The banana postharvest value chain analysis in Zimbabwe

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The banana postharvest value chain analysis in Zimbabwe

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Abstract

Purpose – The purpose of this paper is to evaluate the banana industry in Zimbabwe focusing on postharvest losses along the value chain (VC).

Design/methodology/approach – The study evaluated the banana industry in Zimbabwe focusing on postharvest losses along the VC.

Findings – Total postharvest losses for 2011-2012 were estimated to be 24-27 per cent of total production with a minimum economic loss of USD69,983/annum/firm, and a total loss of more than USD500,000/annum between the VCs analysed. The bulk of the losses occurred at farm level during handling and transportation. The major factors contributing to banana postharvest losses were: unreliable transport, poor communication and coordination between producers and processors; lack of or inefficient temperature management and poor sanitation.

Practical implications – The study identified production capacity, quality and branding as opportunities and challenges in the banana industry. Currently, there is a 40 per cent unmet local demand for bananas and hence there are no exports. If modern banana handling systems are employed and more research and development is carried out along the VC, postharvest losses can be reduced significantly, resulting in increased income and potential expansion of the industry.

Originality/value – This is the first known attempt to analyse the banana VC in southern Africa and quantify postharvest losses.

Keywords Africa, Infrastructure, Agriculture and food technology, Value chain, Storage management, Distribution channels and markets

Paper type Research paper

1. Introduction

Banana, a predominant all year round dessert food and cash crop in Zimbabwe, is growing in importance and occupies second position after potatoes in revenue generation at Mbare Musika (Knowledge Transfer Africa, 2015; personal communication), the most important and largest public market in in the country. An unmet local demand for banana of 40-50 per cent was identified in the country by the local leading banana wholesalers (Mudyazvivi and Maunze, 2007; Mudyazvivi, 2010). Further investigation at a national scale indicated that close to 80 per cent of the banana consumed in Zimbabwe comes from Manicaland province (Mudyazvivi and Maunze, 2007) where close to 12,000 small-scale farmers depend on production and marketing of bananas for more than a third of their income (Mudyazvivi, 2010;

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Anonymous, 2014). In the province, bananas are mainly grown by both large-scale farmers who account for 60 per cent of the bananas market share, and by small-scale growers, who grow mainly under contract with large private companies (Sunspun or Matanuska) (Anonymous, 2014). Therefore the banana sub-sector has a vital role in on-farm income generation, poverty alleviation, food security and sustainable agriculture in Zimbabwe.

The unmet banana market demand in Zimbabwe may be attributed to a number of problems faced by banana producers and other key players in the industry, which need to be properly investigated and addressed. Amongst these problems, a decline in the commercial sector production and postharvest handling are significant contributory factors. Currently, access by value chain (VC) actors to appropriate banana harvesting, packaging, transportation, storage, processing and other postharvest technologies is still very limited. Technological advancement in developed countries made possible establishment of cold chains for the entire postharvest and handling operations and this has seen large volumes of quality horticultural crops produced in these countries made available to millions of people in the world.

Currently there are no data on banana exports in Zimbabwe since 2008 due to a variety of reasons including lack of systematic data collection mechanisms for the crop within the government departments and lack of postharvest practitioners and scientists. Analysing the levels of postharvest losses and identifying the key determinants are key steps towards designing appropriate future loss prevention efforts within the sub-sector. It helps to improve the expertise and awareness of the causes of postharvest losses to policy makers, extension workers and other responsible bodies (Kitinoja *et al.*, 2011). Reducing banana postharvest losses offers an important way of increasing banana availability on the market without requiring additional production resources. In developing countries such as Zimbabwe, it can contribute to rural development and poverty reduction by improving agribusiness livelihoods. To create an enabling environment for the banana VC development, the African Governments need to develop and implement supportive policies within the industry and strengthen their performance, relating better to other stakeholders like the producers, processors, government technical support departments (research and extension) and non-governmental organisations.

A high postharvest loss caused by inadequate and inefficient postharvest handling practices is one of the major problems limiting the expansion of banana production in Africa (Olorunda, 2000; FAO, 2014). During the process of handling, transportation, storage, ripening, distribution and marketing, substantial losses are incurred ranging from a slight loss of quantity to total spoilage. The primary causes are biological (chemical, microbial, injuries, cuts, bruises, peeling and trimming, etc.), environmental (overheating, chilling, freezing and dehydration, etc.) and physiological (sprouting, rooting and transpiration, etc.) (Nelson, 2009; FAO, 2014). Secondary causes include improper storage, inappropriate transportation, inadequate production and harvest planning. These losses occur at different stages like harvesting, processing, grading and packing, storage and transportation.

Banana damage and deterioration may result due to physical injury, enzymatic action by the attack of microorganisms or combination of these factors. Injuries and damage to fruits may in turn result in loss of moisture due to faster surface evaporation. Injured fruits are attacked by microorganisms (fungi, bacteria) and become diseased. The diseased fruits respire at faster rates than intact fruits (Agrios, 1997). The probability of a pathogen entering the produce increases with the

size of the opening or bruise. However, even tiny natural openings, such as stomata and lenticels, can serve as entrances for disease organisms (Picha, 2002).

Bananas are a very delicate commodity which can be easily damaged and deteriorate fast during postharvest handling activities. Any activity that reduces the number of times the produce is handled will help reduce physical damage of the produce. Damage results in heavy losses in quality and quantity hence great economic loss is being incurred during the postharvest phase. Currently, it is not clear where exactly along the VCs are the main postharvest losses occurring and what causes the losses.

In order to promote the banana industry and to enhance competitiveness of the fruit on both local and international markets in terms of quality, quantity and consistence, there is an urgent need to thoroughly investigate scientifically the factors causing postharvest losses along the banana VC. There are no statistical data for the current banana postharvest handling losses in Zimbabwe, as most of the studies focus on grain crop postharvest loss estimation. There is need to estimate the banana postharvest losses and find the major determinants of postharvest losses from farm level to market level.

A better understanding of the determinants of postharvest losses in the sector can be obtained after conducting a value chain analysis (VCA). The VCA identifies and describes all actors (e.g. types of producers, types of processors, types of buyers, degree of consolidation), activities (e.g. postharvest value addition, quality differentiation) and transactions (e.g. degree of vertical coordination, contracting issues) within the chain in bringing a product from conception to final consumption (Gereffi *et al.*, 2005; Verhofstadt and Maertens, 2013). A VC can be a vertical linking or a network between various independent business organisations and can involve processing, packaging, storage, transportation and distribution (FAO, 2005). This helps the governments and stakeholders (researchers, extensionists, policy-makers, farmers and the private sector) in developing countries to identify measures needed to minimise losses and improve the policies and environment for private sector investment and thus, strengthen the competitiveness and growth potential of the banana industry so that it plays its role in promoting a broad-base economic growth in developing countries. Using the case of Zimbabwe, the study objectives were therefore to:

(1) assess the current postharvest handling systems within the banana industry;

(2) estimate losses at each stage along the VC; and

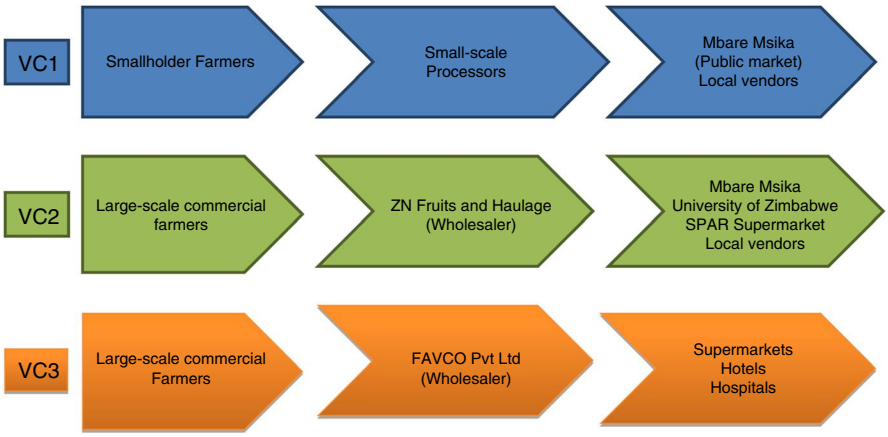
(3) identify factors contributing to the postharvest losses at each stage from harvesting to market and retail levels.

2. Materials and methods

Primary data were collected from key actors in the banana VCs. To have a clear understanding of the banana postharvest handling system in Zimbabwe, three different VCs were investigated based on the volumes of the produce they move in the VC: small-scale players (value chain 1 (VC1)); medium scale players (value chain 2 (VC2)); and large-scale players (value chain 3 (VC3)) as illustrated in Figure 1.

2.1 Assessment of the current postharvest handling systems in the banana industry

To address objective 1, the study targeted banana producers and banana processors in Manicaland and Mashonaland Central provinces who were willing to participate in the study. The data collection tools included: focus group discussions (FGDs); field



Notes: VC1, value chain 1; VC2, value chain 2; VC3, value chain 3

Figure 1. Three banana value chains (VCs) in Zimbabwe

and market visits and observations (FMVOs); and key informant interviews. FGDs were conducted with two banana producer support groups; Rusitu Valley Fruit Growers and Marketing Trust (RVFG) and Honde Valley Smallholders Development Company (HVSDC).

To address objectives 2 and 3 the following data collection tools were used:

(1) FMVOs.

(2) Standard semi-structured questionnaires.

Key players in each VC were interviewed (Table I).

3. Results

3.1 Assessment of the current banana postharvest handling system

The identified three processors and six producers formed the basis of the three VCs that handled the fruit from the field to the market (Table II). It was observed that preharvest activities require much labour and are time-consuming. Despite pre-postharvest activities' significance in relation to yield and quality of bananas, very few smallholder farmers who supply VC1 and VC2 practice banana field bunch management.

To avoid any inconveniences caused to the producer when the processor fails to collect the bananas on time or not at all, the producer and processor agree that bananas are reaped after the processor's truck has arrived on the farm. Bananas are reaped, washed in treated water (fungicides) and packed for loading within five hours and this

	Value chain 1	Value chain 2	Value chain 3
Producers	2	2	2
Transporters	1	2	1
Processors	1	1	1
Wholesalers	3	3	1
Vendors	3	3	3
Retailers	0	2	2

Table I. Number of players interviewed for each banana value chain

Activity	Value chain 1	Value chain 2	Value chain 3
Pre-harvest activities; tagging, propping, bagging and deflowering	Very few small-scale producers practice pre-harvest activities	All activities are done by large-scale producers (commercial farmers)	
Reaping (harvesting)	Manually (500-2,000 kg per batch)	Manually (20,000-30,000 kg per batch)	
Transit of bananas from field to packing house	Carry on shoulders with hatter or in animal drawn carts	Tractor trailers with plastic bag made cushions to prevent banana abrasion injuries	
De-handing	Done manually in packing house or shed using a sharp curved knife		
Washing	Very few wash bananas with fungicide solutions	Wash bananas using Bental fungicidal solution	
Air drying and storage	None	None	None
Grading	No grading	There are three grades based on size and degree of ripening	
Packing	Buyers come with plastic crates and polypropylene bags (also used for maize grain packaging and storage)	400 kg wooden Chep bins	
Loading and transportation from producer	Load manually. Processors' hire 10-20 tonne trucks (unreliable) and some use public transport	Use 1.0 tonne forklifts. Hire unreliable cheap 30tonne trucks for an average cost of $1,100.00	Use 1.0 tonne forklifts. Hire reliable expensive 30 tonne trucks at an average cost of $1,750.00
Receiving	Manually. Bananas packed in large bins for ripening	Use 1.0 tonne forklifts. Weigh is done after arrival and management check for quality	
Ripening in the cold rooms	Temperature – (14-18°C) Capacity – 30 tonnes Duration – 4-5 days	Temperature – (14-18°C) Capacity – 100 tonnes Duration – 3-4 days	Temperature – (14-18°C) Capacity – 200 tonnes Humidity – (75-90%) Duration – 3-4 days
Packaging	Grade according to appearance and pack in 18 kg plastic crates	Grade fruit according to size and appearance and pack them in 18 kg crates	
Market, distribution and respective price	Local vendors and Mbare Msika wholesalers in Harare. Sell @ $0.55/kg	Mbare Msika, local vendors, University of Zimbabwe, Zimbabwe Staff College, chain supermarkets such as TM and SPAR. Sell @ $0.75/kg	Local vendors, retailers and wholesalers, hospitals, hotels and boarding schools. Sell @ $0.80/kg

Table II.
Comparative analysis of the three banana value chains

has a great advantage to the producer since bananas lose less moisture content before weighing, loading and departure of the truck.

3.2 The VC actors

In Zimbabwe banana production occurs on a range of farm scales including small-scale (0.5-2 ha) and medium scale (2-50 ha) farms as well as large plantations (more than 50 ha). There is relatively less difference in the three VCs after the farm gate. VC1 and VC2 are supplied by all the three types of farms (small, medium and large-scale). A single player does the transportation, ripening and wholesaling of bananas for both VC1 and VC2 as shown in Figure 2. VC3 is a vertically integrated corporation; it produces, transports, ripens and markets bananas on its own. A single hand is involved in the VC.

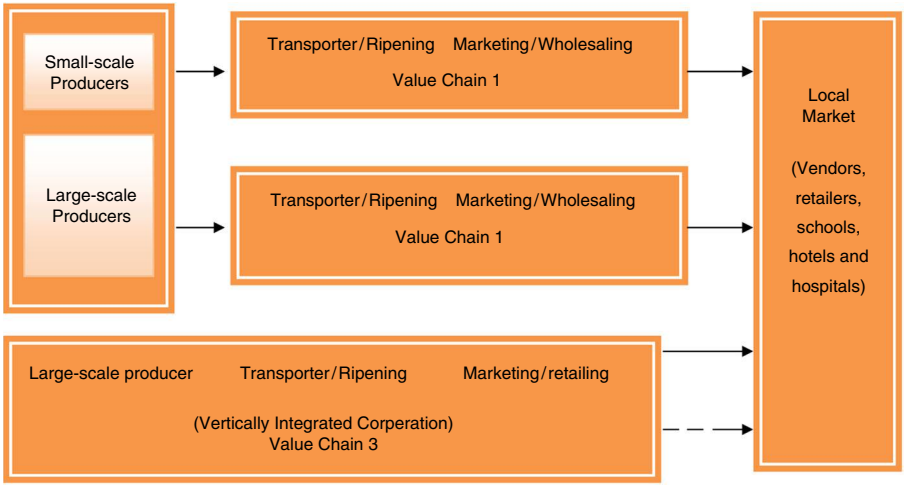


Figure 2.
Players involved in the three value chains

3.3 Production volumes of the three VCs

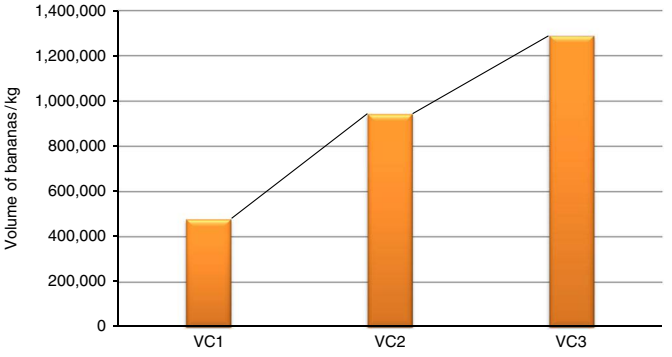
VC3 tends to handle the largest volume of bananas whilst VC1 handles the least (Figure 3).

Production volumes tend to drop during the winter (May to July) for all VCs due to the absence of rains and low temperatures which cause chilling of the fruits. Despite the November disease, the production volumes rise during the rainy season (Figure 4).

3.4 Estimated losses at each stage along the banana VC

The losses for every postharvest handling activity were calculated into percentages per weight moved in the VC per batch. The average weights moved per batch are 10,000 kg for VC1 and 20,200 kg for VC2 and VC3, respectively. Pack house activities (washing, grading and packing), transportation and ripening are the major stages where more losses are incurred (Table III). Total losses range from 24 to 27 per cent with VC3 incurring the lowest losses while VC1 and VC2 are more or less similar.

Summing all the losses incurred in each VC, the results show that more losses are incurred during on-farm level activities than off-farm level activities (Figure 5) although it



Notes: VC1, value chain 1; VC2, value chain 2; VC3, value chain 3

Figure 3.
Annual production volumes of three value chains (March 2011 to February 2012)

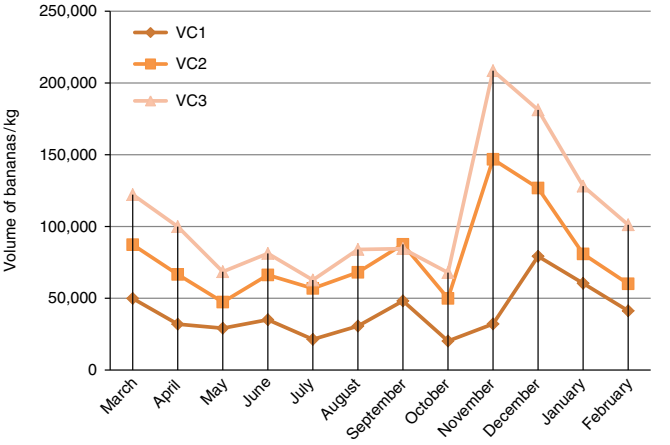


Figure 4.
Monthly volumes/kg moved in the value chains (March 2012 to February 2012)

Notes: VC1, value chain 1; VC2, value chain 2; VC3, value chain 3

Table III.
Estimated postharvest losses along the banana value chain based on 2011-2012 season

Activity	VC1 (kg/10,000 kg)	VC2 (kg/20,200 kg)	VC3 kg/20,200 kg
Reaping	387 (3.87%)	735 (3.64%)	755 (3.74%)
Transit to packing house	425 (4.25%)	825 (4.08%)	817 (4.04%)
De-handing	16 (0.16%)	38 (0.19%)	41 (0.20%)
Washing, grading, packing	132 (1.32%)	1,731 (8.57%)	1,699 (8.41%)
Loading and transportation	992 (4.92%)	920 (4.55%)	912 (4.51%)
Unloading and receiving	36 (0.36%)	45 (0.22%)	52 (0.26%)
Ripening	587 (5.87%)	1,025 (5.07%)	428 (2.12%)
Packaging and marketing	79 (0.79%)	203 (1.00%)	120 (0.59%)
Total losses	2,654 (26.54%)	5,522 (27.34%)	4,824 (23.88%)

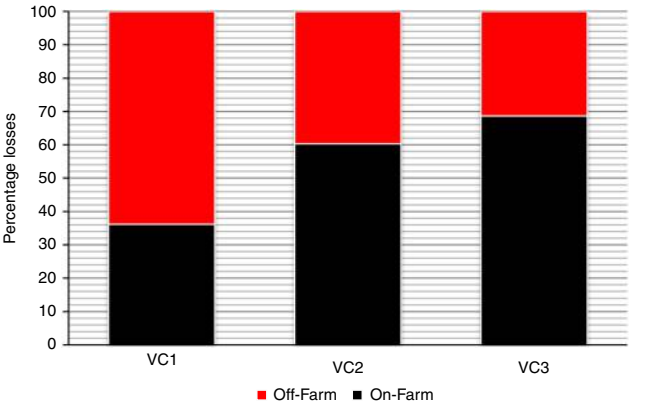


Figure 5.
Comparison of on-farm and off-farm postharvest losses

Notes: VC1, value chain 1; VC2, value chain 2; VC3, value chain 3

is the reverse for VC1. For VC1, the small-scale processors collect the fruit from the smallholder farmers before de-handing. There are more off-farm activities in VC1 than in VC2 and VC3 hence less postharvest losses are incurred on-farm in VC1.

3.5 Postharvest economic loss estimations per annum

Despite losing a smaller percentage of bananas, the monetary loss incurred in VC3 is actually much higher (Table IV). The evaluated postharvest economic loss estimations did not include loss in value for slightly spoiled bananas which can be sold at a lower price value. The analysis also shows that a total economic loss of about USD510,000 was sustained across the three VCs (Table IV).

3.6 Factors contributing to postharvest losses

A number of factors were identified as contributing to banana losses in Zimbabwe.

3.6.1 Producers not practicing banana bunch management in the field. The absence of banana bunch management practice in the field such as bagging, tagging, propping and de-flowering lead to premature fruit fall, sooty molds on bananas and poor harvest timing. Poor harvest timing results in harvesting of immature or over-mature bananas which will shrink or crack. Bananas tend to ripen at different times.

3.6.2 Poor sanitation, recklessness and improper postharvest handling of bananas in the packing house. Most of the banana producers are not aware of the dangers of poor sanitation in the packhouse and they tend to be reckless in handling the soft fruit leading to physical damage. Plates 1 and 2 show some of the small-scale packing houses in Manicaland province of Zimbabwe.

	VC1	VC2	VC3	Total
Total production per annum (kg)	479,432	944,568	1,290,236	2,714,236
Total loss (%)	26.54	27.34	23.88	25.55
Total weight loss (kg)	127,241	258,245	308,108	693,594
Market prices of bananas	0.55	0.75	0.80	
Economic loss (USD)	69,983	193,684	246,467	510,134

Table IV.
Estimated economic losses

Source: Authors' own

Plate 1.
Packing house floor

Plate 2.
Banana receiving from the field

Source: Authors' own

3.6.3 Producers not washing and air-drying bananas before selling. Most of the small-scale producers are not treating their bananas after de-handing from the bunch as required and the very few who do, are not air-drying after washing. Crown rot, Ceratocystis and Anthracnose are the three primary postharvest infections identified in the banana VCs and they usually appear on ripening fruits either at points of sale or after purchase. Although the infections are safe for human to consume, they reduce fruit quality, shelf life and marketability.

3.6.4 Lack of temperature management system (temperature control tracking). In most cases, there were no adequate and functional temperature management or tracking systems. The absence of these facilities affect the VC negatively. Most of the VC players could not afford better storage facilities and cold rooms to ensure a better temperature management system.

3.6.5 Unreliable transport, poor communication and coordination between producers and processors. To reduce operational costs, the processor hires cheap, unreliable and open trucks without a temperature control system and resulting in damage of fruits due to undesirable temperatures. Sometimes the transporter fails to deliver the fruits on time due to technical faults, poor road infrastructure and sometimes the transporter travels during the night only to avoid traffic police since their trucks are usually not roadworthy or designed for the job. The more time the fruit spends on the road, the more undesirable changes and physical damages occur. Sometimes the producer and processor fail to communicate properly and this may lead to delays for collection or high-working rates to meet the targeted volume to be collected whilst the transporter is waiting. High-working rates result in high spillages and careless handling of fruit on-farm. Uncollected fruit is also a huge loss to the producer as the producer has to identify alternative strategies within a short space of time, which compromises price bargaining power.

3.6.6 Inefficient cold rooms and clod room doors and poor sanitation. The cold rooms were often found inefficient. The absence of relative humidity control mechanism resulted in high moistures in the cold room air which usually caused banana splitting and fungal infections. Inefficient cold rooms resulted in poor pulp softening during ripening.

3.6.7 Packaging material. Most of the procesors in Zimbabwe use wooden Chep bins, plastic crates and second-hand polypropylene bags (previously used to bag maize or fertiliser) to pack bananas during transportation. All these materials have rough surfaces which can cause abrasion injuries to fruits.

4. Discussion

The study showed that the current postharvest handling system in Zimbabwe needs to be developed to meet the global operating standards to avoid economic losses and to be competitive on the international markets when the opportunity to export arises. This includes the adoption of the cold chain and the pressurised ripening system which ensures a more even banana colouring after ripening and reduction in disease occurrence. Anthracnose, one of the most important banana postharvest diseases can result in 30-40 per cent losses of marketable fruit. Bananas are classified as climacteric and therefore measures to manage ethylene emission are required to delay senescence. In developed countries, the cold chain and countermeasures such as ethylene inhibitors, absorbers and scrubbers can be used to deal with high ethylene levels in fruit and vegetables (Blanke, 2014). Approximate minimum safe temperature which does not cause chilling injury in mature green or ripe bananas is 11.5-13°C while mature green bananas can be stored for 14 weeks at 13-14°C and 90-95 per cent relative humidity. The majority of the players in the banana industry were not aware of the huge losses incurred within the VC and they appreciated the awareness the current study created and are interested to be engaged further in improving the banana postharvest handling system in Zimbabwe.

The major problem affecting bananas during and after harvest is the susceptibility of the mature fruit to physical damage (del Aguila *et al.*, 2010). Their tender texture and high-moisture content makes them very liable to physical damage by bruising leading to deterioration during harvesting and following handling chains. Therefore, when selecting packaging material, this susceptibility to damage must be taken into account. Most of the smallholder farmers and small-scale processors use polypropylene bags as packaging material when transporting and handling bananas. The use of rigid containers such as plastic crates, wooden boxes and fibreboard boxes can minimise the serious damage occurring in fruits during handling and transportation (Anonymous, 1986). Bananas are very sensitive to temperature changes and undesirable temperature shortens the shelf-life of the fruit, increases the rate of ripening, causes undesired ripening and results in physical damages. Low temperatures, inefficient ethylene management and low humidity cause uneven and incomplete banana ripening (Dadzie and Orchard, 1997).

Although the losses are incurred along the whole VC, the study showed that the critical factors governing banana postharvest losses are mostly before the farm gate (farm level). This is not true for the VC1 where more losses are incurred during off-farm activities because there are more players involved and more time spent handling the fruit after the farm gate.The more frequently the fruit is handled, the more the losses are incurred. Most of the on-farm level activities are carried out by the smallholder farmers and since they have inadequate and inefficient postharvest handling systems, they incur more losses compared to off-farm level activities which are mainly done by medium and large commercial processors with better access to equipment and postharvest handling management systems.

High-economic losses are being incurred within the banana postharvest handling stage, resulting in higher prices for bananas. The critical entry points by the stakeholders and government departments so as to reduce these losses include: further research and design of methods to reduce losses during ripening, reaping and transportation. There is also need to improve the roads and telecommunications infrastructure so as to enhance market information flow and therefore increase product mobility on the market. However, infrastructural development requires substantial investment and more stakeholder engagement.

Kinyua (2008) identified inefficiencies within the Kenyan dissert banana VC as: large number of intermediaries; poorly organised small-scale producers; and lack of comprehensive knowledge of the market by all VC players. In the same study, high-costs associated with transportation, transaction and intermediaries were also identified as challenges. Policy and institutional failures identified were lack of regulatory systems for bananas; and lack of agreed grades and standards. More recent studies in Kenya along the banana supply chain showed that the highest quantitative losses of 20 per cent occurred at the ripening stages which translated to a whopping USD20.5 million followed by transportation losses from bulking centres to the market with a weight loss of 10 per cent valued at USD13 million (FAO, 2014). However, an economic feasibility of possible interventions to reduce the losses along the banana supply chain showed that training and awareness-raising had the highest potential and impact. Most of these issues and implications also apply to many countries in east and southern Africa including Zimbabwe.

In central Africa (covering Rwanda, Burundi and eastern Democratic Republic of Congo), Ouma and Jagwe (2010) showed that there were weak linkages within the banana VCs with poor integration of VC actors. The study also found that transaction costs comprising transport, handling and storage contributed a high proportion of cost items in the VC. Although the study investigated cooking, beer and dessert bananas while in the current study, the focus was on dessert bananas only, their findings apply to the circumstances in Zimbabwe. Innovations such as the participatory market chain approach as adapted and applied on a range of horticultural commodities in Uganda could facilitate the integration of the banana chain actors and reduce transaction costs. In Zimbabwe, development partners including non-governmental organisations and financial institutions demonstrated that banana yield could be raised from an average of 15 MT/ha with local varieties to 60 MT/ha using tissue cultured varieties (Anonymous, 2014). There is need for similar aggregation of players to work together reduce banana postharvest losses and ensure good return on investment along the VC players.

5. Conclusions and recommendations

The study investigated the current banana postharvest handling system in Zimbabwe and revealed that the system is lagging behind against global trends. Total postharvest losses for the year 2011-2012 were estimated to be 24-27 per cent of the total production with a minimum economic loss of USD69,983/annum/firm, and a total income loss of more than USD500,000/annum within the VCs analysed. Most of the losses incurred during postharvest handling were identified as the lack of awareness of such huge losses and poor knowledge and access of the postharvest handling technology.

The study also showed that on-farm activities cause more postharvest losses than off-farm activities although this was not the case in the VC where the fruit is handled by many players. Losses incurred during off-farm level activities are attributable to distance of producer from processor, poor ripening techniques and facilities, marketing experience, poor handling, unreliable transport system, absence of a cold chain and perishability nature of bananas.

If modern banana handling systems are employed and more research and design is carried out in the VCs, the weight losses may be reduced to less than 10 per cent. Although the Government of Zimbabwe acknowledges the importance of banana production in poverty alleviation, the government's role is small, especially in facilitating setting up of infrastructure, access to affordable loans and technical service provisions to producers.

It can be deduced that if physical and information infrastructure could be improved, there could also be immense benefits in the enhancement of the structure, conduct and performance of the banana postharvest VCs. The following recommendations may be useful to improve the current postharvest handling system at various levels and minimise the losses:

(1) adopting modern packing house operating layouts with conveyor belts, cushioned tables;

(2) practicing good sanitation and adopting standard operating procedures;

(3) wearing textile gloves when handling banana fingers directly so as to avoid physical damage by finger and nail scratches and bruises;

(4) design of mini-cold rooms from cheap and available material which are more efficient and affordable to medium scale processors;

(5) improve packaging (use of card board boxes);

(6) improve temperature management and tracking system;

(7) provision of product handling training by agricultural institutions for both on-farm and off-farm personnel;

(8) "Bulking", whereby bananas from many farms are aggregated at one collection point before being transported to the market;

(9) formation of producer groups could facilitate easier access to credit to establish banana plantations or invest in existing ones, e.g. use of improved planting material; and

(10) develop contract farming arrangements to improve quality, quantity and reduce postharvest losses.

In developing countries, drivers to reduce banana postharvest losses include more widespread training of, and awareness-raising amongst VC actors on the causes of postharvest losses; better infrastructure to connect farmers to markets; more effective VCs that provide sufficient financial incentives at the producer level; opportunities to adopt collective marketing and better technologies supported by access to microcredit; and the public and private sectors sharing the investment costs and risks in market-orientated interventions.

Transport speed must be suited to the quality and condition of the roads and truck/trailer suspension kept in good repair. Tyre air pressure on transport vehicles must be reduced to minimise the amount of motion transmitted to the produce.

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Further reading

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