concludes with an investigation of policy implications for developing country governments, for the World Bank and regional financial institutions, and for other providers of external assistance. Of particular note, the policies required to generate supply chains in horticulture constitute a race-to-the-top among countries in improving national doing-business indicators, in upgrading local infrastructure, in establishing effective investment promotion procedures, and in launching public-private vocational-training partnerships in farming and agribusiness.","author":[{"dropping-particle":"","family":"Moran","given":"Theodore","non-dropping-particle":"","parse-names":false,"suffix":""}],"container-title":"Ssrn","id":"ITEM-1","issue":"February 2018","issued":{"date-parts":[["2018"]]},"title":"FDI and Supply Chains in Horticulture (Vegetables, Fruits,

and Flowers, Raw, Packaged, Cut, and ProcessedMOA, 2019). The National Post-Harvest Management Strategy (NPHMS), the Investments Policy and the National Horticultural Developments Policy were strategies aimed at facilitating development of horticultural industry including minimizing post-harvest losses (Underhill *et al.,* 2019; Issa & Munishi, 2020;HODECT, 2012). Furthermore, the formation of farmers and trade associations, intermediaries market orientation, agricultural innovation strategy and business skills are specific interventions to minimise post-harvest losses (Maier, 2015; Hailu & Derbew, 2015) regional, national and export markets using Dar es Salaam, Ifakara, and Mtwara as case study examples. The major impediments for trade in Tanzania has been categorised into three groups: 1.

Despite the efforts invested by various stakeholders, post-harvest losses of FFV are still witnessed in large quantities in many cities of the Sub-Saharan Africa, Dar es Salaam inclusive. It has of recent been reported that the magnitude of post-harvest losses (PHLs) in Tanzania due to insects and rodents has been estimated at 35 percent, while losses caused by transportation from field to storage has been rated at 16 percent (MOA, 2019). Moreover, Post-harvest loss (PHL) resulting from improper weighing and packaging is rated at 12 percent, improper drying at the rate of 9 percent, unpredictable markets (delay in selling the produce) at 5 percent, loss during processing at less than 5 percent and grain breaking into pieces (especially for rice) also at less than 5 percent (MOA, 2019). This situation calls for among other things an examination of the existing control mechanisms for PHL in the fresh fruits and vegetable trade in terms of infrastructures, knowledge and equipment necessary for preventing the post-harvest losses in urban areas (MOA, 2019).

While a number of studies on the post-harvest losses in the context of fresh fruits and vegetables supply chain have been undertaken (MOA, 2019*;* Anwar *et al.,* 2018; Agarwal, 2017a; Mgonja & Utou, 2017; ; Negi & Anand, 2016a;Negi & Anand, 2016b; Khatun & Khandoker, 2014; Zakaria *et al.,* 2014; Rehman *et al.,* 2007; Eskola, 2005)889 tons of pieces of orange fruits are produced mainly by small holder farmers in the district per year and about 3.9 tons (39.7 percent, these works mainly focused on post-harvest loss in the fields but did not specifically focus on the post-harvest losses in the market areas and more especially in the urban based market places. Owing to the above problematic situation, this study intends to examine factors leading to post-harvest losses for urban fresh fruits and vegetables supply chain with the view to provide strategies for overcoming the situation. Specifically, the work intends to examine ways in which post-harvest losses for urban fresh fruits and vegetables occurs in the context of supply chain and recommend strategies for alleviating post-harvest losses.

LITERATURE REVIEW

It should be understood that Post-Harvest Losses have been a rampant issue in the FFV trade. These have been experienced in all stages of the supply chain of this trade right from the harvest, storage, transportation, value addition and quality improvement and marketing services (Ruteri *et al.,* 2009; Issa & Munishi, 2021).

During the storage stage, post-harvest losses have been associated with the existence of poor and inappropriate storage facilities for fruits and vegetables (Kimaro & Msogya, 2012). Studies indicate that lack of cold storage facilities such as refrigerators, force traders and intermediaries to use traditional storage devices (Mwagike & Mdoe, 2015; Tanzania. Semi-structured questionnaires were administered to 133 small vegetable farmers and 109 traders. Data analysis was done using descriptive statistics such as frequencies, percentage, chi-square and one way analysis of variance. The study revealed that majority (58%Negi & Anand, 2015a). Closely related to this, a number of markets in urban settings lack central storage facilities (warehouse). Such a situation obliges traders to sell their produces in less appropriate urban spaces (open market space) or to buy fruits and vegetables in bulk in order to sell them in retail outlet to final consumers (Mgonja & Utou, 2017). It has also been noted by Negi & Anand (2015b) that even if storage facilities were in place, inadequate knowledge and skills on the use of such facilities and their alternatives also has been leading to PHL.

During the transportation stage, post-harvest losses have been associated with poor and inadequate transport infrastructure such as roads and railways. In the similar vein, it has been reported that inadequacy of special vehicles for carrying fruits and vegetables directly to urban areas escalates the problem(Zakaria *et al.,* 2014;889 tons of pieces of orange fruits are produced mainly by small holder farmers in the district per year and about 3.9 tons (39.7 percent Kiaya, 2014). It has further been reported by scholars (Wakholi *et al.,* 2015;Verma *et al.,* 2019) that poor and inappropriate loading and offloading facilities in fields contribute to more PHL in the VVF trade. Moreover, inadequate storage facilities notably cold temperature facilities within trucks is yet another escalating situation (Sharma & Singh, 2011; regional, national and export markets using Dar es Salaam, Ifakara, and Mtwara as case study examples. The major impediments for trade in Tanzania has been categorised into three groups: 1Negi & Anand, 2016b; Kitinoja & AlHassan, 2012)wholesale and retail markets, to increase the knowledge base and identify priority postharvest problems that currently limit market access for small farmers and rural marketers, 2.

Moreover, in the value addition and quality improvement level Mgonja and Utou (2017) report that lack of modern harvesting tools have led to more PHL in FFVs. This is due to the use of rudimental tools. The situation has been complicated by lack of appropriate

technologies for processing fresh fruits and vegetables before and after delivering them to urban markets (Negi & Anand, 2016b). Further studies (Rais & Sheoran, 2015; lack of temperature controlled vehicles, unavailability of cold chain facilities in various parts of country for preserving the produce, along with significant processing of the agricultural produce which results in immense losses to the nation. Hence a proper supply chain management in fruits and vegetables has to be improved in all the stages of the supply by adopting best global practices in storage, packaging, handling, transportation, value added service etc to meet the country's demand of fruits and vegetables. As per this paper important drawbacks of the current supply chain are high level of wastage, quality degradation, poor infrastructural facilities and high cost. Government and private operators have to join hands to improve the physical infrastructure, information sharing and the service required for quality improvement of the supply chain.","author":[{"dropping-particle":"","family":"Sheoran A","given":"Rais M","non-dropping-particle":"","parse-names":false,"suffix":""}],"container-title":"Journal of Food Processing & Technology","id":"ITEM-1","issue":"03","issued":{"date-parts":[["2015"]]},"title":"Scope of Supply Chain Management in Fruits and Vegetables in India","type":"article-journal","volume":"06"},"uris":["http://www.mendeley.com/documents/?uuid=beadd9ae-36cc-4fc1-b4d9-cc3e64f02374"]}],"mendeley":{"formattedCitation":"(Sheoran A, 2015Maier, 2015) report that inadequate guidelines and skills on value addition and quality improvement lead to more PHL. It has also been reported that lack of quality assurance regulatory systems and inadequacy of knowledge by farmers on the FFVs preparation and processing before and after harvesting them have caused more PHL (Haldar, 2018; Wakholi *et al.,* 2015; Haldar, 2018; Mgonja & Utou, 2017; Wakholi *et al.,* 2015; Kiaya, 2014).

With regard to market and marketing services level, post-harvest losses have been associated with unreliable markets for FFVs partly due to poor road connectivity and networks (Sudharshan et al., 2013: Mwagike & Mdoe, 2015)Tanzania. Semi-structured questionnaires were administered to 133 small vegetable farmers and 109 traders. Data analysis was done using descriptive statistics such as frequencies, percentage, chi-square and one way analysis of variance. The study revealed that majority (58% and inadequate markets and marketing information (Karim & Biswas, 2016; Zakaria *et al.,* 2014)889 tons of pieces of orange fruits are produced mainly by small holder farmers in the district per year and about 3.9 tons (39.7 percent. Studies by Negi and Anand (2015a), Mwagike and Mdoe (2015)Tanzania. Semi-structured questionnaires were administered to 133 small vegetable farmers and 109 traders. Data analysis was done using descriptive statistics such as frequencies, percentage, chi-square and one way analysis of variance. The study revealed that majority 58% have reported that poor coordination among the fruits and vegetables stakeholders notably farmers and intermediaries leads to disorganisation among different parties involved in supply chain intensify PHLs. While other studies (Zakaria *et al.,* 2014) report poor market network, Kader, (2005) loss of acceptability by consumers, and loss of edibility, Deliya *et al.,* (2012) and Verma *et al.,* (2019) associate the loss with lack of timely information sharing between farmers and other supply chain players as well as unstable demand and supply of the fresh produces emanating mainly from seasonality aspect.

Realities from reviewed literature indicate that PHL is a serious problem in the entire supply chain continuum. Despite the fact that existing studies have concentrated on PHL of FFV in the fields while neglecting the situation in urban markets, this study intends to bridge the existing knowledge gap by focusing on the urban markets in Tanzanian context.

CONCEPTUAL FRAMEWORK

This conceptual framework addresses aspects of research problem and objectives which include the post-harvest losses, causes of post-harvest loses and possible strategies for alleviating postharvest losses in the urban setting. Components of post-harvest loss in the context of supply chain are storage facilities, transportation, value additional and quality improvement markets and marketing services (Negi & Anand, 2016b; Haldar, 2018; Zakaria *et al.,* 2014; Kader, 2005; Kiaya, 2014; Karim & Biswas, 2016; Sharma & Singh, 2011. Mgonja & Utou, 2017; Mwagike & Mdoe, 2015; Underhill *et al.,* 2019; V erma *et al.,* 2019; Deliya *et al.,* 2012). Accordingly, in order to minimize post-harvest loses it is imperative to explore factors leading to post-harvest losses within the supply chain context of urban fresh fruits and vegetables. It is expected that the information emanating from the exploration of the factors can be relied upon to improve supply chain functions thereby alleviating the post-harvest losses of urban fresh fruits and vegetables.

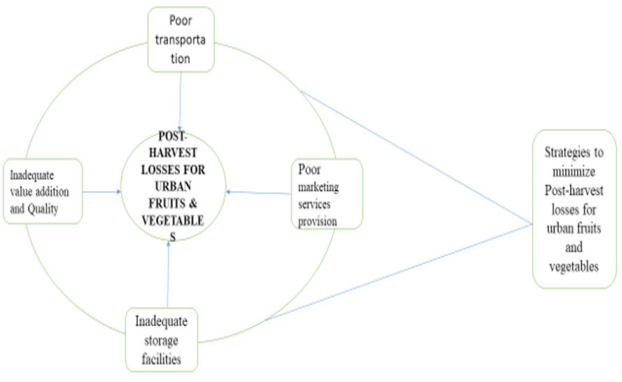

Figure 1
Conceptual framework on post-harvest losses for Fresh Fruits and Vegetables
Source: Researcher's creation, 2021

METHODOLOGY

Research Design and Context

This study adopted a qualitative case study design. This is because of the power of the design to study the intended phenomena in depth. The approach helped researchers to explore respondents' views on PHL in FFV. It also allowed respondents to air their views freely regarding how post-harvest losses occur in at every point of the supply chain function (Bryman, 2003). It was through this strategy the questions of what and how could easily be answered (Goodrick, 2014; Yin, 2013) rather than collecting data in numeric form that do not give a clear picture about the problem under the study. The work was carried out in Dar es Salaam city with Temeke stereo and Ilala market used as case studies. The two markets were used because they are the biggest FFV markets in the city with a vast number of vendors of FFV from whom valid data obtained, would not be secured from any other vendors in other markets. Thus, researchers, after obtaining data from the right source, studied the problem exhaustively.

Research Instruments

Data were collected through interviews, observation, Focus Group Discussion (FGD) and documentary review. With regards to interview, researchers set and pretested open ended interview questions before administering to respondents to check if they lead to collecting intended information. These questions were in line with what causes PHL in the supply chain continuum in Dar es Salaam markets. In this regard, consideration was made to transportation, storage, value addition and quality and marketing services. By using these questions, interviews were administered to intended participants. These were asked the same questions except in the period when participant deviated from the question or gave inadequate information which attracted more probing. All interviews were carried at vendors' business place(s) (Stereo/Ilala market). Interviews lasted between 30 and 45 minutes each session. With regards to FGD, two sessions (one from each market) were conducted among traders and intermediaries moderated by one of the researcher while the other two recorded the proceedings. By the use of market leaders, we recruited FGD participants in a convenient place and moderated the discussion. Each discussion held, lasted for an hour. As for documentary reviews, researchers reviewed a number of studies and regulatory framework including the national post-harvest management strategy, national horticultural developments policy, national Strategy for Growth and Poverty Reduction I & II, Agricultural development policy and SMEs policy. All these captured information related to PHL in FFV in urban markets. In the same vein, both FGD and documentary reviews were centred on PHL and the supply chain continuum. Quotations from verbal expression of participants and extracts from documentary reviews are presented in result presentation section. Due to the fact that the study was conducted during their working hours, participants were allowed to attend their customers in the middle of the interview and FGD. While the interview was about 40 minutes long, each FGD was carried for 90 minutes.

Case Selection Criteria

The study employed 55 respondents including customers, traders, market officer and intermediaries with 35 respondent from Stereo market and 20 from Ilala market. While researchers used convenient sampling to obtain customers, they, on the other hand, used purposive sampling, to recruit other participants in this study. Researchers recruited a total of 10 customers from both markets and the rest of participants from a combination of intermediaries, market officers and traders. It was pertinent to include customers because they are the ones who accidentally of deliberately buy damaged products. As for other participants, they were included in this study because of their vast knowledge in the topic and in simple terms, FFV trade is part of their life. These were approached and requested to participate in the study. Those who consented were interviewed with regards to the topic. While the study had intended to use more 100 participants, however, by the 45th participant, the researcher reached data saturation and added more 10 participants for confirmation.

Data Analysis

Due to the fact that we intended to produce valid results, our tools were subjected to a pre-test peer debriefing and prolonged engagement with respondents. We further, expounded the procedures we had intended to use in data collection so as to get corrected by our peers. We ensured that all participants were asked the same questions, and FGD were properly moderated and recorded. Due to the fact that Swahili is the easiest medium of communication in Tanzania, interviews and FGD were conducted in Swahili. The Swahili transcriptions were translated into English, typed and saved as documents in rich text format. By the use of MAXQDA 10 data were coded to determine the repeating contents. Thus, by using content analysis important contents of interests were obtained which formed a basis for the research report. Together with these, frequencies and quotations and important extracts are reported in findings.

Reflexivity Statement

The study was conducted during more challenging moments in the sense that the first challenging moment is that the government was conducting a survey to increase taxes, hence anyone seen to question about anything would be regarded as a tax officer and people would tend to shy away from him/her. Secondly, due to the COVID 19 pandemic there were few customers in the market. However, before data collection, we introduced ourselves

to market leaders, presented our research permits and identification cards. Market leaders introduced us to our intended respondents, informed then the intention of our study and its benefits to them and the country at large and assured them that we were not from the tax section. With regards to customers, the number we obtained was sufficient for our study.

FINDINGS AND DISCUSSION

These findings are structured around the four functions of the supply chain process which include storage, transportation, value addition and quality improvement as well as markets and marketing services provisions. In this case factors or rather ways in which post-harvest losses of urban fresh fruits and vegetables occur is traced and explained based on the abovementioned functions.

Post-Harvest Loss and Storage Facilities

Post-harvest losses of FFV at the storage level occurs and is caused by a number of reasons. Firstly it is caused by the absence of adequate central storage facilities for fruits and vegetables at the market places in the urban areas as evidenced by around 69% of the respondents. The reality shows that, neither of the market visited had a central storage facility. Due to this, stakeholders in the trade resorted to using only few available storage spaces implying that a greatest segment is never stored adequately leading to PHL as attested by one respondent here under:

> We keep a lot of our commodities [fruits and vegetables] on the floor as there are no specific storage devices here. Traders simply store their products in the ways convenient to them. This way a lot of our commodities are wasted and disposed every. To my understanding big market places like these ones should have central storage facilities. We are even ready to pay for it. (Male mangoes wholesaler (32), Temeke stereo market).

Secondly, it is associated with poor storage facilities as attested by around 63.6% of the respondents who emphasized that existing improvised storages do not have sufficient and effective devices. This has compelled many traders and intermediaries resort to using traditional and less suitable storage facilities such as wooden box, plant leaves and canvas sheets. These make FFV look awkward to customers. Moreover, it was established that lack of awareness by traders and intermediaries is another aspect that impeded them from making good and effective use of modern storage facilities available at the market and elsewhere as attested by around 56.36% of the respondents as briefly attested by one of the respondents below:

> …we have been using bamboo baskets, wooden boxes and crates to store our products. What's wrong about that? If you say that this is not proper what then should we do [use]? Nobody has ever come here and instructed us to use alternative storage facilities [modern facilities]. If there is anything different we need to do, let them [experts] come here and tell us. (Make Respondent (45), Temeke Stereo Market)

Thirdly, PHL at this level were caused by lack of knowledge and sensitization on the importance of proper storage by the various stakeholders as evidenced by around 39% of the stakeholders. Indeed it was noted that there were no any ongoing initiatives by the government and private sector to empower the traders and the intermediaries on the importance of appropriate storage.

Table 1
Summary of post-harvest loss caused by inadequate storage

Absence of /inadequate central storage facilities	69%
Poor storage facilities	63.6%
Inadequate knowledge on use of appropriate storage	56.36

Source: field data 2021

Drawing from Table 1, it is clear absence of adequate central storage facilities, poor storage facilities as attested by around and poor storage facilities among other factors contribute to PHL. These findings correspond well with the works as formerly conducted Tanzania (Kimaro & Msogya, 2012; Mwagike & Mdoe, 2015;Mgonja & Utou, 2017); India (Negi & Anand 2014; 2015; 2016; Rehman *et al.,* 2007). This further means that the current findings do not tell a very different story suggesting that it complements to the existing body of knowledge concerning the ways in which post-harvest losses of urban fresh fruits and vegetables occurs more especially at the storage level.

Post-Harvest Loss at Transportation

Findings present that PHL for urban FFV at the transportation level has been caused by the state of roads, transport facilities, loading and offloading mechanisms and handling practices. With regard to poor road infrastructure, these have led to the delay of products from one point as confirmed by around 83.6% of the respondents. It was further clarified that vehicles took too long to transport fruits and vegetables from one point to the other due to dilapidated roads. Moreover, vehicles carrying fruits and vegetables would opt for long routes with better roads an aspect that further resulted in the delays that lead to product damages and hence post-harvest losses.

Poor transportation facilities and equipment has been another cause of PHL of FFV as attested by 72.72% of the respondents. It was claimed that their financial capacity could not allow them to afford standards transportation facilities e.g. covered trucks with inbuilt storage facilities. These respondents explained that there were not adequate and specialized vehicles for transporting the fruits and vegetables. For example more often than not, transporters used open trucks or lorries that did not have storage facilities in them. This condition led to spoilage of fruits and vegetables before and even after arriving at the intended destinations as further explained one of the respondents:

> Most of the trucks and Lorries used for transporting fruits and vegetables are not designed for undertaking this task; hence transporters and agents of fruits and vegetables have resorted to using them because they are the available ones. As a result, FFV are exposed to hostile which depletes their quality.

Moreover, poor loading and offloading technology has been associated to causing PHL as attested by around 56.36% of the respondents. Respondents emphasized that in most cases picking up for fruits and vegetables specifically during loading and offloading to the trucks were done manually by individuals who would like to maximize their income through a number of trucks they load/offload. In this case, they are careless in handling FFV. All this is caused by lack of recommended standard loading and offloading equipment as further shown in the photos below:

Figure 1
Using less improved storage facilities within a truck
(Photo: Issa, I.M, 2020)

Hand in hand with the above point, another ways in which post-harvest loss occurs at the transportation level was through use of poor and inappropriate handling tools and distribution from the farms to the truck as attested by 73% of the respondents. They emphasized that handling and distribution facilities for fruits and vegetables were almost missing more especially when handling the products from farms to the transportation facilities and as a result they resorted to the use manual or less improved ones as stated here under:

> Basically farmers and intermediaries use very traditional handling tools here when it comes to collecting or carrying the fruits and vegetables from vehicles to markets. You can image using some traditional tools such as bamboo baskets and woven sacks it is really tiresome and risky. Sometimes, products fall down and get spoiled. This causes huge post-harvest losses as you can see. So at times business people receive them while already spoiled. (Tomatoes and oranges intermediaries (38) (42), Temeke stereo market)

Table 2
Summary of post-harvest losses at transportation function

Poor road infrastructure & delay in transporting products	83%
Poor transportation facilities and equipment,	72%
Through poor loading and offloading technology	56%
Use of poor and inappropriate handling tools and distribution	73%

Source: Field data 2021

Based on the above findings it can be said that, postharvest losses at the transportation level was caused by poor road infrastructure that led to the delay of the products from one point, through poor transportation facilities and equipment, through poor loading and offloading technology as attested by around and above all through use of poor and inappropriate handling tools and distribution from the farms to the truck. These results correspond well with existing literature (Zakaria *et al.,* 2014; 889 tons of pieces of orange fruits are produced mainly by small holder farmers in the district per year and about 3.9 tons (39.7 percentKader, 2005loss of acceptability by consumers, and loss of edibility; Kiaya, 2014; Wakholi *et al.,* 2015; Verma *et al.,* 2019; Sharma & Singh, 2011; Eskola, 2005; regional, national and export markets using Dar es Salaam, Ifakara, and Mtwara as case study examples. The major impediments for trade in Tanzania has been categorised into three groups: 1Negi & Anand, 2016b; Murthy *et al.,* 2009; Kitinoja & AlHassan, 2012wholesale and retail markets, to increase the knowledge base and identify priority postharvest problems that currently limit market access for small farmers and rural marketers, 2; Rais &Sheoran , 2015;lack of temperature controlled vehicles, unavailability of cold chain facilities in various parts of country for preserving the produce, along with significant processing of the agricultural produce which results in immense losses to the nation. Hence a proper supply chain management in fruits and vegetables has to be improved in all the stages of the supply by adopting best global practices in storage, packaging, handling, transportation, value added service etc to meet the country's demand of fruits and vegetables. As per this paper important drawbacks of the current supply chain are high level of wastage, quality degradation, poor infrastructural facilities and high cost. Government and private operators have to join hands to improve the physical infrastructure, information sharing and the service required for quality improvement of the supply chain.","author":[{"dropping-particle":"","family":"Sheoran A","given":"Rais M","non-dropping-particle":"","parse-names":false,"suffix":""}],"container-title":"Journal of Food Processing & Technology","id":"ITEM-1","issue":"03","issued":{"date-parts":[["2015"]]},"title":"Scope of Supply Chain Management in Fruits and Vegetables in India","type":"article-journal","volume":"06"},"uris":["http://www.mendeley.com/documents/?uuid=beadd9ae-36cc-4fc1-b4d9-cc3e64f02374"]}],"mendeley":{"formattedCitation":"(Sheoran A, 2015 Mgonja & Utou, 2017; Verma *et al.,* 2019). This is to say that, even though the existing studies focused on PHL of FFV in fields, this study has confirmed that it is not in fields alone even during transporting the same to markets of Dar es Salaam and other urban setting in Tanzania.

Post-Harvest Losses at Value Addition and Quality Improvement

One of the factors that caused post-harvest losses at value addition and quality improvement function relates to lack of appropriate value addition technology both at harvesting and processing stages as attested by over (63.6%) of the respondents. They stated that farmers used traditional or essentially manual means for harvesting and process various fresh fruits and vegetables. More specifically lack of modern harvesting tools lead to ineffective cleaning, sorting and grading of fruits and vegetables thus further leading to post-harvest losses as confirmed by a respondent here under:

> We are wasting a great deal of fruits and vegetables here because farmers and Intermediaries especially collectors in particular lack the required tools for cleaning grading and sorting out the fruits and vegetables products in order to assure quality before harvesting the products. (Urban farmer and trader, 44, (31), Temeke stereo market).

The absence of inspection tools during harvest, transportation and processing times have also caused PHLs as confirmed and evidenced by around (67.2%) of the respondents. Farmers and intermediaries stated that they basically lacked specific knowledge and skills for ensuring value and quality of fruits and vegetables before, during and after harvesting partly because there were no agencies that would advise them on to appropriate quality of FFV needed in the market. The end up sending to the market any produce, while traders receive the destroyed, the ripe, the unripe which afterwards are never sold but disposed. This was confirmed by one of the respondent;

> At times we're basically incapable of effectively determining what should be included or thrown away when sorting and grading because we lack skills and criteria for determining that. This is something we have always shared with various authorities but has not been solved. Consequently we lose a lot of what would be good products for fruits and vegetables. (Male intermediaries (FGDs), Ilala market)

It was reported further that lack of quality and value assurance regulatory system at both in fields and markets contribute to PHL in FFV as evidenced by majority of the respondents (67.2%). In this regard, traders always bring to the market any FFV they come across most of which is never used by consumers because it does not conform to their preferences and ends up being spoiled. It was, on the same note, revealed that farmers complained about poor government enforcement on quality assurance aspects. Presence of these quality regulatory systems with proper inspection tools in fields and markets would ensure harvesting the right produces, cleaning, sorting and grading them and would recommend hygienic loading/ offloading, packaging and transportation means from the farms to markets. They further complaint that they did not know the value of appropriate packaging facilities as well as even lack of enough capital to afford and buy modern and improved packaging facilities for fresh fruits and vegetables. Thus, farmers and intermediaries resort to use traditional and less improved ones. One respondents stated hereunder:

> We uses bamboo baskets, nets, woven sacks, wooden boxes to be out packaging and handling facilities for the produces. These are our facilities, we admire to have modern ones but we don't have enough funds and assistance from the market officers, government as well as private sectors" (males avocadoes and pension traders (36) (41), respectively, Temeke stereo market)

Findings also revealed lack of appropriate packaging materials as severe cause postharvest losses of urban fruits and vegetables as evidenced by around 82% of the respondents. Respondents maintained that containers and other facilities are deficient in almost all important areas at the time for harvesting in the farm, when loading them in trucks or lorries as well as at the markets places. This obviously caused post-harvest losses for fruits as testified by the following respondents:

> You have to note that, we use floors, pallets, boxes and sacks as handling tools as well as packing and packaging material. No any other alternative. I am compelled to use these dilapidated wooden boxes and woven sacks to hand the products. Almost all other people here use the same means. This is because we don't have funds to perchance more modern and appropriate packing and packaging tools. In this ways we lose a lot fruits because they simply get rotten or damaged in various ways (Male, 48) fruits and vegetables trader (Temeke stereo market)

Table 3
Summary of post-harvest losses at value addition and quality improvement

Inappropriate value addition technology	63.6%
Absent of inspection tools during harvest and processing times	67.2%
Inadequate/lack of quality and value assurance regulatory system	67.2%
Absence of grading and sorting tools	80%
Inappropriate tools for inspecting fruits and vegetables	82%

Source: Field data 2021

It can be summarized that post-harvest losses at value addition and quality improvement was caused by inappropriate value addition technology and absent of inspection tools during harvest and processing times. Other causes included absence of grading and sorting tools which could help identify products maturity from the farms, inappropriate tools for inspecting fruits and vegetables and lack of appropriate packaging handling tools. These findings correspond well with some former works in some parts of East Africa Tanzania inclusive (Mwagike & Mdoe, 2015;Tanzania. Semi-structured questionnaires were administered to 133 small vegetable farmers and 109 traders. Data analysis was done using descriptive statistics such as frequencies, percentage, chi-square and one way analysis of variance. The study revealed that majority (58%Mgonja & Utou, 2017); India (Wakholi *et al.,* 2015;Haldar, 2018;K. Kalidas

*et al.,*2012; L. Kitinoja & AlHassan, 2012;wholesale and retail markets, to increase the knowledge base and identify priority postharvest problems that currently limit market access for small farmers and rural marketers, 2 Kiaya, 2014; Hailu & Derbew, 2015; Negi & Anand, 2016b; Agarwal, 2017b;temperature, mechanical injury, poor sanitation and improper packaging. Off-farm losses include inadequate storage and transportation facilities, lack of reliable market information and processing units and poor knowledge of farmers. Post-harvest losses lead to food insecurity, higher food prices, and ultimately loss of scarce resources used in their production. Thus in order to achieve food security, these losses need to be reduced at farm, retail and consumer levels. The objective of this paper is to present a literature review concerned primarily with identifying the main causes for post-harvest losses in agri-food supply chain and recommending strategies to reduce these losses.","author":[{"dropping-particle":"","family":"Agarwal","given":"Shivani","non-dropping-particle":"","parse-names":false,"suffix":""}],"container-title":"International Journal of Advance Research in Science and Engineering","id":"ITEM-1","issue":"4","issued":{"date-parts":[["2017"]]},"page":"400-407","title":"Post-Harvest Losses in Agri-Food Supply Chain : a Literature Review","type":"article-journal","volume":"6"},"uris":["http://www.mendeley.com/documents/?uuid=ee241e68-00b6-41fe-9bf3-fb364c182cbe"]}],"mendeley":{"formattedCitation":" (Agarwal, 2017b Haldar, 2018; Sharma & Singh, 2011; Verma *et al.,* 2019). However, an interesting part of this discussion relates to the lack of quality assurance regulatory system and absence of inspection tools as a critical cause for post-harvest losses for urban fruits and vegetables at the value addition level. This has not been captured by other previous works. Accordingly this is the new contribution made by this current work.

Post-Harvest Losses at Markets and Marketing Services Function

Findings revealed post-harvest losses were variously associated with markets and marketing services provisions. Specifically, one of the aspects that caused post-harvest losses at this stage was related to unreliable market for fresh fruits and vegetables as attested by over 56.3% of the respondents. Respondents explained that traders transporting FFV from rural to urban areas do not have specific markets instead they depended on intermediaries who at times would overstay with the products hence leading to spoilage and post-harvest losses. Lack of markets was further contributed by inadequate number at value addition and quality improvement industries as confirmed by 36% of the respondents. Due to the fact that FFV are seasonal at the peak of their season markets were overflowed by these products most of which end up being spoiled. They added that such products would be absorbed by the related industries such as juice industries etc. Moreover, lack of markets was further fuelled by the outbreak of COVID-19 as attested by 41% of the respondents who affirmed that the outbreak prevented customers from visiting various urban marketing places for shopping.

Another marketing related aspect that contributed to the losses relate to poor coordination and relationship between the farmers and intermediaries on the one hand and among the intermediaries themselves on the other hand as evidenced by 51% of the respondents. Respondents explained that the existing relationship between farmers and intermediaries/traders was exploitative in nature, meaning that intermediaries were always setting prices that would benefit them at the disadvantage of farmers. In this case, farmers overstayed with the products in search of better prices while the intermediaries also overstayed with the products in search of super profits at the expenses of the farmers. Similarly, in such a blur relationship there is limited information flow between actors about what is prevailing in the market. Such a situation may lead into farmers transporting their produces in urban markets only to find them flooded. This causes them to witness their produces perish in front of their eyes. The situation was testified by a respondent as captured below:

> Intermediaries and some traders in many FFV markets in Dar es Salaam city have little knowledge and an understanding regarding the market trends and the dynamism that characterise these markets. And that have this knowledge don't share it between stakeholders. This is partly due to lack of information sharing mechanism among them (**Male cabbage trader (34), Ilala market)**

Another market and market related factor that contributed to the post-harvest losses is associated with the unstable or rather unpredictable demand and supply for fruits and vegetables as attested by over 53% of the respondents. This is to say that simply farmers and intermediaries were incapable of predicting the market forces to due to constant changes of the market conditions in terms of buying and selling prices.

Table 4
Summary of post-harvest loss caused by poor marketing services

Unreliable market for fresh fruits and vegetables	56.3%
Poor coordination and relationship between the farmers and intermediaries	51%
Lack of marketing information and poor marketing communication	80%
Unstable/ unpredictable demand and supply for fruits and vegetables	53%

Source: field data 2021

In this stage post-harvest losses were caused by the unreliable market for fresh fruits and vegetables, poor coordination and relationship between the farmers and intermediaries, lack of marketing information and poor marketing as well as the communication , unstable/ unpredictable demand and supply for fruits

and vegetables. These factors very closely correspond well with the existing literatures as formerly discussed in Tanzania (Mwagike & Mdoe, 2015)Tanzania. Semi-structured questionnaires were administered to 133 small vegetable farmers and 109 traders. Data analysis was done using descriptive statistics such as frequencies, percentage, chi-square and one way analysis of variance. The study revealed that majority (58%, India (Karim & Biswas, 2016; Zakaria *et al.,* 2014889 tons of pieces of orange fruits are produced mainly by small holder farmers in the district per year and about 3.9 tons (39.7 percent ;Negi & Anand, 2015a; (Deliya *et al.,* 2012;in emerging economies as well as developments markets, the power of the seller has overtaken that of the customer. Supply chain Management not only helps in cutting costs, but also adds to maintain and improve The Quality of fruits and vegetables marketed. In marketing fruits and vegetables, which are Perishable in nature, supply chain plays a crucial role. The very nature of land holding by the farmers, Varied climate conditions, production spread over wide geographical area, mainly in remote villages, diversified consumptions patterns and poor infrastructure makes SCM for fruits and vegetables complicated. In India, SCM is at its growing stage in marketing of Fruits and Vegetables. Marketing of Fruits and Vegetables are challenging because of the perishability, seasonality and bulkiness and consumption habits of the Indian Consumers. In addition to this, poor infrastructure, poor equity in SC and conventional small scale unorganized retailers, make state of the art supply chain challenging in the present scenario. The Indian retail market is mainly dominated by unorganized retailers. The unorganized retailers are homogeneous group. Recent development in retailing is the entry of large number of organized retailers. Current supply chain catering mainly to the unorganized retailers is riddled with number of drawbacks. As per this paper important drawbacks of the current supply chain are number of intermediaries, high level of wastage, quality degradation, poor infrastructural facilities and high cost. Government and private operators have to join hands to improve the physical infrastructure, information sharing and the service required for quality improvement of the supply chain.",”author”:[{“dropping-particle”:””,”family”:”Deliya”,”given”:”Mitul”,”non-dropping-particle”:””,”parse-names”:false,”suffix”:””},{“dropping-particle”:””,”family”:”Thakor”,”given”:”Chanduji”,”non-dropping-particle”:””,”parse-names”:false,”suffix”:””},{“dropping-particle”:””,”family”:”Parmar”,”given”:”Bhavesh”,”non-dropping-particle”:””,”parse-names”:false,”suffix”:””}],”container-title”:”Commerce and Management”,”id”:”ITEM-1”,”issue”:”3”,”issued”:{“date-parts”:[[“2012”]]},”page”:”40-57”,”title”:”A study on \”differentiator in marketing of fresh fruits and vegetables from supply chain management perspective\”.”,”type”:”article-journal”,”volume”:”1”},”uris”:[“http://www.mendeley.com/documents/?uuid=6ac0d07b-b5c7-4dc1-a9e5-c91827b499ce”]}],”mendeley”:{“formattedCitation”:” (Deliya, Thakor, & Parmar, 2012 Sudharshan *et al.,* 2013; Underhill *et al.,* 2019; Verma *et al.,* 2019). This is a clear indication that the current study contributes to the existing literature about this particular subject matter.

CONCLUSION

The study intended to get a better understanding of factors leading to PHLs for urban FFVs supply chain. Specifically, the work intended to examine ways in which post-harvest losses for urban fresh fruits and vegetables occurs in the context of supply chain continuum. The findings were structured around the four functions of the supply chain process which include storage, transportation, value addition and quality improvement as well as markets and marketing services provisions. In this case factors leading to post-harvest losses of urban fresh fruits and vegetables are traced and explained based on the above mentioned functions.

Accordingly, it is evident that the planning of markets built in urban settings did not consider the importance of providing storage facilities for all products. If the situation is not addressed, we are far back to achieving zero PHLs of FFV in markets. It can further be generalized that the transport network with dilapidated roads lay grounds for the delay of FFV and ultimately decay. Worse still even when these produces delay, they are not in proper transport means and in most cases the situation in which they are damage their quality. It further tells that these produces will always yield low prices leading to produce and monetary losses.

With the way it stands, there are limited effort of quality improvement and value addition in the FFV trade in general. This implies that never will these produces compete in the market, they will be the last and will continue to rot. In the same way these produces will only be consumed locally and will never compete neither qualify for international markets. Moreover, due to the fact that there are no platforms monitored by the government providing information about the market trend of FFV it is evident that stakeholders will always face market uncertainties due to inadequate information. The situation will lead them into increased PHLs of these produces day after the other.

Recommendations

The study puts forward a number of recommendations order to alleviate post-harvest losses associated with FFV trade in urban markets in Dar es salaam, Tanzania. These include construction of central storage facilities which are well equipped with cooling equipment that will ensure that all FFV are stored well and in a hygienic acceptable situation. This can be done through taking special

contributions from traders because they are ready for that. Municipal authorities and private sector may be included in this as well. Moreover, important FFV supply chain stakeholders should be sensitized on the proper utilisation of relevant and available storage facilities.

In order to alleviate the post-harvest losses related to the transportation function, firstly government through the ministry of transportation and road construction should work hard to improve the existing poor road infrastructure that causes delays in transporting fresh fruits and vegetables products. The general public should be sensitized on the investment of FFV friendly and hygienic transporting vehicles. Such vehicles will minimize the loss incurred in the VVF supply chain continuum. Along with this, FFV trade stakeholders through the ministry of agriculture and food security should be trained on proper FFV handling in terms of hygienic harvesting, packing and packaging, sorting and selling.

To alleviate PHLs at value addition and quality improvement function, the ministry of education in collaboration with the ministry if investment should encourage the establishment of value additional industries. These will consume all products available in the market there by minimising PHLs in this trade. Along with this, training should be extended on proper harvesting, piling, sorting and grading as well as selling. Further regulatory requirements be extended to all stakeholders and regular follow ups be conducted by Tanzania Bureau of Standards (TBS) from the farm to market. These will not only safeguard consumer's health but also minimising the rate of PHLs.

With regards to PHLs caused by markets and marketing services we recommend that the ministry of agriculture and food security should search for markets of FFV locally and internationally and make sure that it publicises information regarding to market trends by the use of social networks and mobile phone USSD codes. This should be facilitated through thorough research on the demand and supply for fruits and vegetables in such a manner that will not cause any damage and spoilage of these products and cause post-harvest losses in particular. This will minimise PHLs in the FFV supply chain continuum.

Future Research

This study was qualitative in nature and thus findings care not generalizable. While the study dealt with FFV in the markets, issues related to regulatory frameworks and FFV trade, consumer hygiene and FFV trade in the sampled markets need to be looked into in future studies.

Data Availability Statement

Data regarding the findings of this paper are available upon request through the correspondent author.

Declaration on Conflict of Interest

Authors declare no conflict of interest with regard to title and findings obtained in this study.

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