Constraints to Profitable Participation in Agri-food Value Chains: A Case of Small-scale Banana Farmers in Meru County, Kenya

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Abstract- Constraints in agri-food value chains tend to heighten the vulnerability of small-scale farmers in Sub-Sahara Africa. This study evaluates the constraints limiting small-scale banana farmers in Meru County, Kenya, from profitably participation in the crop's value chain, producers' efforts in- and suggestions to-overcoming them. Results of this study reveal that banana farmers face several interdependent constraints such as inadequate know-how on banana management, high cost plantlets, and pests and diseases that amplify one another but efforts to overcome them have been partial. It is therefore, necessary to have several measures implemented concurrently to address the constraints. Thus, future interventions should have concerted efforts from governments and non-government organizations.

Index Terms- Agri-food, bananas, constraints, Kenya, small-scale farmers, value chain.

I. INTRODUCTION

Constraints in agri-food value chains tend to heighten the vulnerability of small-scale farmers in Sub-Sahara Africa (SSA). For producers who entirely derive their livelihood from farming, constraints in agri-food chains are life-threatening. Typically, small-scale farmers are disadvantaged even when opportunities such as increase in food demand either domestically or internationally arise because of constraints such as lack of information on prices and export opportunities, a strong presence of middlemen, inaccessibility to credit, poor transport services, and stringent safety measures requirements (Ashraf, Ginè and Karlan 2009; Asfaw, Mithöfer and Waibel 2010, Schaffnit-Chatterjee, 2014). Yet, constraints in agrifood value chains are expected to be compounded in future as more people move to urban areas as well as change their consumption habits. Research reveals that with increased urbanization world over, consumers are reducing their food demand of staples and are diversifying to high quality, processed and pre-cooked animal products, vegetables and fruits (Neven, Reardon, Chege and Wang, 2006; Hazell and Wood, 2008; Satterthwaite, McGranahan and Tacoli, 2010; Ngigi, Okello, Lagerkvist, Karanja and Mburu, 2011; Maertens and Swinnen, 2012). This calls for efforts by farmers to align their production and marketing activities in ways that will enable them benefit from the emerging food demands. An understanding of the existing value chains is, therefore, useful in diagnosing the constraints and fashioning strategies of promoting producers' profitable participation in their commodities' value chain.

Banana farming is an activity that can improve the livelihood of small-scale farmers in SSA in general, and in Kenya, in particular, by broadening their income sources. Banana constitutes one of the most important tropical food staples after rice, wheat and maize in terms of gross value production, and most of its production (98%) is in the developing countries (Pillay, Tenkouano and Ortiz, 2012). In Kenya, banana is one of the important fruits with a market share of 35.6% followed by pineapples (20%), mangoes (17%), avocados (6%), paw paws (6%), passion fruits (3.6%), oranges (3%), water melons (3%), and tangerines (2%) (Horticultural Validated Report, 2014). It is the most popular fruit in the country (Neven et al., 2006; Nzioka, 2009)**.** Bananas are a source of vitamins A, B, and C, potassium, magnesium, fibre, are low in fat and sodium, and are cholesterol-free (Fruit Production Technical Handbook, 2011; Pillay et al., 2012; Horticultural Validated Report, 2014). Due to their nutritional features, bananas appeal to health conscious consumers (Pillay et al., 2012). Farmers in Kenya are taking up banana as a cash crop, catching up with conventional ones such as coffee (Mwangi and Mbaka, 2010; Murithi, 2011; Miriti, Wamue, Masiga and Murithi, 2013; Republic of Kenya, 2013). Despite their nutritional and economic importance, banana value chains are described as 'lumbering giants with feet of clay' (Domaingue, Lewicki, This, Bakry, Horry, Braconnier, Pot and Trouche, 2017: 143).

A number of studies on banana farming constraints focus either on production or marketing (Karembu, 2002; Kiiza, Abele and Kalyebara, 2004; Biruma et al., 2007; Mbaka, Mwangi and Mwangi, 2008; Mwangi and Mbaka, 2010; Mbaka, Nakato, Auma and Odero, 2009; Miriti et al., 2013). For example, tissue culture technology adoption (Karembu, 2002), spread of pests and diseases (Biruma et al., 2007; Mbaka et al., 2009), restoring banana production (Mwangi and Mbaka, 2010), and marketing (Kiiza, 2004). While such studies are important in prompting and

guiding interventions by the government and non-government firms, the efforts are mainly segmented and thus hardly successful (Jogo, Karamura, Kubiriba, Tinzaara, Rietveld, Onyango and Odongo, 2011; Muchui, Gatambia, Kamau, Thuranira, Miruka, Wasilwa, Gitau, and Gitau, 2013). This is partly because such interventions fall short of linking production and marketing as important components of agri-food value chain that should be developed concurrently. This study attempts to link production and marketing by adopting a value-chain perspective in examining constraints facing small-scale banana farmers in Meru County, Kenya. Thus, the current study provides information that may guide policy makers in formulating more comprehensive and sustainable interventions measures.

II. MATERIALS AND METHODS

This study on constraints in banana value chain included primary data collection from April 2015 to July 2015. The required information was collected from 384 farmers and 384 banana traders in Meru County using semi-structured questionnaires. The questionnaire for farmers covered the types of seedlings planted, sources of seedlings, farm sizes, amount of banana stools on farm, distance between farms and markets, methods of selling, selling prices of bananas, constraints faced, strategies used by farmers in addressing the identified constraints, and suggested solutions to the constraints. The 384 farmers were randomly selected from four sub-counties of Meru County in Kenya namely; Imenti South, Imenti Central, Imenti North and Igembe South. These sub-counties were purposively picked because they produced 283,373 tons of the total banana production of 323,363 tons in the entire County in the year 2013 (Ministry of Agriculture, Livestock and Fisheries, 2015 [MOALF]). Besides the high banana production, Igembe South is one of the sub counties that prior to the ban by United Kingdom relied on Khat exports (Riak, 2014). Imenti South, Imenti North and Imenti Central are relatively located closer to Meru-Nairobi tarmac road which potentially enhances access to the key banana markets in Kenya. In addition, Imenti South and Imenti Central are privileged with well-established water projects (Miriti, 2011; J. Mwangi, Personal communication, April 27, 2015). Through the guidance of the sub-counties' horticulture, agribusiness and extension officers, 96 farmers from each sub county participated in the study.

The questionnaire for traders covered sources of bananas, methods of buying, selling destinations, the constraints faced, strategies used to overcome such constraints, and suggestions on how to address the constraints. The 384 traders were randomly selected from 10 banana markets namely; Tiira, Maua, Kanuni, Kariene, Kanyakine, Gakoromone, Miruriiri, Mitunguu, Mujwa, Kamachege, Ntharene, and Mwichiune. The number of traders interviewed in these markets were; 6, 16, 8, 38, 30, 70, 30, 18, 30, 30, 70, 38 for Tiira, Maua, Kanuni, Kariene, Kanyakine, Gakoromone, Miruriiri, Mitunguu, Mujwa, Kamachege, Ntharene, and Mwichiune, respectively. To arrive at the number of banana traders interviewed from each market, two conditions were observed; the size of banana markets approximated by the number of banana traders present and the co-operation of traders. In addition to the data collected from the farmers, information was also sought from the Key Informants. Further information

was collected through Focus Group Discussions (FGDs). The key informants included; Imenti North sub-county agricultural officer, Imenti South and Imenti Central sub-county horticulture officers, Igembe South sub-county agribusiness officer, Kaguru Training Institute crops' officer, Nkuene Ward agricultural extension officer, Meru Green Horticulture (MGH Ltd) marketing officer, and Meru Banana Farmers' Cooperative (MBFC) manager. Two FGDs were conducted. One of the focus group discussions comprised of five female and two male banana farmers. The other consisted of four female and one male banana farmers cum traders and three male banana carriers. The key informants interviews and focus group discussions solicited for in-depth information on constraints of banana farming in Meru County.

One way analysis of variance (ANOVA) was used to determine the statistical differences in the average distances between banana farms and markets, and banana stools on farms in different locations of Meru County. The statistical differences in prices fetched by farmers at the farm-gate and the various open-air markets in Meru County were determined using the Student's *t* test.

III. FINDINGS AND DISCUSSIONS

Opportunities

Results of this study revealed that there was a demand at local and national levels for bananas produced in Meru County. At a local level, bananas were sold in Igembe North, Igembe Central, Tigania East, and Tigania West sub counties of Meru County that had low production (Table 1). An agribusiness officer in Igembe South, expressed the dire need for bananas in Igembe North, Igembe Central, Tigania East, and Tigania West, 'our bananas are not sufficient to feed our very own' (D. Mburugu, personal communication, 16 July 2015). Igembe North, Igembe Central, Tigania East, and Tigania West have for years relied on Khat as their main cash crop (Carrier, 2005; Anderson and Carrier, 2009; Riak, 2014). The dependency on Khat is, however, threatened by recent bans by importing nations such as the United Kingdom (Klein, 2013; Riak, 2014). This implies that banana farming is potentially an economic worthy venture for Khat farmers in Meru County.

Table 1: *Banana Production Statistics of Meru County, 2011 - 2013*

Sub-County	2011		2012		2013	
	Area (ha)	Production (tons)	Area (ha)	Production (tons)	Area (ha)	Production (tons)
Imenti North	1,075	52,625	892	43,708	1,035	41,400
Meru Central*	1,279	76,740	1,299	75,342	1,800	108,000
Igembe North	455	13,650	457	15,995	225	6,750
Igembe Central	0	0	0	0	545	16,350
Imenti South	1,653	94,050	1,650	94,050	1,789	101,973
Tigania west	252	2,016	264	13,200	300	15,000

Tigania East	220	1,760	250	2,500	230	1,840
Igembe South	1,364	40,920	1,380	41,400	1,104	32,000
Buuri	0	0	2	10	10	50

Note. *Meru Central is currently Imenti Central
Source: Mbuthia (2018)

Besides the demand for bananas at the local level, the results of this study revealed that there was a national and potential international demand. Bananas from Meru County were sold in at least 12 of the 47 counties in Kenya. The counties include; Laikipia, Mombasa, Nyandarua, Nairobi, Nakuru, Isiolo, TharakaNithi, Kirinyaga, Nyeri, Embu, Muranga, and Kiambu. Meru County had the highest (60.7%) number of operations. This observation may be partly because some traders doubled as banana farmers who exploited their close proximity to local markets. On one hand, bananas originating from Meru County were sold in counties where banana farming had not thrived (for example, Laikipia, Mombasa, Nyandarua, Nairobi, Nakuru, Isiolo). These counties were banana deficient and therefore provided a ready market. Apart from being banana deficient, Nairobi's population of over 4 million provided a big market. On the other hand, Meru bananas were also sold in counties where production was flourishing (for example, TharakaNithi, Kirinyaga). This observation implied that the demand even in regions where banana farming was thriving outweighed the supply. The national demand is expected to continue rising given that 26.7 percent of the population live in urban areas and urbanisation has sustained a steady 2.12 percent average annual growth rate since 1968 when it was 9.5 percent (World Population Prospects, 2017). Moreover, the urban population in Kenya is projected to 'exceed 36% by 2030–2040' (Hope, 2012: 5).

Farmers in Meru County through the MBFC had in 2014 supplied an exporting horticulture company based at Embakasi in Nairobi with ripe sweet bananas. An interview with the MBFC's manager, however, revealed that the cooperative had the contract cancelled on March 2015 as a result of failing to supply on time (S. Gikokunda, personal communication, 21 April 2015). This finding attests the results of previous studies on export and / or high value domestic outlets that small-scale producers must produce consistently, large volumes or quantities, quality products and supply on time (Neven et al., 2006, Ashraf 2009, Keleman, Ranó, and Hellin, 2009, Asfaw et al., 2010). Keleman et al. (2009) noted that small-scale maize farmers in Mexico needed to produce in large quantities and get information in order to compete in global markets with large-scale producers. Neven et al. (2006) observed that small-scale fresh fruits and vegetables producers in Kenya targeting to sell to supermarkets outlets faced challenges of producing consistently, volume and quality.

This research revealed that there was meagre value addition on bananas in Meru County. A few of the farmers (0.5%) and 41.7 percent of the traders ripened bananas. All the respondents who ripened bananas used the traditional method. The traditional method involved wrapping bananas plus a few avocados or passion fruits in a polythene paper for three or four days. At the end of these days, the polythene paper was removed and bananas were put on a dry place to ripen completely. Well ripened medium banana finger retailed at Ksh 5 or $ 0.05 compared to Ksh 10 or $ 0.1 for three unripe ones.

Banana processing into products such as snacks and juices was on small scale and in the early years of establishment. Both banana snack and juice processing involved five similar preliminary or preparation steps (Figure 1). Upon harvesting, bananas were sorted to eliminate those of poor quality. After sorting, bananas were washed in clean water, dried and ripened. On ripening, the bananas were peeled and the main processing of juice and solar dried snacks' proceeded. The main steps in solar dried banana snacks processing includes slicing, sun-drying and packaging ready for consumption markets (Figure 1).
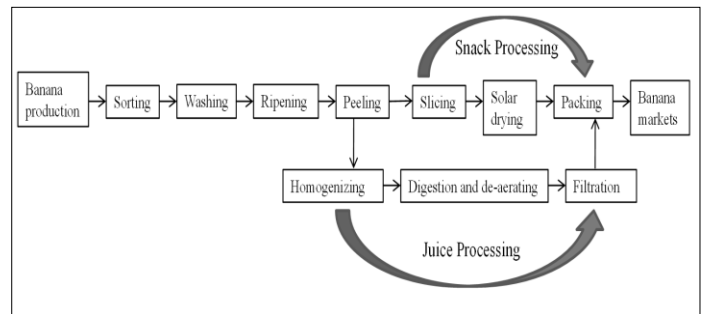

Figure 1. Banana Juice and Snack Processing
Source: Mbuthia (2018)

Banana solar dried snack processing was conducted by a banana solar processing firm at a local trading centre (Mitunguu). The firm was established in January 2015 by a group of five banana farmers. These proprietors supplied bananas from their farms. By May 2015, the solar processing firm had its initial solar dried snacks in the market. The proprietors engaged themselves in marketing the snacks too. The take-up of processing and marketing activities by farmers or vertical integration is important in managing price risks for the producers. The shortening of the value chain means that the actors sharing the profit earned are reduced to the benefits of farmers. A study by Ouma and Jagwe (2010) found out that banana beer processing cottage industries in Central Africa were operated by traders. These traders acquired their bananas from wholesalers bulking from farmers.

As Figure 1 shows banana juice processing involved four main steps (homogenizing, digestion and de-aerating, filtration, and packaging in bottles). The juice processing was being undertaken by MBFC. An interview with the MBFC manager revealed that the cooperative began operating in the year 2014. Upon its establishment, the cooperative engaged itself in selling bananas on behalf of farmers either in raw form or after ripening. By the time of data collection for this study, the MBFC staff processed banana juice and were searching for a market. Moreover, in April 2015, the Meru Banana Farmers' Cooperative management board members were trained on banana value addition (such as jam, purée, crisps) by experts from Jomo Kenyatta University of

Agriculture Technology (JKUAT). The banana value addition could prolong the shelf life of bananas, create more jobs in the sector and enhance domestic and international marketing. Lack of well-established banana value addition activities along the chain has been reported in other banana studies in Africa (for example, Kiiza et al. 2004; Mwangi and Mbaka, 2010; Ouma and Jagwe, 2010). Mwangi and Mbaka (2010) recommended that maximising banana value through improving packaging and labelling to differentiate products would promote competition. Ouma and Jagwe (2010) noted that banana beer processing in Central Africa – Rwanda, Burundi, and eastern Democratic Republic of Congo – was done using rudimentary techniques in cottage industries. Nevertheless 4 percent of the banana beer was exported to the regional markets.Kiiza et al. (2004) noted that whereas about 200 banana products such as juice, wine (*tonto*), gin (*waragi*), banana pulp based bakery (*kabalagala*) among others exist in Uganda, only a few (for example, gin) were fully developed and industrialized. The other products were processed locally, in small scale and often in poor quality.

Constraints

The results of this study showed that banana farmers in Meru County face at least 17 constraints in their crop's value chain (Table 2). Most of the constraints (12) concern production. Pests (nematodes and weevils) and diseases (*ura* - a bacteria wilt and sigatoka) was the most reported constraint (Table 2). The importance of pests and diseases is intertwined with infected conventional suckers and expensive tissue cultured (TC) plantlets (Ksh 120 or $ 1.2 per seedling). Plantlets were costly due to their scarcity in the study area following the back off by the government institutions such as JKUAT and Kenya Agricultural Research Institute (KARI) in the late 2000s from distributing seedlings in the County (Karembu, 2002; Muchui et al., 2013). The high prices of plantlets partly contributed to the high (96.4%) use of potentially infected suckers acquired from the farmer's older banana stools or friends and neighbours. While all pests and diseases reduced the quality and quantity of bananas compromising the prices fetched, *ura* infected maize and beans too. The disease posed a threat to food sources for the households given that maize and beans are important food crops in the County.

Table 2: *Constraints Faced by Banana Farmers, the Applied and Suggested Solutions*

Constraints	f	%	Applied solutions	Suggested solutions
Pests and diseases [a]	86	23.2	1.6% applied ash around banana stool, 3.9% sprayed, 0.3% pruned and 1.6% uprooted plants and burnt them	15.6%, government to provide a cure, 3% agricultural extension officers to train farmers
Inadequate water for irrigation [a]	51	13.7	9% reduced the number of banana stools	11%, government to dig boreholes and construct dams
Poor roads [a, b]	41	11.1	Reduced load size and increased trips during rainy season	9.6%, government to upgrade feeder roads and repair dilapidated parts of main roads
Low selling prices [b]	36	9.7	47% sold at the farm gate	11.3%, a banana cooperative should be established
High marketing costs (levy) [b]	31	8.4	Sold at the farm gate	6.8%, government to reduce levy
Poor market structures and congestion [b]	26	7.0	Sold at the roadside	9.9%, government to construct more markets and improve the existing infrastructure
Lack of enough customers [b]	22	5.9	-	-
Uncertified or poor seedlings [a]	20	5.4	96.4% used convectional seedlings acquired either from their old orchards or neighbours and friends, established plantlet hardening nurseries on their farms	2%, government to avail plantlets
Expensive inputs (seedlings) [a]	19	5.1	96.4%, used suckers	0.5%, government to provide inputs
Lack of know-how on farming [a, b]	11	3.0	-	2.9%, suggested that should train farmers on banana management
Crop fall [a]	9	2.4	0.8%, used wooden stays, 0.5% planted short and medium varieties	-
Theft [a]	8	2.2	2.1%, hired guards	-
Wild animals (especially monkeys) [a]	3	0.8	Scarecrows	-
Brokers [b]	2	0.5	-	Government to ensure that brokers are eliminated in the marketing channel
Small farms [a]	2	0.5	Intercropping	-
Lack of labour [a]	2	0.5	Hiring workers, and selling bananas at farm-gate	-
Soil erosion [a]	1	0.3	-	-
Total	371	100		

Note. - represents no action, [a] production-related constraints, [b] marketing-related constraints
Source: Mbuthia (2018)

As shown in Table 3, the average number of banana stools on each farm were 177. The number of stools however, varied from one sub-county to another. A statistical significance test of the observed variations was found to be significant, $F = 5.249$, $p = .001$ at .05 level. This difference in banana stools in the four sub counties may be partly due to availability of irrigation water. In Imenti North and Igembe South where water shortage was prevalent, 42.7% and 60.4% of the farms had less than 80 stools on their farms, respectively (Table 3). This meant that banana production in the two sub counties was low and did not break even in line with Qaim (1999).Qaim (1999) had observed that with 80 banana stools, a farmer could reap profits from banana farming. The finding on low banana production in parts of Meru County concurs with findings of earlier studies in Kenya (Karembu, 2002; Qaim, 1999).

Table 3: *Number of Banana Stools on Farm*

	Imenti North	Imenti South	Imenti Central	Igembe South	Entire study area

Stools	f	%	f	%	f	%	f	%	f	%
Less than 80	41	42.7	9	9.4	28	29.2	58	60.4	136	35.4
80 and above	55	57.3	87	90.6	68	70.8	38	39.6	248	64.6
Total	96	100	96	100	96	100	96	100	384	100
Average Stools	151		230		181		147		177	

Source: Mbuthia (2018)

Majority of the farmers (94.5%) did not adhere to the recommended planting spacing of 4 x 4 m, 4 x 3 m, and 3 x 3 m for tall, medium and short varieties, respectively (Fruit Production Technical Handbook, 2011). Failure to observe the recommended spacing may be explained with respect to inadequate know-how on banana management and the limited extension services in Meru County as 83.6 percent of the farmers had not received any services from extension officers on banana farming. This observation concurs with findings by Miriti (2011) that majority (64%) of banana farmers in Imenti South had not received extension services for a period of one year.

Banana toppling was reported by 2.4 percent of the farmers (Table 2). Tall banana variety required stays upon fruition. Without the support, this variety was prone to tumble before maturing or harvesting. Toppled bananas acquired broken and bruised fingers. This meant that a farmer could not sell the banana or fetched low prices because of the defacement. Crop toppling, therefore, reduced the quality bananas, a problem reported by 0.8 percent of the traders. Apart from buying low quality bananas at low prices, such products were disqualified from high level domestic and international markets. The challenge of meeting quality demands has been reported in other agricultural studies (Keleman et al. 2009; Zamil and Cadilhon, 2009; Bolo, Lorika and K'Obonyo, 2011). Bolo et al., (2011) found out that dairy farmers in Kenya either used poor milk jars that easily got contaminated with bacteria or sold through brokers who diluted milk leading to failure to deliver quality milk to cooperatives. This observation may be explained by the farmers' lack of knowhow on dairy farming. Keleman et al. (2009) established that buyers of *criollo* maize variety required that it should have 12 percent moisture, white- or cream-coloured, no insects, mould, or other signs of rot.

The requirement that maize be either white or cream coloured meant that farmers could not sell *criollo* of other colours though such varieties were readily produced. Zamil and Cadilhon (2009) noted that Mr. Abdul Kadir, the owner of Konika Mushroom Ltd, based in Mymensingh in Bangladesh demanded that mushrooms supplied to his company be fresh and clean, packaged in polyethylene bags bearing the label, 'This mushroom is a product of the FAO-supported group Jhinuk Mushroom producer Group and marketed by Abdul Kadir of Konika Mushroom, Mymensingh' and a date of packaging (Zamil and Cadilhon, 2009: 929). At times farmers harvested mushroom that were not fresh and Mr. Kadir advised them to dry for dry-mushroom market. Failure to meet the requirement for fresh mushroom costs the farmers a lot. For instance, a farmer needed '10 kilograms of fresh mushroom to make 1 kilogram of dry ones' as

well as repackage to sell to Konika Mushroom Ltd (Zamil and Cadilhon, 2009: 926).

This study revealed that more than a quarter of the farmers (33.1%) did not search for price information. Having farmers ignorant on the prevailing prices in banana markets denied them a baseline for determining prices. Thus, farmers were likely to be taken advantage of by traders as they would accept whatever prices offered for their crop. Such a scenario meant that as main actors along banana value chain, farmers were not reaping benefits for their activities. This finding agrees with other agricultural studies in developing nations (for example, Piper, 2007; Jaeger, 2010; Jeckonia, Mdoe and Nombo, 2013). Jeckonia et al. (2013) found out that onion farmers in Tanzania lacked reliable information on prices and availability of onions creating a chance to be exploited by brokers and middlemen. Piper (2007) and Jaeger (2010) note that farmers in developing nations lacked adequate knowledge on market information.

Of the farmers interviewed for this study, 66.9% sought price information. These farmers got information from different sources including; banana traders (35.7%), fellow farmers (19%), both traders and fellow farmers (7.3%),agribusiness officers (1%) and previous market prices (0.1%) among others. Whereas traders reportedly shared information on the prevailing market price at the national level with the farmers, the information given could not be authenticated since traders are largely after profit making. Contacting fellow farmers was likely to provide valid information on the market prices. The downside of this would be that such information would be limited to the local area. Apart from being a time-intensive process, information acquired during market visits was confined to local markets. This meant that such farmers were guided by narrow (local) rather than broad (national and international) sources of information in determining selling prices for bunches. Similar methods of acquiring market information have been documented in other studies (for example, Muendo, Tschirley and Weber, 2004; Onumah, Davis, Kleih, and Proctor, 2007; Mwithirwa, 2010). Muendo et al. (2004) established that market information around the boarder markets in Kenya was mainly (92%) by word of mouth from friends, relatives and fellow business people. Mwithirwa (2010) noted that 60 percent and 71 percent of traders in Meru South and Mbeere, respectively relied on other traders.

The findings of this study revealed that low selling priceof banana was a concern for both farmers (10%) and traders (4%). An interview with the MBFC's manager revealed that banana prices dropped to Ksh 150 or $ 1.5 from Ksh 500 or $ 5 between April and May, and November and February because avocados and mangoes are in season (S. Gikokunda, personal communication, 21 April 2015). Farmers and traders indicated that prices dipped more when buyers were few and a lot of bananas were available in the markets. Low selling prices deter farmers and traders from devoting themselves to banana farming and trading. Furthermore, use of infected suckers, presence of pests and diseases, inadequate know-how on crop management, toppling, limited price information, limited value addition, lack of a standard grading system and sales unit, lack of bargaining power, few buyers, long value chains, and competition with

alternative fruits (avocados and mangoes) work synergistically to make banana prices low.

There was no standard grading system and sale unit of bananas in Meru County. Majority of the farmers (70%) sold their bananas using bunch or *githukio* method. The bunch method involved an arbitrary determination of banana buying or selling price by either the buyer or farmer by merely considering the size of the bunch, the quantity of bananas in the market, number of buyers in the market, and the bargaining capability of the transacting parties. The subjectivity driving the bunch selling compounded by individual selling (97.4%) often exposed farmers to exploitation by traders who offered low prices. Lack of a standard grading system and sale unit of bananas in Kenya is well documented by Miriti et al. (2013) and Nzioka (2009). Miriti et al. (2013) noted that *Kibuchio* (selling by luck to any buyer) was the common method used by women in Imenti South. Nzioka (2009) observed that farmers in three divisions of Kiambu East District - Githunguri, Municipality and Kiambaa determined banana prices by eye and sold a bunch at Ksh 172, 180 and 216, respectively. Furthermore, individual household in Githunguri, Kiambaa and Municipality divisions of East Kiambu District, on average earned them: Ksh 22,569; 21,345 and 10,065 per year, respectively. These figures were low compared to average results of: Ksh 65,848; 104,487; and 35,175 per year for Githunguri, Kiambaa and Municipality divisions in a simulated group marketing scenario.

Poor and congested market facilities partly contributed to development of banana markets along major roads. Apart from Gakoromone, all the other eleven banana markets operated at roadsides. The roadside markets lacked important infrastructure such as shelter, toilets, water points, and stalls. Similar results on poor market infrastructure in Kenya were reported by Mwithirwa (2010) and Wambugu (2005). For instance, Mwithirwa (2010) found out that poor state of stalls in most open air markets subjected maize and beans to theft and damage by rainfall. Wambugu (2005) noted that most of the periodic open air maize markets had no stalls, sanitation, drainage, perimeter fence, were either muddy or flooded during rainy seasons and dusty during the dry season.

Results of this study showed that on average, the distance covered between banana farms and nearest market in the study area was 3.3 kilometres. Although relatively short distances were covered between farms and markets, poor feeder roads and some deplorable main roads that became impassable during rainy seasons served the area. This limited the quantity and quality of bananas transported on human back or head and by motorcycle, popular means of transport at the farm level. Slippery roads led to rise in accidents and high transport charges by motorcycle operators. This compromised the prices fetched.

The problem of poor roads affirms findings of other studies on rural areas in Kenya (Mbuthia, 2003; Wambugu, 2005; Mwithirwa, 2010; Miriti, 2011). Mwithirwa (2010) found out that 95 percent of the traders used poorly maintained dry weather roads to access major buying areas. Miriti (2011) reported that bad rural roads was the main constraint (highest ranked) facing

banana farmers in Imenti South. Wambugu (2005) noted that majority of male and female (73% and 53%, respectively) maize traders used dry weather roads which became impassable during rainy seasons. He further reported that other roads were dilapidated and poorly maintained. Mbuthia (2003) found out that muddy routes were highest rated (89%) constraint by rice farmers in Mwea Irrigation Scheme.

A few traders (4.6%) reported the problem of high transport costs. Traders particularly, those who bought bananas in large volumes reported that the means of transport from the Meru County to the selling destinations were not readily available. The traders pointed out that the transport providers were either unavailable or available but demanding high pay for the service. Transport charges depended on distances covered, means of transport used and the load size carried. In an attempt to overcome the challenge of lack of means of transport, several traders teamed up and approached the available transport providers and then negotiated for the service. Otherwise, the traders would have to wait, sometimes overnight until a transport provider was available.

Farmers and traders reported that the traditional method of ripening bananas did not achieve a homogenous ripening of all bananas and that some started rotting at the finger tips. Nevertheless, the continued to use the same method. The problem of rotting was more pronounced during cold months of July and August. Rotting lowered the quality of bananas and consequently the prices they attracted in the markets.

Use of poor methods of ripening bananas is not unique to Meru farmers and traders. Berhe, Puskur, Teka, Hoekstra and Tegegne (2008) noted that farmers in Metema District in Ethiopia used a trial and error method in ripening bananas. Initially, farmers put bananas in open wooden boxes leading to change of colour to black that put off consumers. To overcome the setback, farmers dug holes where they placed banana hands arranged in layers separated with green grass to cushion and hasten ripening for five days. Although better than the first method, bananas remained green in colour. To attain the yellow colour upon ripening, farmers applied a third method where bananas were kept above the ground in sacks and crates under shade. The sacks and crates were covered with hay, dry banana leaves and sometimes plastic sheeting for five to six days.

Solutions to constraints

The findings show that farmers applied a number of strategies to overcome various constraints (Table 2). Strategies such as application of ash and of elevating scare crows indicated that farmers use indigenous knowledge in an effort to improve banana production. While some of the strategies (for example, establishment of plantlet hardening nurseries on their farms –see Figure 2 and shoring up banana plants) used enhanced profits, others were detrimental (for example, planting of short and medium varieties and farm-gate selling). Planting of short and medium varieties, for instance disadvantaged farmers in bunch selling as the sizes of bunches they harvested were smaller than the tall varieties. Farm-gate selling on average fetchedlow (Ksh

157 or $ 1.57) compared to (Ksh 223 or $ 2.23) the market sales. A statistical significant *t* test yielded a significant difference in prices with $t = 29.135$ and $p < .000$ at .05 level. Thus, the hypothesis that there is no significant difference in prices fetched at the farm-gate and the market by farmers in Meru County was rejected in favour of the alternative.

Figure 2. Plantlet Hardening Nursery at a Farmer's Farm
Source: Mbuthia (2018)

Several of the strategies of overcoming constraints used by farmers such as hiring of workers and guards, increased production cost of bananas. Other solutions, for instance, selling bananas at farm-gate, exposed farmers to exploitation by buyers. The position of farmers was further complicated by methods used by traders to overcome the challenges they encountered. For example, to overcome rotting losses, 9.9 percent of traders who ripened bananas reduced the quantity they bought during cold seasons while 1.1 percent lowered the selling prices to attract buyers. These strategies by traders eventually affected the farmers' activities in that they could not sell all their supplies and the selling price declined.

In dealing with the high transport costs, traders used two methods aimed at reducing banana volume. One of the methods involved wrapping together of two to three bunches (Figure 3). Whereas the transport charges for an average bunch from Meru to Nairobi was Ksh 40 or $ 0.4, transporting two or three bunches wrapped together cost Ksh 70 or $ 0.7. The other method necessitated the cutting of bunches into hands and packaging them in sacks, locally referred to as *mutumba* (Figure 4). One sack comprised of seven to nine medium sized banana bunches and was charged Ksh 80 or $ 0.8 on average to transport from Meru to Nairobi. These methods were however, not recommended for transporting bananas as they compromised the quality (Muchui et al., 2013).

Figure 3. Wrapped Banana Bunches
Mbuthia (2018)

Figure 4. Banana Hands Packaged in Sacks
Mbuthia (2018)

Conclusion

Banana farming has enormous potential to benefit not only producers but other actors along the chain as well. However, several interdependent constraints that amplify each other, inherent in the chain, hinder the realization of the benefits. The constraints include; pests and diseases, small farms, high plantlet costs, inadequate irrigation water, inadequate know-how on banana management, low production, limited price information, limited value addition, lack of standard grading system and sales unit, low selling prices, poor and congested market facilities. It is therefore important that interventions be they from government and non-government bodies should cut across the chain and be implemented simultaneously to comprehensively address the constraints.

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