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REGULAR ARTICLE

Postharvest losses to agricultural product traders in Mutare, Zimbabwe

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Abstract

The study examined the nature and causes of postharvest losses incurred by formal and informal traders in Mutare urban. A survey was conducted where questionnaires were administered to various respondents in the formal and informal sector of fruits and vegetables. The research study assessed the profitability of trading in fruits and vegetables to formal and informal traders. It also assessed traders' perception of the losses of fruits and vegetables and further determined the possible ways of reducing these postharvest losses so as to enhance profitability in the sector. The study from a sample of 34 respondents revealed that both formal and informal traders experience losses during storage and transportation of goods. Losses incurred during storage were due to the unavailability of proper storage facilities specifically to informal traders. Furthermore, postharvest losses were also resulting from excessive exposure of crops to sunlight, poor packaging, poor carrying containers, attacks by insect pests as well as microbial or disease attacks. Postharvest losses affect profitability and growth of the fruits and vegetables sectors. There is need for farmers to improve on the quality of their produce and harvesting practices as emphasized by traders as they suffered losses as a result of poor quality goods supplied. Further postharvest practices should be improved by traders with special emphasis on adequate storage, handling and proper transportation of goods.

Keywords: Post harvest losses, vegetables, fruits, storage, profitability, quality

Introduction

Throughout the world, the population explosion is a major concern and is expected to reach 10.5 billion by 2050 [1]. This explosion in population demands the increase in the agriculture and food resources. The supply of the food should increase at least by 60% in order to meet the food demand in 2050 [2]. Currently, Zimbabwe's economy is improving step by step after an economic decline from 2000 to 2008. The main contributor in economy is agriculture sector, with about 70%

of the population depending on agriculture. Apart from this increase in economic growth through agriculture, the losses due to poor postharvest practices remain a concern for most of the farmers.

The losses due to post-harvest practices are both qualitative and quantitative food loss along the supply chain, since the beginning of harvest until consumption [3][4][5]. Losses of fruits and vegetables can be qualitative and quantitative. Qualitative losses result in the

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reduction in the quality and consequently, the value of the food item. Quantitative losses results in a reduction in weight and consequent loss in total value. Losses in quantity have been found to be more common in developing countries [6]. According to FAO, at a global level, volumes of lost and wasted food in high income regions are higher in downstream phases of the food chain, but just the opposite in low-income regions where more food is lost and wasted in upstream phases [7].

These losses need to be reduced so that traders may realize reasonable profits and contribute immensely to economic growth and poverty reduction in the country. There is need to assess traders’ perception of the losses of fruits and vegetables, to determine the major causes of postharvest losses to formal and informal traders, as well to assess the profitability of fruits and vegetables trading to formal and informal traders in Mutare.

The study will assess the causes of losses and determine major solutions. The findings from the study are hoped to provide relevant information to traders on appropriate measures they should implement to reduce losses and enhance profitability.

Materials and methods

The research was conducted in Mutare District of Manicaland Province in South-Eastern Zimbabwe. Mutare, the provincial capital is the third largest city in the country. It boards Zimbabwe and Mozambique. The city has a tropical location but it has a temperate climate due to being located in a mountainous area. The study area has a variable climate from wet to semi-arid. The mean annual temperature of the area is 19°C and the mean annual rainfall is 818mm [8]. The study area is the central business district of the town and a few farmers outside Mutare. The research study focused on the major formal dealing with fruits and vegetables as well as informal traders in the city.

The formal traders are mainly retail outlets and wholesalers and the informal traders were the fruit and vegetables vendors. Research was carried out using multiple data collection methods to enhance the validity and reliability of the data collected. Both primary and secondary data sources were used. Secondary research involved gathering data that already existed either from internal sources of the firm, publication of governmental and non-governmental institutions, and free access data on internet, in professional newspapers, journals and magazines. Primary research consisted of original primary data collected by the researcher. Primary research was undertaken and it used methods such as face-to-face interviewing, telephone and postal surveys, experiments, questionnaire and direct observation. Field research was performed for correct data analysis of the study.

Data Collection

The research study used questionnaires as the instrument of data collection and a total of 34 questionnaires were administered, the information required was about types of fruits and vegetables traded, fruits and vegetables handling, transportation, packaging, fruits and vegetables losses as well as profitability. A random sampling method was used to select respondents. Results of the survey were analyzed and presented in percentages.

Data analysis and organization of data

Data collected from the study was entered into the Statistical Package for Social Sciences (SPSS). SPSS 14.0 was used for data analysis and generation of outputs. Data was both qualitatively and quantitatively analysed in order to produce an informative research. Graphs and charts were used to represent diagrammatically the findings so as to identify important variables, and their significations.

Below is the type of data that was required to fulfill the research’s objectives.

Objective	Data Required	Data Collection Method
<i>To assess the traders’ perception of postharvest losses of fruits and vegetables</i>	Information about post-harvest losses, causes and its impacts	Questionnaires Observations
<i>To assess causes of postharvest losses incurred by both formal and informal traders in Mutare urban.</i>	Information about post-harvest handling practices, how it’s causing losses.	Observations Questionnaires Interviews
<i>To assess possible mitigation strategies for losses in the value chain.</i>	What the traders are doing to reduce losses in order to increase profits.	Key informant interviews Questionnaires

Results

Demographic characteristics of the respondents

Gender, marital status and the age of the respondents

Data pertaining to distribution of gender status of the sample respondents is shown in Fig. 1. Of the 34 respondents from the informal traders only 33.3% of them were male while a larger proportion of these informal traders were females (66.7%). Results from the formal trader's shows that male traders comprised a larger proportion (75.0%) while only 25.0% of them were females.

Table 1 shows that the majority of the respondents in the informal traders were married (50.0%) while 20.0% were single, 10% divorced and 20% were widowed. The lowest

proportions of the respondents were divorced comprising only 10.0% of the informal traders. Data obtained reveal that the bulk of the formal traders were married (75.0%), and the rest of these traders were unmarried (25.0%).

Table 1. Distribution of marital status of respondents

Status	Frequency	Percentage (%)
Informal		
Single	6	20.0
Married	15	50.0
Divorced	3	10.0
Widowed	6	20.0
Formal		
Single	1	25.0
Married	3	75.0
Divorced	0	0.0
Widowed	0	0.0

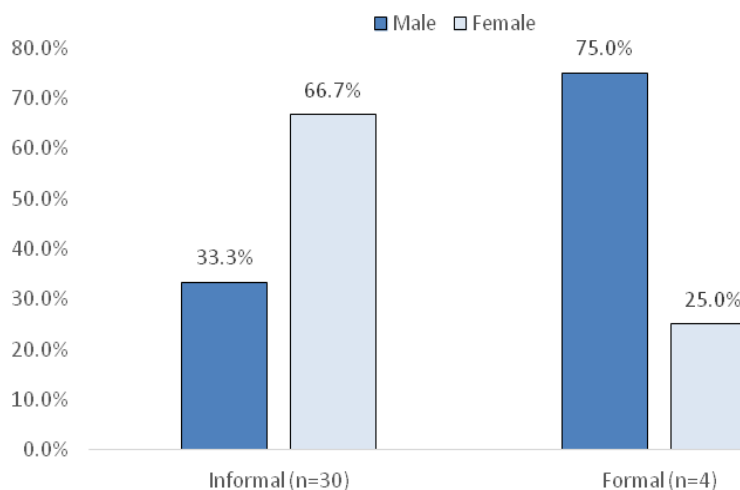


Fig. 1. Gender distributions of the respondents

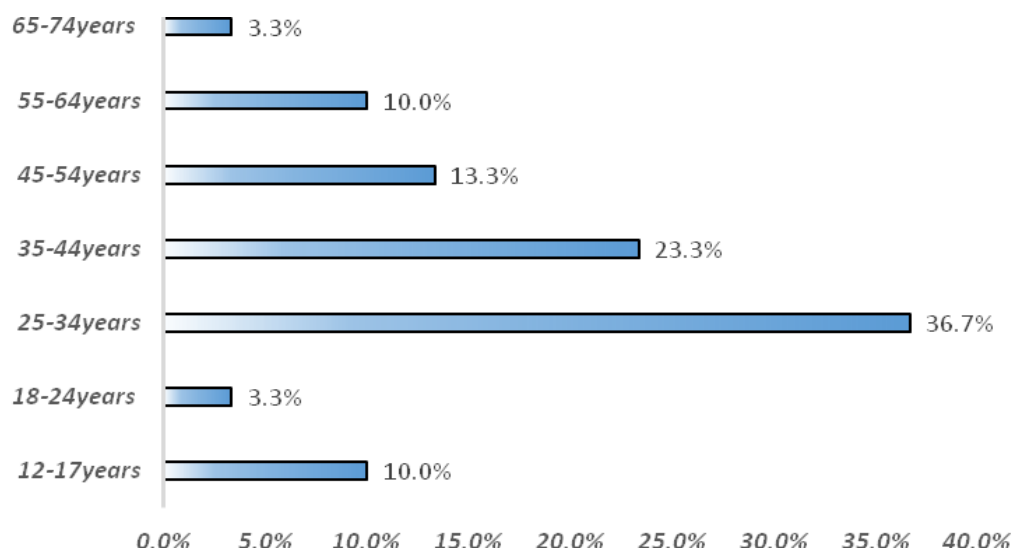


Fig. 2. Age distribution of the respondents

Data regarding the age distribution of the respondents from the informal traders is presented in Fig. 2. This data reveal that the age of the traders was ranging from 12years to 74years. The age group with the highest (36.7%) number of respondents recorded was 25-34years group while the age groups 18-24years and 35-74years recorded the least (3.3%) number of respondents. Many households in cities supplement their incomes by means of various forms of informal activities [9]. This could explain the fact that over half of the respondents were below the age of 40. All the respondents from the formal traders were in the 25-34 years age group.

Data presentation and analysis

Level of education attained, period in business and training on postharvest handling

Fig. 3 shows the data regarding the highest academic qualification attained by the sample respondents in this study. This data indicates that most of the respondents from the informal traders have Ordinary level (50.0%) followed by Advanced level (16.7%) qualification. The highest academic qualification with the least number of respondents (3.3%) from the

informal traders was from those with no schooling at all and with Certificate level. The rest of the sample respondents either went to school up to Grade 7 or had some secondary education. However, all the respondents from the formal traders went to school up to Ordinary level (Fig. 3).

Table 2 The period in time (years) the respondent has been doing this business

Period	Frequency	Percentage (%)
Informal		
<5years	1	3.3
>5years	29	96.7
Formal		
<5years	1	25.0
>5years	3	75.0

Table 2 indicates that the majority (96.7%) of the informal traders have been in the fruit and vegetable business for more than 5years, and only 3.3% of the respondents were under 5years in the trade. Those in the formal trade of fruits and vegetables who has at least 5years experience of the business are 75.0% while the other 25.0% has less than 5years experience in the business.

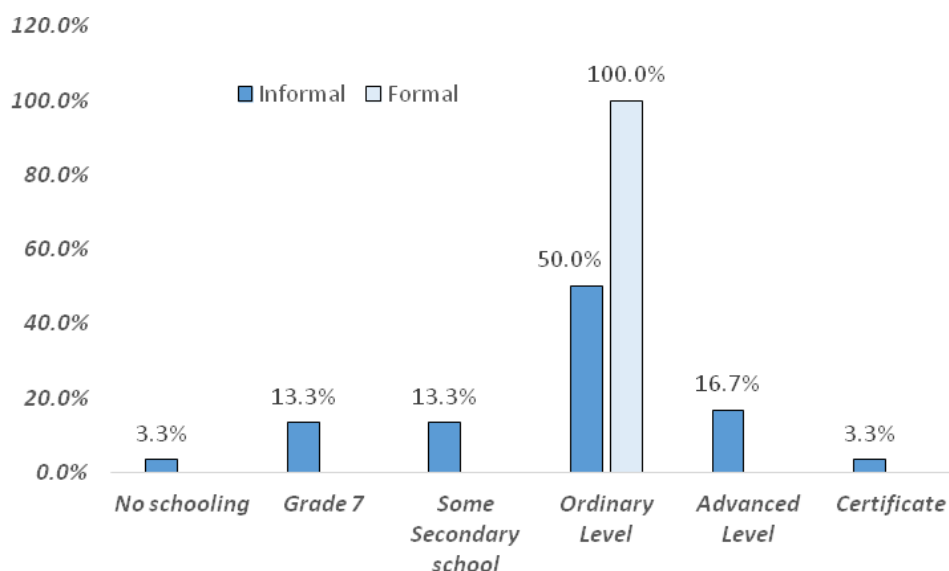


Fig. 3. Education levels of the respondents

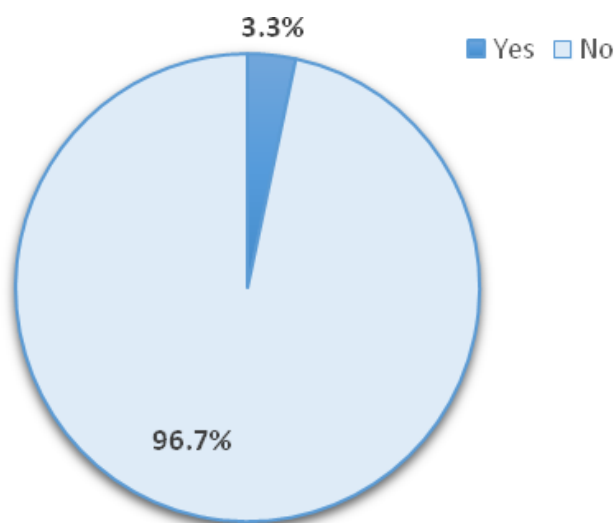


Fig. 4. Distribution for Postharvest training acquired

The survey results from the study indicate that the majority (96.7%) of the informal traders do not have any training regarding postharvest handling of their fruits and vegetables which they sell (Fig. 4). However, a few (3.3%) who have got some general training from wholesale traders were they buy their fruits and vegetables for re-sell. Fifty percent of the formal traders have got some training on postharvest handling of fruits and vegetable while the other 50.0% does not have training.

Fruits and vegetables traded and their source

Information regarding the most commonly traded fruits and vegetables by both the informal and the formal traders is shown in Table 3. It is important to note that all the informal traders sell all fruits and vegetables. However, you may not find all at the same time on their tables but they do sell all types of fruits and vegetables. The three most common sources of fruits and vegetables are local producers, South African and Mozambique distributors. All the respondents indicated that they buy locally from local producers who include both smallholder and medium to large commercial farms, and peri-urban producers. Of the sample respondent 26.7% of them buy some of their fruits and vegetables from South Africa; apples, grapes, peaches, pears and onions top the list. On the other hand, 13.3% of the respondents buy their commodities from Mozambique; bananas and coconuts tops the list. The formal traders also buy and sell the same fruits and vegetable as the informal traders however, all of them buy locally, from Mozambique and South Africa as well.

Postharvest handling practices

The following practices by both informal and formal traders gives us more insight on how these traders handle their commodities from the purchasing point right up to their market place. This study revealed some of the practices which either promote or reduce the postharvest losses by these traders.

Table 3. The most common type of fruits vegetables sold and sources.

Produce type	Sources		
Fruits	Mozambique	South Africa	Local markets
	Coconut	Apples	Oranges
	Bananas	Grapes	Bananas
		Plums	Avocado
		Litchi	Strawberries
		Pears	Apples
			Peaches
Vegetables	Onions	Onions	Tomatoes
		Cauliflower	Potatoes
		Broccoli	Lettuce
			Cabbage
			Cauliflower
			Covo
		Rape	

Table 4. Transport methods used by the respondents

Method	Informal		Formal	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Head Load	-	-	-	-
Drought power	-	-	-	-
Commuter omnibus	15	50.0	-	-
Bus	4	13.33	-	-
Van	7	23.33	3	75.0
Truck	4	13.33	1	25.0
Railway	-	-	-	-
	(n=30)	100%	n=4	100%

Transport methods

Table 4 shows the type of type of transportation that is used by these traders when carrying their commodities from the different sources. The most popular type of transport used is the commuter omnibus for the informal sector while the formal sector mostly uses business vans and the refrigerated trucks for certain fruits and vegetables.

Types of containers used

The most popular type of containers used by the informal traders is large multi-purpose baskets and sacks (Table 5). For some commodities such as tomatoes, avocados and bananas cardboard boxes are used. The formal traders also use plastic crates which are a bit

expensive for most informal traders as well as the designed containers and refrigerated truck to transport commodities such as strawberries, grapes, kiwi fruits and some vegetables like lettuce, broccoli and pepper.

Storage facilities used

Table 6 shows the type of storage facilities that are used by informal and formal traders in the fruit and vegetable business. Some informal traders (16.67%) store their commodities in their houses but at the market place none of the traders have access to a storage place. At the end of the day's trading they just cover their produce with sacks and plastics then they go home. A security officer is paid USD\$1.00 to secure the place overnight.

Table 5. Types of container used by respondents

Method	Informal		Formal	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Baskets	12	40.00	2	50.0
Sacks	13	43.33	-	-
Plastic	-	-	-	-
Crates	9	30.0	3	75.0
Cardboard box	3	10.0	-	-
Refrigerated truck	-	-	2	50.0
Designed containers	-	-	3	75.0

Table 6. Storage facilities used by respondents

Method	Informal		Formal	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Living house	5	16.67	-	-
Modern store	-	-	1	25.0
Cold room	-	-	3	75.0
No storage	30	100.0	-	-

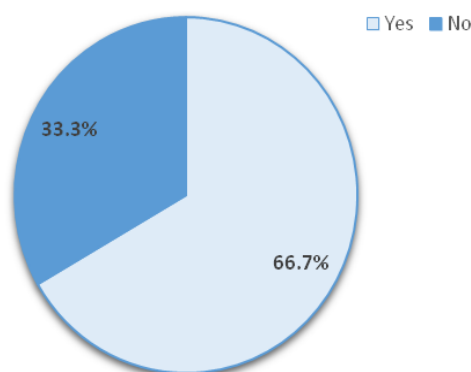


Fig. 5. Importance of postharvest losses to traders

When asked on the importance of postharvest losses they encounter in their everyday business not all respondents from the informal traders gave an affirmative response as would have been expected. 33.3% of the respondents replied they were not apprehensive of these losses (Fig. 5). All formal traders gave an affirmative response regarding postharvest losses. Those who gave a favourable response, both informal and formal traders, were asked to put on scale the importance of these postharvest losses in their business. All the respondents scored the maximum relevance of these postharvest losses in their business.

Phase of postharvest losses

Table 7 indicates that most of the informal traders experience these postharvest losses during the storage and marketing phases. Also, more than 50% of the respondents lose some of their commodities during transportation either from purchasing from farmers and wholesalers or when transporting commodities, as well as during storage. Handling of the fruits and vegetables during

packing has also been reported to result in the postharvest losses experienced by these traders. No processing losses were reported by the traders. On the other hand, all the formal traders reported that they experience losses during transportation mostly from the farmer or wholesale markets to their shops. Other losses were also experienced during the marketing of the fruits and vegetables.

Table 7. Phase at which traders experience postharvest losses

	Time	Respondents (%)	
		Informal	Formal
a.	During storage	70.0	25.0
b.	Transportation	53.3	100.0
c.	Packaging	43.3	-
d.	Marketing	73.3	50.0
e.	Processing	-	-

Causes of postharvest losses

The causes of the postharvest losses experienced by these traders are multiple and complex. Table 8 shows some of the causes which have resulted in the traders not getting the maximum out of the fruit and vegetable business. Most of the informal traders highlighted that they experience losses due to poor storage, poor transportation and from insect pests damages. Most of the formal traders reported to experience losses from microbial and/or disease attacks on their fruits and vegetables, careless handling during harvesting, poor packaging and poor transportation. Harvesting of immature crops and poor carrying containers from the farmers were also reported by these formal traders to have contributed significantly to postharvest losses incurred.

Table 8. Causes of postharvest losses

	Time	Respondents (%)	
		Informal	Formal
a.	Poor processing	-	-
b.	Poor method of food preservation	-	-
c.	Careless handling of items during harvesting	13.33	50.00
d.	Microbial/Disease attack	46.67	75.00
e.	Harvesting of immature crops	-	25.00
f.	Poor storage	73.33	-
g.	Excessive exposure of food crops to sunlight	23.33	-
h.	Insect pests	70.00	-
i.	Poor carrying containers	13.33	25.00
j.	Poor packaging	13.33	50.00
k.	Poor transportation	66.67	50.00

Determining profitability

An assessment was done to find out how profitable the fruit and vegetable business is by these traders. The informal traders who turn over some of their stock within a day are 53.3% while others, on different commodities, the turnover is 5-10 times or more per month. The proportion of informal traders who reported more than 50% and below 50% monthly total revenue from the trading of fruits and vegetables are shown in Fig. 6.

The determination of the losses is measured in the number of 20L buckets or boxes thrown away of the spoiled commodity. None of the traders weigh the quantities that they throw away from the simple reason that they do not have the scales and also do not pay much particular attention to postharvest losses. The respondents also highlighted that there are some consumers who are willing to pay for some damaged fruits and vegetables. However, the traders usually reduce the price of such commodities by up to 50% of the initial selling price in order to try recover on the cost incurred in buying the fruits and vegetables from the farmers. The formal traders also reported that they sometimes reduce the price of damaged or bruised fruits and vegetables by 50% or even 75% so to avoid outright loss. Figure 8 shows the proportion of those traders whose reduce prices by either 50% or more than 50% of the selling price.

The informal traders have indicated that storage of their fruits and vegetables attract a

charge which vary from USD\$1.00 per week to USD\$2.00 per week depending on the facilities available. Both informal and formal traders have reported that distance from the source of the fruits and vegetables affect the profitability of the business. The cost of transporting new stock of fruits and vegetables for informal trader's ranges from USD\$0.50 to USD\$1.00 per basket, crate or sack and also depending on the mode of transport and distance from the market

Fig. 8 shows the USD average weekly and monthly transport costs as well as storage costs incurred by informal traders. The average weekly cost is \$1.50 and \$5.25 for storage and transport respectively.

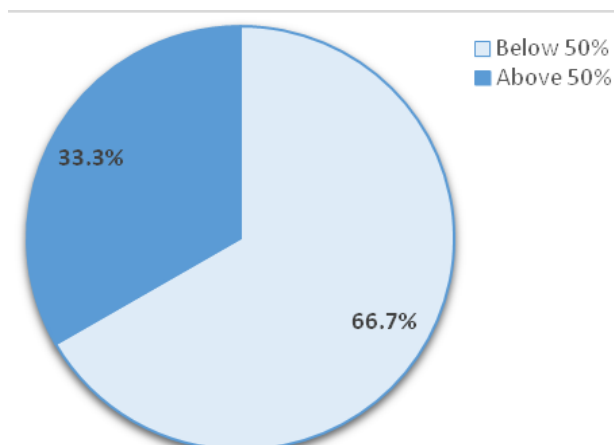


Fig. 6. Proportion of monthly revenues from trading fruits and vegetables by the informal traders

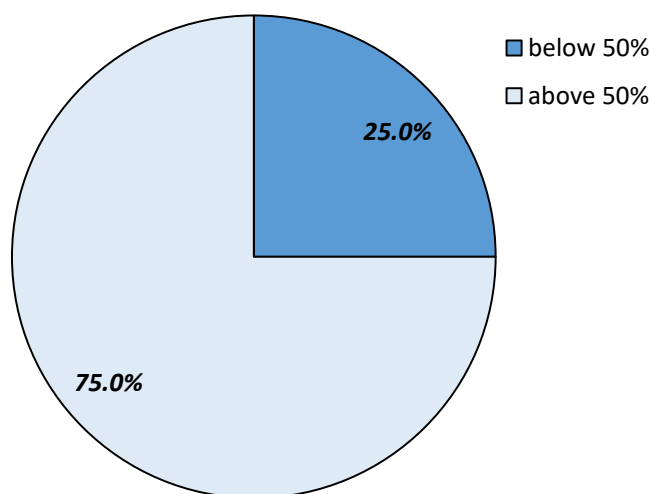


Fig. 7. Proportions of informal traders who reduce prices by 50% or above by

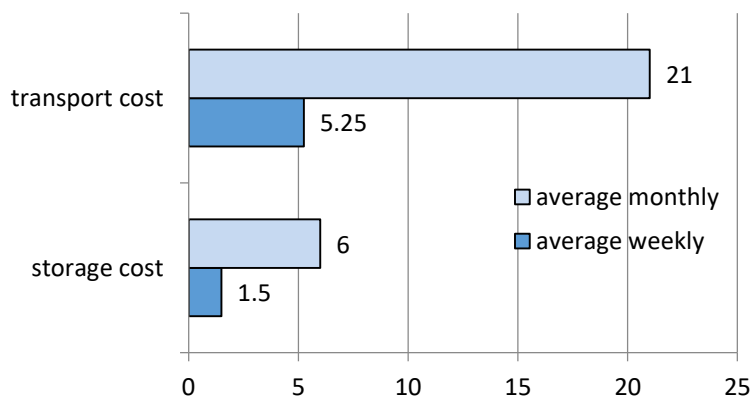


Fig. 8. Transport and storage costs incurred by informal traders

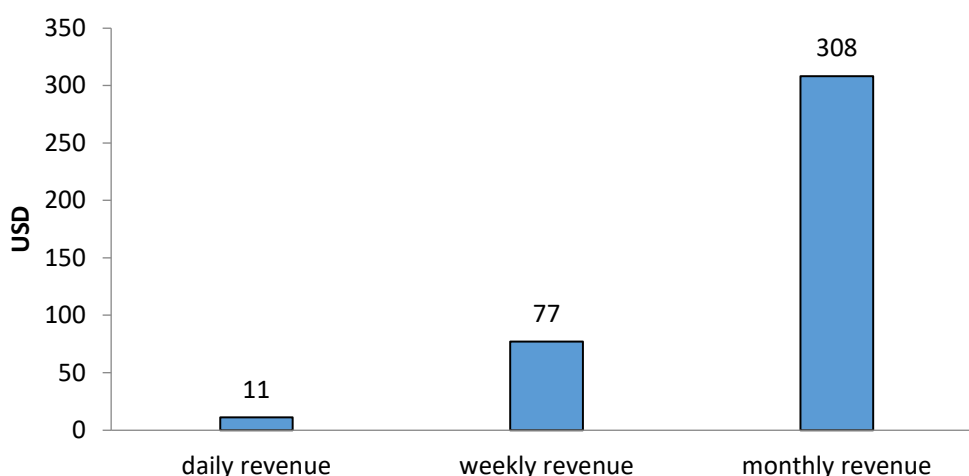


Fig. 9. Revenue for informal traders

Fig. 9 shows the average daily, weekly and monthly revenues for informal traders in Mutare. In a day informal traders are able to earn \$11, \$77 in a week and a minimum of \$308 on average per month from the sale of their different fruits and vegetables.

Measures to minimize postharvest losses

Table 9 shows measures that were perceived by both formal and informal traders to be important to minimize postharvest losses in order to ensure profitability of the business.

Table 9. Responses on measures to minimize postharvest losses

Time	Respondents (%)
a. Carefulness in loading and unloading of items	50.0
b. Avoidance of over stacking of items	62.0
c. Avoidance of exposure of items to direct sunlight	30.0
d. Harvesting of crops in the morning and evening to prevent them from sunlight	16.6
e. Recognize maturity index of various items.	-
f. Demonstration of handling techniques of items during grading and sorting	16.6
g. Use of appropriate means of transport	50.0
h. Avoid exposure to sunlight	56.6
i. Giving postharvest education	26.6
j. Use more appropriate carrying containers	30.0

Discussion and interpretation

The study reveals that the majority of these traders reported that postharvest losses occur during the transportation, storage and marketing period. Other sources of losses are reported to come from the time of packing the fruits and vegetables. Despite most of the respondents being fairly educated (at least Grade 7) lack of basic training in handling their commodities at these stages could be attributed to the resultant losses. Close observations on the methods adopted by these traders, especially the informal traders, reveal that knowledge of crop physiology is lacking. It would be assumed that since most of them have been in the business for a number of years (>5 years) they would have gained some wealth of experience. While losses are experienced during transportation phase damage that result may not be ascribe so much to type of vehicle in this instance. However, the containers which these traders use to carry their commodities inflict much damage to the fruits and vegetables. The containers used are too large because the traders want to avoid having to carry the same commodities in many containers. As a result, overloading results in either fruits or vegetable at the bottoms to suffer mechanical damage from the inappropriate containers and the overload. Transportation by bus has contributed to great postharvest losses because while on top of the bus, the fruits and vegetables are exposed to too much sun and wind abrasion. More often than not, some traders have also reported that other goods are put on top of their commodities resulting in mechanical damage unlike when they use commuter omnibus, trucks or vans.

The reeds baskets and the sacks bruise and cut the fruits and vegetables during transportation. Losses were also experienced when refrigerated truck or designed containers are used. Over-piling could be the main reason for these losses as reported by the traders. Improper piling of the containers such that they will be sliding from side to side as the truck is moving has contributed to losses from bruises caused. Rolle also noted horticulture postharvest losses to be attributed to rough handling, untimely harvesting, a lack of appropriate harvesting tools, inadequate field sorting, grading and packing protocols for

commodities, poor transportation infrastructure, a lack of appropriate transport systems, and a lack of refrigerated transportation vehicles [10].

Most fruits and vegetables are delicate by nature, some bruise or crack easily while some cannot withstand harsh weather conditions such as heat or too much wind as they can tear-off. Despite this, results have shown that the informal farmers use no storage facilities. This has been attributed to postharvest losses experienced as fruits and vegetables stay in the open been exposed to harsh weather conditions. The formal traders use either modern stores or cold rooms. Nevertheless, a closer observation into these facilities and flaws were noted in the way they store their commodities. In addition, despite the availability of storage though not adequate enough formal traders incur more losses from poor quality produce from local farmers that has an unreasonably short life cycle and losses in transportation as produce is transported over long distances such as from South Africa to Mutare. Postharvest losses occurred as a result from overstocking and over-stacking. There is need to avoid over stacking of food crops. Over stacking leads to heat generation and deterioration of food items, different fruits and vegetables require different storage temperatures but because of lack many of these facilities the same temperature is exposed to the stored fruits and veggies. Closer observation into the facilities of the formal traders has shown that some fruits are exposed to too low temperature while others the temperature is not low enough to store them for a longer period of time. The result is that some fruits and vegetables rot while in cold store and others as soon as they come out of the cold store and start to defrost the tissues collapse and shelf-life is greatly reduced before they go bad.

These traders they buy their commodities from three main sources, local markets, South Africa and Mozambique. In this regard, some of the fruits and vegetables travel over a very distance to reach the traders and along the way is exposed to several adverse conditions. Now, because a significant large number of these traders are not apprehensive of the postharvest losses (Fig. 6), they do not practice any basic grading or sorting of the commodities when it

reaches to them. An observation on how these traders receive their commodities has also been ascribed to postharvest losses they incur. Fruits and vegetables that are bruised, cracking and with sunscald even rotten find their way into storage. Improvement in the processing and storage by grading and/or sorting will drastically reduce postharvest losses. Some fruits and vegetables from both local and foreign sources needs to be graded to remove immature fruits and vegetables which may start to rot and cause others around it to go bad as well, sorting which is not being practiced becomes important.

Both informal and formal traders experience postharvest losses due to microbial, pests and/or diseases attack. This challenge is aggravated especially during storage by the fact that not much grading or sorting is done prior to storage of the fruits and vegetables. When further asked about their knowledge on identification of diseases on their commodities most of these traders showed very limited know-how. The researcher observed fruits and vegetables are affected by fungal diseases to a larger extend and less bacterial diseases. As a result of over-piling and over-stacking during storage, the diseases are noticed very late when a significant amount of the commodity have been spoiled beyond recovery. Other causes as indicated in Table 12 such as exposure to sunlight and poor packing are a result of poor adoption of new technologies that could prevent such losses either in storage and/or at the market especially with most of the elderly traders. In that regard, the age has been postulated to influence agricultural technologies either positively [11,12] or negatively [13,14]. This is mainly due to lack of knowledge about new technologies or development in the sector [15]. The results in Fig. 4 for this sample however, suggest that the traders were fairly educated.

The results from the study have presented a generalized view regarding profitability of the fruits and vegetable sector to formal traders. (Fig. 8) indicates that 75% of the formal traders earn about 80% revenues in the trading of fruits and vegetables with estimated losses of 15-20%. Formal traders have indicated that profits are guaranteed especially from vegetables because these are basic necessities required on a daily basis but this is only enabled by good quality produce and longer shelf life of products such as onions. However

formal traders encountering losses attributed that to poor quality products supplied by small scale farmers. Formal traders further outlined that poor quality products had a limited shelf life which resulted in the traders incurring more losses.

Informal traders on the other hand do not appropriately account for losses as they simply throw away products that may have gone bad. Informal traders base their profitability on the initial capital invested in purchasing stock and resulting revenue. However most informal traders indicated that transport cost and storage cost affects their profits but to a limited extent. Fig. 8 shows average weekly and monthly transport and storage costs. This is further exacerbated by losses incurred due to poor storage facilities and losses in transportation such as bruising, and cracking. However, despite informal trader not appropriately accounting for losses through weighing of baskets or crates lost, the study indicated that a significant proportion (66, 6%) of the traders are able to make revenue of above 50% while the remaining (33.3%) made revenue of below 50%.

Some measures for minimizing postharvest losses were identified in this study (Table 9). Careful loading and unloading of items has been noted to greatly reduce postharvest losses by the traders as this reduces the number of fruits vegetables which suffers mechanical damage from rough handling. Due to over stacking heat builds up thus accelerating the rate of deterioration of the commodities while in storage. Exposure of the commodities to excessive sun will result in sun burns on the skin of fruits and vegetables thereby enhancing the chances of easy bruising and later growth of microbes. Therefore, harvesting of crops in the morning and evening to prevent them from the sunlight was noted. Since some fruits and vegetables easily bruise, demonstration of handling techniques was identified as a measure which could reduce postharvest losses. Use of appropriate means of transportation and appropriate carrying containers was also identified to significantly reduce postharvest losses. Traders acknowledge the need for training in postharvest handling of the different commodities which they sell. Due to the difference in the perishability, nature and shelf-life of these commodities handling

techniques can therefore not be generalised and one method cannot be used for all.

Conclusion

The study indicated that much of the losses usually occur during storage and marketing. On this note there is need for the traders to learn to apply effective methods of storage, grading and sorting of their commodities as well use of proper packing materials to reduce losses. The mode of transport and transport distance play an important role in influencing the magnitude of postharvest losses. Poor transportation method, larger distance from the market, and outdated use of storage containers lead to higher postharvest harvest losses. The study further identified the potential for the fruits and vegetable sector to be profitable and viable if postharvest losses are reduced. Despite transport costs and storage cost affecting profits, postharvest losses in poor storage, transportation, poor packaging as well as microbial disease attacks affects profits significantly. Postharvest losses therefore hinder growth, and viability of the fruits and vegetable sector.

Most traders outlined the need for farmers to improve on the quality of their produce and use adequate input when producing commodities. Some goods traded have suffered poor shelf life and this has been attributed to production of low quality product. Farmers are therefore encouraged to improve on their production practice so that they can supply quality goods to consumers. Also, the Mutare City Council should provide and promote a conducive environment for informal traders so that they can contribute more to the country's gross domestic product (GDP). This can be done by providing licensing charges at price within the reach of most vendors.

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Authors' Contribution

All authors contributed equality in carrying out the research study and the development of this paper.

References

1. UN. World Population Prospects, the 2012 Revision – "Low variant" and "High variant" values. 2012
2. Alexandratos N, Bruinsma J. World agriculture towards 2030/2050: The saving water. From Field to Fork-Curbing Losses and Wastage in the Food Chain 2012 revision. Working paper: FAO: ESA No. 12-03, 2012, p.4.
3. De Lucia M, Assennato D. Agricultural Engineering in Development: Post-harvest Operations and Management of Foodgrains. (1994). FAO Agricultural Services Bulletin No. 93. Rome: FAO.
4. Hodges RJ, Buzby JC, Bennett B. Postharvest losses and waste in developed and less developed countries: opportunities to improve resource use. *Journal of Agricultural Science* 2011;149: 37-45
5. United Nations ESCAP. Post-harvest Management for Sustainable Agriculture. CAPSA-ESCAP, 2015. Indonesia.
6. Kitinoja L, Kader AA. Measuring postharvest losses of fresh fruits and vegetables in developing countries. Postharvest Education Foundation. 2015.
7. FAO. Food wastage footprint: Impacts on natural resources. 2013.
8. Dube L, Mutetwa M. Assessment of aflatoxin awareness by players in groundnut value chain: The case of Dora in Mutare, Zimbabwe. *IJIRD Journal*, Vol. 4(10), 2015, 90-100.
9. Kirby DA, Watson A. Small Firms and Economic Development in Developed and transition Economies: A Reader. 2006: Ashgate Publishing Limited.
10. Rolle RS. Postharvest Management of Fruit and Vegetables in the Asia-Pacific Region. Asian Productivity Organisation. 2006. Tokyo.
11. Lapar MA, Pandey S. Adoption of soil conservation: the case study of Phillipine uplands *Agric Econ* 1999;21: 241.256.
12. Baidu-Forson J. Factors affecting adoption of land enhancing technology in Sahel: Lessons from a case study in Niger. *Agricultural Economics* 1999;20(3): 231.239
13. Neill SP, Lee DR. Explaining the adoption and Disadoption of Sustainable Agriculture, The case of cover crops in Northern Honduras *Economic*

- Development and Cultural Change,2001;49
(4), 793-820
14. Qaim M, Javnry A. Genetically modified crops corporate pricing and farmers' adoption, the case of BT Cotton in Argentina. American Journal of Agricultural Economics, 2003;85(4), 814-828
 15. El-osta HS, Morehart MJ. Technology Adoption in Dairy Production and the Role of Herd Expansion, Agricultural and Resource Economics 1999;28(2), 84-