

# Using information-sharing systems to address opportunistic behaviour between tomato farmers and brokers in Zambia

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## About the project

### Southern Africa –Towards Inclusive Economic Development (SA-TIED)

The SA-TIED programme looks at ways to support policy-making for inclusive growth and economic transformation in the southern Africa region, through original research conceived and produced in collaboration between United Nations University World Institute for Development Economics Research (UNU-WIDER), National Treasury, International Food Policy Research Institute (IFPRI), and many other governmental and research organizations in South Africa and its sub-region. A key aspect of the programme is to encourage networking and discussion amongst people involved in policy processes across the participating organizations and civil society aiming to bridge the gap between research and policy-making.

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### ABSTRACT

Brokers on the Soweto market in Zambia behave opportunistically (towards farmers who trade on this market) by taking advantage of the existing information asymmetry to obtain a hidden commission from tomato sales. The present study aims to determine the extent to which broker opportunism on this market can be reduced by using information systems. It is found that the use of the information-sharing system contributes to reducing broker opportunism. The results indicate the absence of broker opportunistic behaviour when farmers have access to price information, and indicate the presence of broker opportunistic behaviour when farmers do not have access to price information via the information-sharing system.

**JEL classification:** D82, D83, O31

**Keywords:** information asymmetry, opportunistic behaviour, Soweto market

## 1 INTRODUCTION

The horticultural industry has exhibited great potential for helping to achieve development objectives, given that production and trade is predominantly in high-value crops (McCullough et al. 2008). The continued growth of the global market for horticulture has been fuelled by the increase in the consumption of fruits and vegetables (Gyan Analytics 2014). This has created market opportunities in the horticulture industry. Utilizing these opportunities, however, strongly depends on knowledge and information to understand market dynamics (Brown et al., 2005). Small-scale farmers involved in horticulture in most parts of the world have been unable to take advantage of these opportunities, partly due to constraints resulting from opportunistic behaviour by other market players. This opportunistic behaviour mainly stems from the inadequacy of market information (creating information asymmetry) and poor communication among market actors involved in agricultural production and marketing chains, especially in developing countries (GTA Team 2005; Brown et al. 2005). According to Brown et al., Sub-Saharan Africa (SSA) is one of the regions experiencing the greatest challenges in linking producers of agricultural commodities to market information.

In Zambia, the horticulture sub-sector is faced with these challenges. Finding effective and efficient markets for high-value crops such as horticultural ones is a major problem for small-scale farmers (Tschirley et al 2011). It has been shown that information asymmetry in horticultural supply chains limits the potential to achieve financial gains that farmers might obtain from marketing fresh produce (Tschirley & Hichaambwa 2010; Emongor & Kirsten 2009). Brokers who act as the link between buyers and sellers of fresh produce have been accused of exhibiting uncompetitive behaviour (Tschirley & Hichaambwa 2010).

A key piece of background to this study is a 2010 study by Tschirley and Hichaambwa. They found that brokers who then operated on the Soweto market charged a hidden commission of about 9–10% over and above the transparent commission of about 10%. This hidden commission is obtained by inflating commodity prices on the market without the farmer's consent. Tschirley and Hichaambwa described this as misconduct 'opportunistic behaviour'. Indeed, opportunistic behaviour emerges in this transaction because one party to the transaction deceitfully obtains economic benefits at the expense of the other party (Williamson, 1975). Tschirley and Hichaambwa attributed this opportunistic behaviour to asymmetric price information between farmers and broker. This arose because farmers (in remote areas, with limited access to market information) are often unaware of the prevailing prices of commodities on the Soweto market in Lusaka, while brokers (as the major players on the market) always have this information.

The opportunistic behaviour of brokers results in slow sales, and farmers often incur losses or obtain very little or no profit from such transactions. This has a devastating effect on small-scale farmers' incomes and livelihoods, as they often depend on income from such activities. This directly affects the household resource allocation decisions on food and crop production for these farm households and consequently affects the sustainability of horticultural production in Zambia.

The situation described above is likely to impede the development of an otherwise viable horticultural industry. As stated by Williamson (1975), opportunistic behaviour acts as a barrier to successful market transactions between partners. In an effort to address market information challenges in Zambia, an information-sharing system that enables farmers to access price information for agricultural commodities was introduced in Zambia's largest horticultural wholesale markets in 2014. Existing literature (for example Wathne and Heide 2000; Myhr and Nordström, 2006; Bhavnani et al., 2008) indicates that farmers' access to price information through various systems or channels, including mobile phones, has been found to manage opportunistic behaviour and to benefit farmers in India, Uganda and Tanzania. The current study aims to offer additional evidence of the positive impact of the use of information-sharing systems which provide price information in agricultural output markets.

Based on this background, this study determines the extent to which broker opportunism (using the hidden commission charged by brokers as a proxy for opportunistic behaviour) in the tomato supply chain in Zambia is reduced by farmers' access to price information through an information system. This has been done by addressing the following specific objectives: (i) to determine whether the use of the mobile phone information system reduced the hidden commission charged by Zambian tomato brokers since the last study in 2010; (ii) to determine if there were information spillovers of the mobile phone information-sharing system from the users to the non-users of the system; and (iii) to determine the perceptions of the users and non-users of the information-sharing system's effect on the tomato brokerage system and broker behaviour.

Addressing these issues may ultimately help to strengthen the farmer-broker relationship by managing broker opportunism and encouraging farmer participation in horticultural markets. The study furthermore aims to contribute to the information required for policy and programmatic decisions regarding appropriate interventions to improve the performance of the domestic horticultural supply chain in Zambia. This is expected to have a significant impact in enhancing growth in Zambia's agricultural sector through increased participation of farmers in profitable agricultural markets and the effective functioning of agricultural markets.

The study is presented as follows: Section 2 provides background information about the transactions between tomato farmers and brokers, and a brief description of the information-sharing system. Section 3 describes the methods used for analysis, and the data sources. Section 4 gives results, and conclusions are drawn and recommendations made in section 5.

## 2 The transaction between tomato farmers and brokers in Zambia

In Zambia, tomatoes are the most commonly grown horticultural crop, and have the largest share of the total fruit and vegetable expenditure of both wealthy and poor households (Mwiinga 2009). Tomato production in Zambia is done on small, medium and large scales, with the large farmers producing about 35%, the medium farmers 33%, and small farmers 24% of the total (Mwiinga 2009). There are two major market systems, the modern and the traditional.

In the modern system, farmers (sellers of produce) and traders (buyers of the produce) sell their produce to grocery shops, mini-marts and supermarkets (McCullough et al. 2008). Typically, actors in the traditional system include farmers, traders, brokers and organizational buyers, and over 90% of horticulture crops are sold through this system. In this system, farmers mainly sell through local wholesale markets, such as at Bauleni or Soweto wholesale markets; the Soweto market in Lusaka (the biggest horticultural market centre in Zambia) is the centre of the traditional trading system. On the Soweto wholesale market, farmers and traders are almost always forced to use brokers to conduct transactions on their behalf for fear of being unable to finding clients for large quantities of produce, and to ensure that their produce does not get stolen in the market (due to the lack of security) (Hichaambwa & Tschirley 2010). The buyers of this fresh produce are either organizational buyers or traders (retailers) who sell on several retail markets within and outside Lusaka. Other farmers that use the traditional market system mainly sell fresh produce along major highways and to individual traders who sometimes buy directly from farmers' homesteads.

However, the presence of brokers in Zambia's fresh produce wholesale markets has both positive and negative effects on transactions. On the one hand, brokers play an important role, as they facilitate market operations by linking buyers and sellers. This is engendered by their ability to quickly collect supply, demand and price, and their familiarity with both buyers and sellers. For this brokerage service, brokers receive a commission of about 10% of the sale price for each transaction. On the other hand, brokers do not usually disclose factual supply, demand or price information to either the buyers or sellers. In fact, Tschirley and Hichaambwa state that 'without the farmers' knowledge, brokers add price mark-ups in addition to the normal broker commission'. The majority of fresh produce sellers (farmers) and buyers on the wholesale

market are therefore unaware of the price that the broker agrees on with the other party. This information asymmetry is exploited by brokers who, through price mark-ups, maximize their personal financial gains from these transactions (Tschirley & Hichaambwa 2010).

The opportunistic behaviour exhibited by tomato brokers by inflating tomato prices has negative impacts on farmers' incomes and, ultimately, their participation in horticultural crop production. When brokers inflate tomato prices, tomato sales slow down. Given the perishable nature of tomatoes, slow sales result in the deterioration and spoilage of tomatoes on the market for long periods. The losses from tomato deterioration and spoilage as a result of the inflated prices are borne by the farmers, because the brokers do not take ownership of the tomatoes but rather get their 10% commission from the total sales. The farmers who produce these tomatoes therefore face bigger losses; they can end up by earning very little or no profit. For small-scale farmers, such losses ultimately lead to severe financial and social hardships, because they are, by definition, resource-poor (Richards 2002).

### 2.1 The information-sharing system on the Soweto market in Zambia

The Lima Links information-sharing system (referred to as the 'information-sharing system' in this study) was developed by International Development Enterprises (IDE) Zambia in August 2014, to enable farmers to access real-time market prices for horticultural products, to enhance informed decision-making capacity about crop production and marketing, and to reduce their marketing risks and uncertainties. Brokers on the wholesale markets where the information-sharing system was rolled out were trained to use the data input interface of the system. This involves entering information on the type of product, price, and quantity for every transaction they conduct. The average price of each type of commodity for each market is calculated by the system and this information is accessible to end-users for free through the Unstructured Supplementary Service Data (USSD) interface by dialling \*789# on an Airtel SIM card.

Monitoring is done to ensure that brokers enter the true prevailing prices; a study which was conducted to determine if the brokers were entering the correct information confirmed that the information was correct (Hichaambwa & Munthali, 2015). The price entered in the information-sharing system is the real price (wholesale price) at which a commodity is sold. This means that farmers that use this system are able to tell if the first seller price (the price agreed on with the broker) is different from the wholesale price. The implication of this is that the farmers are able to detect if their broker inflates the price, and can engage in bargaining to reach alternative price.

## 3 Data sources and methods

Convenience sampling was used as the sampling method in this study – specifically a walk-in method, which involved randomly approaching tomato farmers as they entered the Soweto market to deliver tomatoes. This approach was followed by Hichaambwa and Tschirley (2010) in a similar study. The study initially planned to use the commonly recommended minimum t-test sample size of 30 system users of the information-sharing system farmers and 30 non-users, with the possibility of interviewing up to 40 respondents for each group to account for possible unforeseen response and attrition challenges. To that end, a total of 40 non-users were interviewed for the study, but only 30 users of the information-sharing system were interviewed, because the number of tomato farmers using the system was small. A structured questionnaire was administered in July 2017 to the 30 users of the information-sharing system and 40 non-users, using face-to-face interviews.

To compute the hidden commission for each group of tomato farmers (the users and the non-users of the information-sharing system), two sets of prices were required per group. The wholesale price, which is the actual price at which brokers sell tomatoes, and the first seller price which is the price which the farmer and broker agree on. To compute the hidden commission for the users of the information-sharing system, the wholesale prices were collected from the Lima Links platform. To compute the hidden commission for the

non-users of the information-sharing system, wholesale prices were sourced from the Agricultural Policy Research Institute (IAPRI) 2017 price database. The first seller prices used here were collected from the users of the information-sharing system by means of the questionnaire. Similar to the users, the first seller prices for the non-users of the information-sharing system were also collected from the non-users via the questionnaire. All the data used were for the same period, June–July 2017.

The face-to-face individual interviews were complemented by focus group discussions (FGDs) in order to better understand some of the findings from the individual interviews. Six FGDs (36 farmers in total) were conducted; three groups of six tomato farmers who use the information-sharing system, and three groups of six non-users. The participants of the FGDs were selected from the pool of farmers that were surveyed in the face-to-face interviews.

A two-step process of determining opportunistic behaviour was conducted on both groups of farmers. The first step was to compute the hidden commission; hence, the difference between the mean first seller price and the mean wholesale price. The next step was to determine the statistical significance of this mean hidden commission. This was done by conducting a t-test to compare the mean first seller price and the mean wholesale to determine if the difference was statistically significant. This analysis was carried out on the group of users of the information-sharing system. It was then repeated on the group of non-users. A statistically significant hidden commission was an indication of the presence of opportunistic behaviour while the opposite was an indication of the absence of opportunistic behaviour. The formula for the t-test was as follows:

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{S_{\bar{x}_1 - \bar{x}_2}}$$

where:

t = t-test ratio

$x_1$  = Sample score for the first group (sample wholesale price)

$x_2$  = Sample score for the second group (sample first seller price)

$\mu_1$  = Population score for the first group (population wholesale price)

$\mu_2$  = Population score for the second group (population first seller price)

$S_{x_1-x_2}$  = Estimated standard error of the difference

With regard to identifying information spillovers, the main interest was in determining the diffusion of the innovation (information-sharing system) in question. The logic here is that the non-users should know something about the information-sharing system if there are information spillovers about the system from the users. A question was included in the survey questionnaire for non-users of the system to elicit information indicating diffusion of information about the information-sharing system among the farmers. Finally, the FGDs were used to collect the data that was used to determine the perception of the users and non-users of the information-sharing system on the tomato brokerage system. FGDs were also used to better understand some of the findings from the individual face-to-face interviews

The Statistical Package for Social Sciences (SPSS) was used to analyse the data collected from the survey.

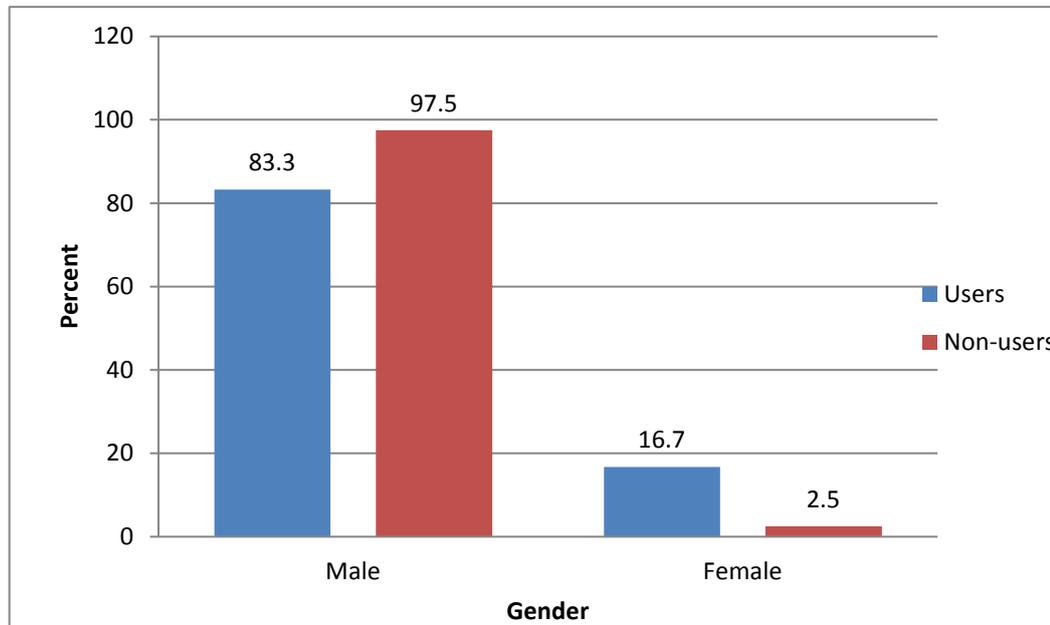
## 4 RESULTS

### 4.1 Socio-economic characteristics of tomato farmers

The average age of the respondents was 39 years old. Each farmer reported having been farming for, on average, about 12 years. The results revealed a highly homogenous group of farmers in terms of gender,

with most being male. Figure 1 shows that the group of users of the information-sharing system had 83.3% of males and 16.7% of females while the non-user group had 97.5% male and only 2.5% female. These findings are consistent with Tschirley et al. (2012), who found that, compared to other African countries, Zambia had a much lower participation rate of females in horticulture marketing at the wholesale level, particularly as first sellers.

**Figure 1: Information-sharing user groups by gender**



From the results, 91.4% of surveyed farmers indicated that they depended on agriculture as their main source of income compared to only 6% who did not. This underscores the importance of agriculture to these tomato farmers.

When it comes to the highest level of education attained by the farmers, 34.3% attained primary education, 44.3% went up to secondary school, while 24% attained tertiary education. Only 7% of all the farmers surveyed had academic tertiary training in agriculture. Formal tomato market channels are more favourable to those that have attained a reasonably higher level of education, because education equips farmers and traders with the knowledge and entrepreneurial skills required to cope with the stringent quality requirements and efficiency that are demanded by such systems. As such, the lack of tertiary education in agriculture among farmers has the potential to negatively affect their advancement to more sophisticated and more profitable formal tomato channel systems. More educated farmers might also have better access to information and ultimately better negotiation and bargaining power.

## 4.2 Testing for opportunistic behaviour

### *Tomato prices and hidden commissions*

Information about tomato prices on the Soweto market in Zambia for the three groups of farmers is presented in Table 1. The table specifically gives price information for the two groups of interest for this study: the users and non-users of the information-sharing system. Also included is the price information for the users of the Soweto market in 2010, retrieved from Hichaambwa and Tschirley’s (2010) study – which was conducted before the information-sharing system was introduced. ‘First seller price’ refers to the price that the farmer and the broker agreed to for the broker to sell the tomatoes at, while the ‘wholesale price’ is the actual price at which the broker sells the tomatoes. The ‘hidden commission’ is the difference between

the first seller price and the wholesale price; this is, the amount that the broker adds to the first seller price without getting the farmer's consent.

**Table 1: Tomato prices and broker commission on the Soweto market**

	2010 <sup>1</sup> group	Information-sharing system users (2017)	Information-sharing system non-user 2017
Mean first seller price – ZMW/kg (A)	2.707	3.310	3.404
Mean wholesale price– ZMW /kg (B)	3.022	3.520	3.902
Mean transparent commission – ZMW /kg (C)	0.275	0.302	0.317
Mean hidden commission – ZMW /kg (D)=(B-A)	0.315	0.189	0.498
Total commission – ZMW /kg (E)=(C+D)	0.591	0.491	0.815
Total commission as % of wholesale price (F)= (E/B)	19.54	13.96	20.89
Mean transparent commission as % of wholesale (G)=(C/B)	9.10	8.59	8.13
Mean hidden commission as % of wholesale price (H) = (F- G)	10.44	5.37	12.77

Note: Exchange rate is USD 1 = ZMW 10

The farmer and the broker agree on a commission for brokerage services, referred to as the 'transparent commission'. The official transparent commission is about 10% of the total amount of tomato sales, although it may be slightly higher for very large quantities of tomatoes or lower for very small quantities. The 'total commission' is defined as the sum of the transparent commission and the hidden commission. The commissions are expressed as percentages of the wholesale price as presented in Table 1 above.

The results presented in Table 1 indicate that in all the three groups there was a difference between the mean first seller price and the mean wholesale price. While the mean hidden commission added by brokers for the tomato farmers surveyed in 2010 was 10.4% of the wholesale price, the users of the system had brokers adding a 5.4% mean hidden commission and the 2017 non-users of the system 12.8%. This translated into a total commission of 19.5% for the 2010 group (before the information-sharing system was introduced), 14% for the current users of the system, and 20.9% for the 2017 non-users. While this difference was not the same across the groups, all three cases indicated the presence of hidden commission. This implies that in all the three cases, brokers charged a higher price on the wholesale market than the price agreed with the farmer (the first seller price).

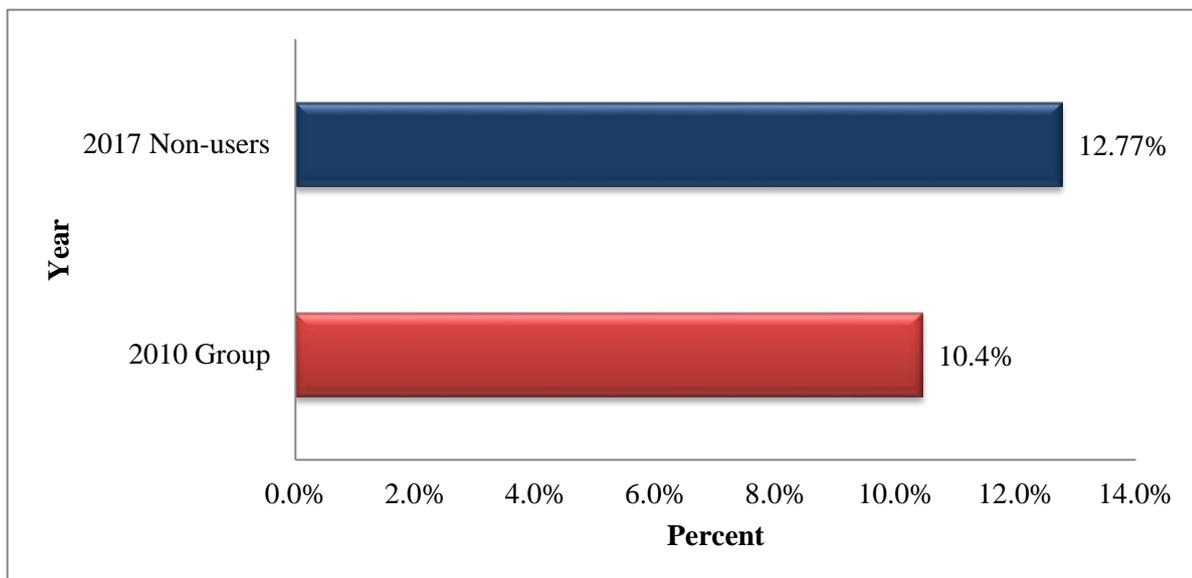
When it comes to the total commission, this is supposed to be fixed at 10% of the total amount sold for each transaction. However, it can be seen in Table 1 that each group of farmers was found to be charged a total commission greater than 10%. The users of the information-sharing system were charged a total commission of 13.96%, the 2010 group 19.54%, and the 2017 non-users were charged the highest total commission, 20.89%. This indicates that, apart from the users of the information-sharing system, the other two groups of tomato farmers were charged about twice the normal commission. This may be explained by the use of the information-sharing system. Having access to price information means that the users would be able to check tomato wholesale prices at any point during the day and would be able to compare these prices with the

<sup>1</sup> All prices in ZMK (old Zambian currency) were converted to ZMW (new Zambian currency) by dividing the ZMK value by 1000 since 1000 ZMK= 1 ZMW. The 2010 prices were further adjusted for inflation using the consumer price index.

prices which they agreed with their brokers. Any difference between the two prices would indicate to the farmer that the broker had inflated the price. From the onset, farmers inform their brokers that they had access to this information. This indicates that brokers knew that the tomato farmers had access to the information sharing system. As such, brokers ensured that the price at which they sold the tomatoes belonging to these farmers was as close as possible to the price that they had agreed with the farmers. A large difference between the two prices would become apparent to the farmers, and would be evidence of dishonesty by the broker, and would probably affect their reputation and they might lose business as a result.

The presence of a small hidden commission such as the mean hidden commission of 5.37% in Figure 2 for the users of the system may be attributed to the nature of the operation of the system. The price that is reflected in the information-sharing system is an average of the prices entered by several brokers in the specific markets, so it may slightly differ from the selling price for each individual farmer’s tomatoes. This means that a user may notice a slight difference between the price at which the broker sold their tomatoes and the price on the information-sharing system at any point. The broker might get away with such small differences because the information-sharing system shows average tomato prices for each market at any given point.

**Figure 2: Mean hidden commission as a percentage of the wholesale price**



In addition, the difference between the hidden commission for the 2010 group and the 2017 non-users of the information-sharing system is further highlighted in Figure 2. The mean hidden commission as a percentage of the wholesale price increased from 10.4% in 2010 to 12.77% for the non-users of the information-sharing system. As for the users, it reduced to 5.37% from the initial 10.4% in 2010. Given that the brokers deal with both users and non-users, it could be that the brokers realized that they were losing out in terms of hidden commission for the users of the system. In light of this, it makes sense that the brokers considered increasing the hidden commission when dealing with the non-users, to offset the loss in hidden commission from the users of the system.

As for the non-users of the system, they relied on the brokers to give them all the price information in the Soweto market. This means that any inflation of the price agreed on between the brokers and the farmers would go unnoticed by the farmers because they did not have any way of checking the actual tomato prices (wholesale price) used by the brokers to sell their produce.

### *Are brokers opportunistic?*

To test for the statistical significance of the mean hidden commission, an independent t-test was conducted. The t-test was conducted on the hidden commission of the two groups in order to determine how broker opportunistic behavior for the users of the information-sharing system compares to opportunistic behavior in transactions with non-users.

### *Users of the information-sharing system (with N=30)*

The following hypothesis was tested:

**Null hypothesis:** The mean first seller tomato price and the mean wholesale tomato price negotiated by brokers are equal for the farmers who use the information-sharing system

**Alternative hypothesis:** The mean first seller tomato price and the mean wholesale tomato price negotiated by brokers are not equal for the farmers who use the information-sharing system.

**t-test statistic:** -1.821

**p-value:** 0.076

**Rejection rule** At a 5% level of significance, the null hypothesis is not rejected

**(p-value < 0.05):** Hypothesis that the mean first seller tomato price and the mean wholesale tomato price negotiated by brokers are equal for the farmers who use the mobile phone based information-sharing system.

It can be concluded that the mean first seller price and the mean wholesale price negotiated by brokers are equal for the farmers who use the information-sharing system. The difference between the mean first seller price and the mean wholesale negotiated by brokers is not statistically significant at a 5% level of significance. The results of the t-test suggest that when tomato farmers use the system, the hidden commission charged by brokers reduces. This could be because brokers do not inflate the tomato prices agreed on with those farmers, as those farmers would realize it, having access to price information.

The results for the users of the system reveal that the hidden commission for the users of the information sharing system is not statistically significant. This is because the mean first seller price is not statistically different from the wholesale price. This implies that tomato farmers that had access to price information through the information-sharing system were exposed to very little or no opportunistic behaviour by the brokers.

### *Non-users of the information-sharing system*

The independence t-test was repeated on the non-users of the information-sharing system. The following hypothesis was tested:

**Null hypothesis:** The mean first seller tomato price and the mean wholesale tomato price negotiated by brokers are equal for the farmers who do not use the mobile phone based information-sharing system.

**Alternative hypothesis:** The mean first seller tomato price and the mean wholesale tomato price negotiated by brokers are not equal for the farmers who do not use the mobile phone based information-sharing system.

**t-test statistic:** -3.566

**p-value:** 0.001

<b>Rejection rule</b>	At a 5% level of significance, the null hypothesis is rejected
<b>(<i>p</i>-value &lt; 0.05):</b>	Hypothesis that the mean first seller price and the mean wholesale price negotiated by brokers are equal for the farmers who do not use the mobile phone based information-sharing system.

It can be concluded that the mean first seller price and the mean wholesale price negotiated by brokers are not equal for the farmers who do not use the information-sharing system. The difference between the mean first seller price and the mean wholesale price negotiated by brokers is statistically significant at a 5% level of significance. In light of this, the t-test conducted on the comparison group which comprises the non-users of the system, reveals different results from the test on the users. The hidden commission for farmers who did not have access to tomato price information through the information-sharing system is statistically significant. This suggests that transactions that involved the group of farmers without tomato price information are characterized by opportunistic behaviour, as brokers inflated tomato prices by a significant amount. These results indicate the usefulness and the effect that the information-sharing system has in reducing opportunistic behaviour by market brokers through increased access to information.

It comes as no surprise that the study found that the use of the information-sharing system to reduce information asymmetries was associated with a reduction in brokers’ hidden commission; as such results are in line with those of related studies. Similar results were reported by Asheeta et al. (2008) about the use of a mobile phone helpline, called the Palliathya initiative, in Bangladesh to provide market information, including price information, to farmers. It was found that the use of the Palliathya resulted in reduced information gaps and the prevention of the exploitation of farmers.

### 4.3 Information-sharing and Information spillovers

With regard to identifying information spillovers, the main interest was to determine the diffusion of the innovation (the information-sharing system) in question. Intuitively, information spillovers if present would be indicated by non-users having some knowledge about the information-sharing system. To this effect, a question was included in the survey questionnaire for the non-users of the system to elicit information indicating the familiarity of the non-users with the information-sharing system. The non-users of the information-sharing system were asked why they do not use the information system. Their responses are presented in Table 2.

**Table 2: Reasons for not using the information-sharing system**

Reason for not using information-sharing system	Number of farmers
I do know anything about it	29
I have very little information about it / I do not know how to use the system	10
I do not trust the information provided by the system	1
<b>Total</b>	<b>40</b>

Of the 40 non-users interviewed, 29 reported that they had never heard of the information-sharing system evaluated in this study (more commonly known in Zambia as the Lima Links system), while 11 were aware of its existence. Some of the farmers either did not trust the information contained in the system or they were not sure how it worked and needed more information about it.

The results indicate evidence of very little to no knowledge about the information-sharing system by the non-users. This implies that information about the system and its benefits hardly diffused to the non-users. The results presented in Table 2 are somewhat surprising, given that each tomato farmer was found to have been trading in the Soweto market for an average of 12 years, and the information-sharing system was introduced to some farmers there in 2014. Farmers trading in the same market for some 12 years would be expected to build relationships and therefore be able to share information about events, news or other occurrences in the market – such as the introduction or the use of the information-sharing system.

These results may be because farmers and traders that used the information-sharing system did not want others to know that they benefited from the using it, possibly fearing that the benefits of using the system would be dissipated if many farmers participated.

This is an indication of the immobility of information among the farmers, and yet this information could be beneficial if adequately shared. The results show that information provided by the information-sharing system remains stagnant as it mainly remains with the system users. Similar results emerged from Wolcott et al. (2008), who attributed such issues to the inadequacy, or a complete lack, of training on the use of information communication technology, as well as the lack of knowledge about the benefits that may result from such use.

#### 4.4 Transaction engagements between tomato farmers and brokers

The other objective of this study was to determine the perceptions of the users and the non-users of the information-sharing system about the tomato brokerage system on the Soweto market. The experiences, attitudes and thoughts of FGDs participants revolved around one broad theme, the renegotiation process.

Opportunistic behaviour by brokers extends to the price renegotiation process that occurs when sales are slow and tomato price adjustments are required. The FGD participants, especially the non-users of the information-sharing system, indicated that the arguments they often have with their brokers are about sales. This is also indicated by the results obtained from the face-to-face individual interviews when the 70 farmers were asked if they have had conflicts with their brokers. The results obtained from the interviews are presented in Table 3. It can be seen that 48 out of the 70 farmers interviewed indicated having had conflicts about sales. The FGD participants explained that these conflicts occur when tomatoes remain on the market for too long. This leads farmers to suspect that the brokers are not expending the effort required to sell their tomatoes, or that they inflated the price too high for available buyers to buy.

**Table 3: Farmer-broker conflict about sales**

Farmer type	Have you ever had any conflict about sales with your broker?		Total
	Yes	No	
User	18	12	30
Non-user	30	10	40
<b>Total</b>	<b>48</b>	<b>22</b>	<b>70</b>

However, the users of the system acknowledged that there was an improvement regarding the issues of slow sales after they started using the system. This information was obtained from the face-to-face individual interviews when farmers were asked if they had any conflicts with their brokers since they had started using the information-sharing system. Only four of the users of the system reported that they had conflicts about sales since they had started using it, while 26 users responded that they had not had

conflicts. This might be attributed to the fact that farmers had informed their brokers that they were actively using the information-sharing system.

In order to understand the severity of the renegotiation process among the tomato farmers, both the users and non-users were then requested to provide information on how often brokers requested a renegotiation of tomato prices due to slow sales. Table 4 below shows, for users of the system, that 36.7% reported that they were rarely contacted for price renegotiation, 56.6% reported that they were contacted sometimes, while 6% reported not being contacted at all. As for the non-users, 36.7% often get contacted for price renegotiation, and 25% always get contacted. Thus, the non-users were contacted to renegotiate tomato prices more frequently than the users were.

**Table 4: Frequency of renegotiation request from broker**

Farmer type	How often in one transaction does the broker contact you to renegotiate the price?					Total
	Never	Rarely	Sometimes	Often	Always	
<b>Users (%)</b>	6.7	36.7	56.6	0	0	<b>100</b>
<b>Non-user (%)</b>	2.5	15	20	37.5	25	<b>100</b>

During the FGDs with the users, they expressed concern over the price renegotiation process in instances when they had to renegotiate tomato prices with brokers. They explained that the renegotiation process is very difficult, as they usually have to agree with the price suggested by the broker. The reason provided revolved around the poor physical infrastructure of the market as this worsens the bargaining position of the farmers, which is a point highlighted by other studies (Mwiinga 2009; Hichaambwa & Tschirley 2010). The Soweto market is simply an open space without a roof or proper storage space for fresh produce, as shown in Figure 3. This means that farmers cannot control the storage environment, despite the highly perishable nature of their produce. They further elaborated that the result of this is that they usually have no choice but to agree to relatively low prices, for fear of even lower prices the next day if they allowed the produce to stay overnight.

Therefore, even with the use of the information-sharing system, the users explained that the information obtained from the system could not be used during the re-negotiation process, which is based on the perishable nature of the produce, and on the farmers’ urgent need to sell the tomatoes as quickly as possible. This implies that the increase in farmers’ bargaining power engendered by the use of the information-sharing system is eroded by the poor infrastructure of the Soweto market. Ultimately, this has a negative effect on their profits.

**Figure 3: The Soweto market in Lusaka, Zambia**



Source: Own pictures

## 5 Conclusion and recommendations

### 5.1 Summary and conclusion

This study assessed the effect of the use of a cellphone-based information-sharing system on the opportunistic behaviour of Soweto market brokers in Zambia. This was achieved by specifically: (i) determining whether the use of the system had reduced the hidden commission charged by Zambian tomato brokers, compared with the last study in 2010; (ii) determining if there were information spillovers of the information-sharing system from the users to the non-users of the system; (iii) determining the perceptions of the users and non-users of the information-sharing system about the tomato brokerage system and broker behaviour.

Both primary and secondary data were used to address the research questions. Primary data was collected from face-to-face individual interviews and focus group discussions, while secondary data was obtained from the Agricultural Policy Research Institute price database and the Lima Links platform (the information-sharing system). A t-test was used to determine the statistical significance of the hidden commission as a test for opportunistic behaviour for the sampled group of 30 tomato farmers who use the information-sharing system. The same test was conducted on the sampled group of 40 farmers who are non-users of the information-sharing system. The main information sources were identified by using the individual interviews; determining their importance to the two groups of farmers was done via focus group discussions using pairwise ranking.

The results indicate that the use of the information-sharing system is associated with a reduction in opportunistic behaviour. This is because the mean hidden commission of 5.37% that was found for the users of the system was not statistically significant, while the mean hidden commission of 12% for the non-users of the system was found to be statistically significant. This is an indication of the absence of opportunistic behaviour for transactions involving users of the system and the presence of opportunistic behaviour for transactions involving non-users of the system.

There were no indications of information spillovers from users to non-users. The benefits obtained from the use of the information-sharing system were limited, in the sense that there were many potential beneficiaries who were unaware of it. More than 70% of the non-users of the system reported that they were not aware of it.

It was found that the increase in farmers' bargaining power engendered by the use of the information-sharing system is eroded by the poor infrastructure of the Soweto market. Therefore, the benefits that might be obtained from reducing broker opportunistic behaviour through the reduction of information asymmetries may be subjected to a few caveats. The caveats arise from the fact that there are other elements of the transactions between tomato brokers and farmers that are likely to hinder the users of the information-sharing system from realizing the full benefits of using it – such as the lack of storage infrastructure on the Soweto market. It is clear that providing an information-sharing system is not a panacea for all challenges related to the opportunistic behaviour of brokers on the Soweto market. Instead, the other caveats still need to be addressed in order to fully take advantage of the benefits of reduced opportunistic behaviour, and to encourage participation of farmers in horticulture markets in Zambia.

## 5.2 Managerial and policy recommendations

In light of the findings and conclusion of the present study, a number of policy managerial and policy recommendations are made.

Providing market information systems or platforms may address challenges regarding the lack of transparency that leads to information asymmetries which contribute to increasing transaction costs and opportunistic behaviour in domestic agricultural markets. This is especially the case in Africa where informal markets are prevalent. The results indicate that the use of the information-sharing system at the Soweto market has contributed to the reduction in opportunistic behaviour by brokers. However, benefits are confined to the users of the information-sharing system, because other farmers that trade on the Soweto market are unaware of it – meaning that they must still rely on brokers for price information. This is a challenge, in the sense that the brokers are the same market actors that behave opportunistically and can, therefore, not be relied on to provide factual price information to the non-users of the system.

In light of this, encouraging investments in the provision of formal market information platforms would address the transparency and information asymmetry problem. The widespread use of mobile phones makes it possible to introduce platforms that are mobile phone based. As indicated by the results of the present study, providing mechanisms for market actors, at either the same level or at different stages of the supply chain, to gain access to the same market information may create a balance of bargaining power among interested parties. Also, efforts should be made by the providers of such services to sensitize all the potential users and beneficiaries of such systems through training and other dissemination exercises that would involve the active participation of all the relevant market actors.

Investment in improving the physical market infrastructure of the Soweto market would address another challenge highlighted by the FGD participants, that is, the bad state of the market infrastructure making it impossible for farmers and traders to keep highly perishable produce in good condition for several days. The fact that tomatoes are highly perishable and cannot last for many days on the market is used as leverage by tomato brokers to behave opportunistically in market transactions. The absence of proper cold storage

facilities, or any proper storage infrastructure, leaves farmers who have large quantities of fresh produce at a disadvantaged in negotiations, which may at times lead to losses. The problem is worse during seasons when supply is very high, and may result in farmers agreeing to sell at very low prices because they desperately need to avoid keeping their produce on the market for too long due to the fear of economic losses caused by deterioration and spoilage. Providing infrastructure for storage, especially cooled storage, would, therefore, create a better trading environment at the Soweto market, especially for fresh produce farmers. Initial investments and maintenance for such initiatives could be made through public private partnerships.

Apart from the provision of soft infrastructure and platforms for communication, deliberate market policies targeted at improving communication and coordination in horticultural value chains may reduce the opportunistic behaviour exhibited by some market actors. The results of the present study indicate that physical interaction among market actors, such as tomato farmers at the Soweto market, is limited. However, this is an important aspect of making value chains work. Hence there is a need to implement market policies that require producers to work in organized groups with each other and/or with other market actors. It would facilitate horizontal coordination and information-sharing. This could work in a similar way to that in which cooperatives work, and may even assist these market actors to cope with various market risks such as price risks as they transact.

Meeting the aforementioned recommendations would eliminate or at least reduce some of the major institutional and infrastructure-related barriers that Soweto market tomato farmers face when marketing their produce. The availability of cooled storage, bargaining in groups, and timely access to accurate price information would place them in a stronger bargaining position. This, coupled with an effective legal framework to regulate the behaviour of all market actors, would create an environment more conducive to healthy trading conditions. The tomato farmers involved in these transactions would be less likely to incur large economic losses as a result of opportunistic behaviour by brokers. The profits obtained by farmers from selling tomatoes would no longer be eroded by losses from deterioration and spoilage, or by agreeing to very low selling prices in an effort to sell all their produce within a short period of time. This would ultimately improve tomato farmers' livelihoods.

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