Smallholder Pig Marketing Systems in the Southern Highlands of Tanzania

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Abstract
A study using two cross-sectional and a longitudinal research designs was undertaken to assess smallholder pig marketing system to explore basic information for improving smallholder pig production and marketing systems. The first design involved a cross-sectional survey of 300 pig farmers randomly selected in 30 villages in Mbozi and Mbeya rural districts. The second design used a cross-sectional survey of 124 pig traders randomly selected in 65 villages in Mbozi and Mbeya rural districts, and Mbeya Municipality. The third one used a longitudinal design and collected data from 40 pig farmers in 10 villages who had also participated in the first design. Results showed that, pig-marketing systems had various channels and segments moving mainly pigs and pork to farmers, traders and consumers. Major market participants in the pig market chain were the pig farmers who played a dual role as pig producers and buyers, traders of live pigs and pork, and finally pork consumers. Most farmers (85%) bought pigs for breeding, while few (18%), bought for fattening. The mean ($\pm$SD) weight and age of pigs purchased was 18.2 ± 12.6 kg and 6.2 ± 4.7 months, respectively. Farmers sold about 70 and 30% of their pigs to pig traders and other farmers, respectively. Pigs sold to farmers had significantly ($P < 0.001$) lower mean age (6.1 ± 1.5 months) and live weight (LW) (14.3 ± 3.6 kg) than pigs sold to traders with a mean age of 12.8 ± 1.5 months and LW of 40.0 ± 3.6kg. The study concludes that marketing systems were dominated by informal marketing channels, hence, limit the effectiveness of pig production and marketing. Marketed pigs had smaller weights compared to their ages, therefore contributing to poor returns to pig farmers and sub-optimal pork market supply. The study recommends strategic development of pig value chain for sustainable improvement of smallholder pig production and marketing systems and quality pork to consumers.
Keywords: Smallholders farmers, pigs, marketing channels, price determinants

1.   Introduction

In Tanzania, pig production and marketing are growing as an important contributor to the rural livelihoods and source of animal protein in rural and urban communities. Most pigs in Tanzania are produced within smallholder farming systems involving over 500,000 rural smallholder households (URT, 2012). In these systems, pig production is primarily a market-oriented activity with 95-99% of pigs been disposed through selling (URT, 2012; Kimbi *et al.* 2015). Studies have confirmed that the main reason for keeping pigs is for income generation through sale, manure production and slaughter for home consumption (Kimbi *et al.* 2003; Ngowi, 2005; Kimbi *et al.* 2015). The income from pig sales meets essential household expenses and provides some financial capital to carry out other agricultural investments (Kimbi *et al.* 2003; Ngowi, 2005). Furthermore, pig farming and marketing is becoming famous in smallholder systems as an important risk reduction strategy for vulnerable communities. Similar situation has been reported in East and Southern African (ESA) countries (Phiri *et al.* 2003; Mutua *et al.* 2011; FAO, 2012) and other parts of the developing world such as India, China and Vietnam (Kumaresan *et al.* 2009; Thornton., 2010; Riedel *et al.* 2012).

Due to increased preference for pork in village and urban areas in Tanzania and other countries with similar environment, pig production, marketing, and consumption have consistently increased. Marketing of live pigs and pork have widened to involve various market channels, segments and participants. In Tanzania, almost all pork produced in is marketed for domestic consumption (FAOSTAT, 2015). Moreover, the import dependency of pork niche in Tanzania reflects unfulfilled demand for either quantity or quality from local pork supply (FAO, 2005; FAOSTAT, 2015).

Based on increasing population, urbanisation, price of beef and trend in per capita income in Tanzania, domestic demand for pork is consistently increasing. Similar tendency has also been reported in ESA countries (Phiri *et al.* 2003; FAO 2012; FAOSTAT, 2015), West African countries (Ajala *et al.* 2007; Ajala and Adesehinwa, 2008) and other developing countries such as India, China, Vietnam, Latin America and Caribean (Delgado *et al.* 1999; Delgado, 2003; Rahman *et al.* 2008; Cheng *et al.* 2011). The increasing demand for pork calls for improved pig marketing systems and meat safety attributes. In this situation, the understanding of the

prevailing pig marketing systems is crucial for developing suitable improvement strategies. The present study sought to assess smallholder pig marketing systems in Tanzania with particular focus in Mbeya region (a region with highest pig population and pig farmers keeping pigs in Tanzania) as a basis of devising suitable pig marketing improvement strategies.

2.   Materials and Methods
2.1.   Study areas
A study was conducted in Mbeya Rural, Mbeya Municipality and Mbozi districts in Mbeya region in the Southern Highlands of Tanzania to assess pig market chain and pig and/or pork commodity flow characteristics from villages to urban areas. Mbeya region was purposively selected due to a large number of pigs (22 % of the national herd) and high proportion (23.4 %) of households rearing pigs. Mbozi district comprised of 152 villages covering a total of 9,586 km^2 and 513,600 inhabitants; Mbeya Rural district had 126 villages covering a total area of 2,334 km^2 and 254,069 inhabitants; Mbeya Municipality occupied an area of 185 km^2 with 36 administrative wards and 385,188 inhabitants (URT, 1997; NBS, 2013).

2.2.   Study designs and sampling procedures
Two cross sectional and a longitudinal research designs were conducted involving smallholder pig farmers as the primary pig producers and market participants, and pig traders as the intermediate market participants. The initial design used a cross-sectional survey to collect pig-marketing data from 300 smallholder pig keeper's households using a structured questionnaire. Thirty villages were randomly sampled from a list of 243 villages keeping pigs in Mbeya rural and Mbozi districts. In each village, 10- pig keepers' households were randomly sampled for interviews. Data collection involved visits to individual households and face-to-face interviews with household heads using structured questionnaire. Data collected included pig commodity flow between farmers and pig traders such as pigs' acquisition/ bought and sales in terms of locations (i.e. within a village, neighbouring village, far village, district, region), sources (i.e. pig trader, other farmer and institution), place of exchange (i.e. pig farmers household, market place), type of pigs and price.

The second design used a cross sectional survey to collect pig marketing data from pig traders located in Mbozi, Mbeya rural districts and Mbeya Municipality using a structured questionnaire. Since there were no defined market places for pigs in the study districts, the study used 124 randomly sampled pig traders based on type and location of their pig business. Ninety-six pig and/or pork business sites located in 45 villages and 20 mitaa   (i.e. 20, 25, and 20 for Mbeya rural, Mbozi districts and Mbeya Municipality, respectively) were thus visited (mtaa is the smallest administrative unit within the ward of an urban authority; mtaa is singular, while, mitaa is plural). Data collection involved visits to traders' business sites coupled with face-to-face interviews. Data collected included sources of pigs/pork, conditions for selling pig and pork, number of animals bought and price paid for different pig live weights. The study also assessed pigs and pork commodity flow from villages to urban areas and between districts.

A longitudinal research design was used to collect data from randomly selected 40 pig farmers' households (i.e. 20 from each of the two districts: Mbozi and Mbeya rural) in ten villages who had also participated in the first study. The researchers visited each household on a monthly basis for eight months covering wet and dry seasons. Pig herd dynamics data such as the number of pigs acquired, bought, disposed off and sold in relation to age, weight, sex and place of acquisition/sold were monitored. Participating households were provided with calibrated pig weighing bands, pig record cards, and trained on recording events for the entire duration of the study

2.3.   Data analysis
STATA 10 statistical software (STATA, 2007) was used to perform all statistical analyses such as descriptive statistics (mean, frequency distribution, percentages and cross tabulation between variables), simple and multiple linear regressions and simple and partial correlation were performed. Simple liner regression was used to analyse relationship between variables such as price and pig ages. Multiple linear regressions were used to analyse relationships between variable such as price and different age and weight groups of pigs bought and sold by pig keepers. A partial correlation was used to analyse co-relationship between pig age, weight and price. Score for each determinant used by pig farmers and traders to select pig to buy and price to pay (Table 4 & 6) was calculated by cumulative cross product of its frequency (number of farmers/traders used the determinant) and rank (weight) given to each determinant by a farmer/trader

3.   Results
3.1.   Market channels for pigs and pork
Pig farmers were the first link in the pig market chain who played a dual role as main pig producers (reared pigs and sold them to traders and other farmers) and buyers (bought pigs from other farmers for breeding or fattening)

(Figure 1). The main driving force compelling farmers to sell their pigs was the need of money to tackle the following major priorities. i) Buy agricultural inputs and pay for farm labour (28 %), ii) buy replacement stock (23%), iii) buy food and home utensils (15%), iv) pay for school fees, children uniform and other school amenities (12%), v) build new or repair old houses (6%), vi) buy furniture (4%), vii) buy pig feeds (4%) and viii) pay for medical expenses (2%).

Pig traders were the second link in pig market chain. Six types of intermediary pig traders (between pig farmers and pork consumers) were identified, namely, butchers, pork centre operators (PCO), pig transporters (PT), pig collecting agents (PCA), pig retailers(PR), and pork processors (PP) (Table 1, Figure 1). Butchers bought live pigs mainly from pig farmers and only a few from intermediate traders, such as PR and PCA. Butchers, similar to other pig traders used different methods to transport bought pigs depending on the proximity to their business centres. For short distances, trekking was the common method, whereas, transportation using cars were common for longer distances. Traders also used bicycles, motorbike and carts for shorter distances. Following slaughter, fresh pork was mainly sold directly to consumers or to intermediate traders such as PP and PCO. Small amount of processed (cooked) pork was sold directly to instant consumers (Table 1 & Figure 1).

PR included a few intermediary pig traders with a relatively high volume of trade. They normally bought pigs mostly from pig farmers in order to sell them to other pig traders such as butchers, PCO and PT. PCA were also intermediate traders, buying pigs mainly from pig farmers on behalf of PT and butchers. PP were specialised in pork processing (i.e. roasting, frying, boiling and barbecuing) mostly located in urban and peri-urban areas (Table 1). PCO dealt with live pigs and pork business mostly in rural areas, and they bought live pigs mostly from pig farmers and a few from PR. Following slaughter, pork was sold fresh or processed to pork consumers mainly in local brew bars, market places or in small pork kiosks in urban areas. PT usually bought relatively large numbers of live pigs from different sources, such as pig farmers, PR and PCA (Table 1). Almost all pigs (99%) bought by PT were transported and sold to other traders such as butchers located in other regions, especially in Dar-es-salaam city. Pork consumers were the last link in the pig marketing chain, and majority of pig keepers (88 %) were also pork consumers.

3.2.   Pig acquisition by pig farmers

Majority of pig farmers acquired new stock of pigs from within their villages and mainly from other pig farmers, while the rest acquired pigs from neighbours or further away villages (Table 2). Pig farmers carried most (99%) of the transactions at the farm gate. Most farmers bought pigs for breeding purposes and few for fattening. There were no significant differences between districts for any of the parameters (P> 0.05) (Table 2)

3.3.   Age, weight and price of pigs bought by farmers

The prices paid by pig farmers for pigs bought at different ages and live weights (LW) in the 40 monitored households are summarised in Table 3. Age of pigs purchased ranged from 2 to 26 months with a mean ± SD of 6.2 ± 4.7 months. Pig farmers bought large proportions of pigs (54%) at weaning (2 – 3 months) or shortly after weaning (3.1 – 5 months). Only 26% of pigs bought by farmers were at the age between 5 and 8 months and few (20%) at an age above 8 months. Overall, the price paid by pig farmers increased with age of the pig (Figure 2A), though, some variation was observed between age groups (Table 3). The relationship (regression coefficient) between pig age and price was positive, but not statistically significant for pigs aged between 2 and 5 months, and negative at ages above five months (Table 3). Pig ages were therefore an overall poor price determinant ($R^2 = 0.22$, Figure 2A).

LW of pigs bought by farmers ranged from seven to 63kg with mean of 18.2 ± 12.6kg (Table 3). Most of the pigs (70%) weighed between 7 and 20kg. Overall, pig buying price increased significantly with increased pig LW ($r = 0.74$, $P < 0.001$). However, variation existed between specific weight groups (Table 3). There was no significant relationship between LW and price for pigs weighing 7 to 15kg (P>0.05). However, the relationship was significant and positive for pigs with LW exceeding 15kg ($P < 0.05$). LW was therefore a better price determinant for older pigs bought by pig farmers ($R^2 = 0.59$) than age (Figure 2B).

3.3.1.   Determinants of pigs bought by farmers

Table 4 summarises important determinants that pig farmers used to select pigs to buy and prices to pay. Expected LW was the most important determinant for selecting pigs and price to pay. However, there were no weighing scales to measure objectively LW of pigs during marketing processes. LW was therefore, estimated based on experience of a buyer and seller rather than actual scale measurements. Sex ranked second and third as an important determinant for pig to buy and price to pay, respectively. Preference for female pigs was higher than for males. Farmers paid more prices for female pigs, especially weaned pigs and gilts compared with males of similar age and weight. Farmers bought females mostly for breeding purposes. Breed of a pig ranked third and second as a determinant for pig to buy and price to pay, respectively. Exotic breeds and their crosses, especially weaners and gilts were more preferred and costlier than indigenous ecotypes of equal weights. Most

pig farmers used pig morphological features such as body length, shape and colour to differentiate between exotic and indigenous pigs. Porcine cysticercosis (PC) status of a pig ranked fourth as a determinant for selecting a pig to buy. Lingual inspection was the most used PC diagnostic method. Other determinants used by farmers to select a pig to buy and price to pay were health status, body length, and coat colour (Table 4).

3.3.2.   Features of the pigs sold by pig farmers

A total of 150 pigs were sold from the 40 households during the 8 months period of the intensive recording. Majority of pig farmers (81%) sold their pigs at farm gate to buyers mostly from within and neighbouring villages. Most pigs (70%) were sold to pig traders mainly for slaughter, whereas, 30% were sold to other pig farmers mostly for breeding purposes (Table 2). There was no significant difference between districts, on the location and type of customer for pigs sold by pig farmers (P > 0.05). The number of pigs sold by farmers varied across the wet and dry seasons (Figure 3). During the wet season, sales decreased consistently from January to mid April reaching the lowest level ending of April, which was also the end of the wet season. Thereafter, sales of pigs increased as dry period proceeded.

The age of pigs sold by farmers ranged between 2 and 51 months with a mean ± SD of 10.7± 9.2 months (Table 5). Most of the pigs sold (79 %) were aged between 2 and 12 months. The LW of pigs sold ranged between 7 and 110kg with a mean of 32.0 ± 23.8kg. Pigs sold to other farmers had significantly lower mean age (6.1±1.5 months) and weight (14.3± 3.6 kg LW) than pigs sold to traders with a mean age of 12.8± 1.5 months and LW of 40.0± 3.6kg, respectively (P< 0.001). Price per kg of LW paid to pig farmers ranged from TZS 635 to 2771 with a mean of TZS. 1202.4 ± 453.2 (exchange rates between Tanzanian Shilling (TZS) and the US dollar (USD) during the period of data collection was 1250:1). The price varied between different age and weight groups (Table 5). Price per kg LW was higher for younger pigs with age between 2 and 4 months (i.e. weaners) than older pigs. There was no consistent trend between age and price for pigs aged more than 4 months. Farmers sold most of their pigs (71%) at a weight between 7 and 40kg LW. The price per kg LW was higher for weaned pigs between 7 and 10kg compared to pigs above 10kg. A highly significant positive correlation between LW and price per kg LW was observed (P < 0.001, r = 0.925). Whereas, the age and price per kg LW was significantly negative correlated (P < 0.01, r = - 0.251). Mean price per LW was significantly higher for females (TZS 1327.5± 71.6) than male pigs (TZS 1056.7±71.6) pigs (P<0.001).

3.4.   Pigs bought by pig traders

3.4.1.   Amount, location and price of pigs bought by traders

Amount of pigs that pig traders bought each month varied from 2-200 (mean ± SD: 21.2 ± 2 pigs) depending on the district, type of pig trade, location and condition of pig business and education level of pig traders (Figure 4). Mean buying price per kg LW was TZS. 1207±348.4 Price per kg live weight of pigs varied significantly (P<0.05) between district, types, and locations of the pig business. The mean price per kg LW was highest in Mbeya Municipality (TZS. 1454.2 ± 473.6), followed by Mbeya rural district (TZS. 1206.5 ± 184.5) and in Mbozi district (TZS 1057.2 ± 313.4). Among traders, butchers bought pigs at a higher mean price (TZS. 1446.7±468 per kg LW), followed by PT and PR (TZS. 1304±129), whereas, the lowest price was paid by PCO (TZS. 1077.2). A higher overall mean price per kg LW was observed for pig traders (irrespective of category) located in urban areas (TZS 1417 ± 395) compared to their counterparts located in peri-urban (TZS. 1327.0± 132.1) and in rural areas (TZS. 1054.5±257.2).

3.4.2.   Determinants of pigs bought by pig traders

Pig traders used different methods and attributes to select pig or pork to buy (Table 6). The PC status of a pig was the most important attribute ranked first followed by LW especially for traders bought live pigs. For pig traders (especially PP) who usually buy pork from other traders, the most used criterion was assurance that the pork has been inspected and ascertained safe by meat inspector. Other important examination criteria were general health status, body length of a pig, type of feeds fed, background history of a pig and colour of a pig (Table 6).

4.   Discussion

Majority of farmers marketed their pigs to other farmers and traders at farm gate. This implies that villages were pig-marketing focal points and pig farmers were important market participants as both pig suppliers and prominent buyers. Similar observations are also reported in smallholder pig systems in Kenya (Kagira *et al.* 2009; FAO, 2012), Nigeria ((Ajala and Adesehinwa, 2007), and Namibia (Petrus *et al.* 2011). However, this observation is contrary to that reported by Kumaresan *et al.* (2009) for smallholder pig farmers in Northern India where most pig farmers sold their pigs at the daily and weekly markets located within their villages. This situation might have been caused by several factors such as lack of an organised market for pigs, religious limitations and an attempt to reduce transaction costs (e.g. transportation, handling cost) as suggested by Key *et al.* (2000). In the study districts, sellers and buyers marketed livestock such as cattle, goats and sheep with exception of pigs in the primary livestock-markets located in the districts. These market places did not consider

pigs as important formal market commodity similar to cattle, goats and sheep.

Pig farmers sold most of their pigs at young ages (2 to 5 months). Reasons such as reducing rearing costs, high demand of this age group coupled with high returns attributed to higher price of this age group might have motivated this incident. A similar observation was reported in small-scale production systems in Kenya where weaned pigs had higher demand associated with higher price (FAO, 2012). A high positive correlation and coefficient of determination observed between pig buying price and weight revealed that pig weight was an important attribute to pig performance and market price and a better indicator of price than pig age. This was also demonstrated by preference of majority of pig farmers and traders to use pig weight as major price determinant. This observation agrees with findings reported by Mutua *et al*. (2010) in rural western Kenya. The present study indicates that pig farmers and pig traders also use pig body size as an important determinants in deciding on a pig to buy and price to pay. Similarly, the use of LW as determinant of livestock to buy and price to pay have been reported elsewhere (Mutua *et al*. 2010; Tesfaye, 2010). The influence of sex and breed as important factors for selecting pig to buy and price to pay may have been caused by the fact that most pigs that farmers bought were used for breeding. Most pigs kept in the study area were local ecotypes and crossbred of local and exotic breeds (Mbaga *et al*. 2005). In this situation, most farmers were interested in keeping more improved breeds and thus paying high prices. Farmers paid higher price for breeding females than other classes of pigs of similar weight. These observations were similar to those reported by Williams *et al*. (2006) in cattle whereby, age, sex, breed, body condition, season of sale and market locations were found to be the most significant factors influencing short-run cattle prices in Central corridor of West Africa.

Pig PC status was ranked fourth by farmers, whereas, it was ranked first by pig traders as a determinant for selecting pigs to buy. The discrepancy between farmers and traders may have been caused by differences in PC sensitivity, purpose of buying pigs, ages of the pigs and knowledge of identifying PC infected pigs. PC has been reported to contribute a considerable pig production and market losses in endemic areas due to downgrading/ condemnation of pig carcasses (Phiri *et al*. 2003; Carabin *et al*. 2005; Pawlowski *et al*. 2005).

Monthly and seasonal variations in pig trading by pig farmers demonstrated a potential variation in market demand for pigs and pork across months and seasons. For example, in the study area, December to April is the peak of cropping season that goes with increased expenditure on agricultural inputs and labour and decreased expenditure in buying pigs for rearing and food items, including pork. The dry season starts from May to November, and demand for pigs is high due to increased income of farmers (from crop sales and reduced expenditures for farm inputs and labour), which in turn increased demand of pigs for rearing and thus increases pig disposal.

The mean LW of pigs (40.0±3.6) sold by pig farmers to traders revealed clearly that pigs were sold at a lower weights compared to their mean ages (around 12 months), suggesting that pigs had poor growth performance. Low growth performance of pigs have been associated to poor management practises such as poor feeding, housing and control of diseases and parasites (Lemke *et al*. 2006; Kumarresan *et al*. 2009) and/or genetic limitations (Ncube *et al*. 2003; Velie *et al*. 2009).

In the study area, the mean number of pigs purchased by traders was higher in Mbeya Municipality than in Mbeya rural and Mbozi districts. A higher demand of pork associated with urban population and pork eating behaviour in Mbeya Municipality might have attributed to this occurrence. This observation is in agreement with Delgado *et al*. (1999) and FAO, 2005; 2012) who suggested the increased demand for meat caused by an increased human population, urbanization, and income. Notably, pig traders with secondary education purchased more pigs showing the influence of education in the pig business. This event could be caused by a heightened entrepreneur skill of pig traders with secondary education, with an increased understanding of market dynamics as suggested by Omiti *et al*. (2009). Pig purchasing prices also varied depending on the district, type of pig traders, and location of the pig business. The observed variations might have been due to variations in demand and supply of pigs, and transaction costs.

5.   Conclusion

The study revealed that smallholders marketing systems had various market channels and segments that connect various actors and transactions involved in the movement of pigs from farmers to pork consumers. Nevertheless, the following challenges were identified as important factor that limit effectiveness of the systems and thus reduced profitability of pig farmers, safety pork to consumers and sustainability of the smallholder marketing systems;

i.   Marketing systems were dominated by informal marketing channels with no defined market place and traders for farmers to sell their pigs;

ii. Marketed pigs had smaller weights compared to their ages, implicating that pigs had poor growth performance and thus contributing to poor returns to pig farmers and sub-optimal pork market supply.

iii. Pig farmers were disorganised thus unable to dictate market price for their pigs

For sustainable improvement of smallholder pig production and marketing systems and finally safe pork to

consumers, we recommend strategic development of pig value chain.

6.   Acknowledgement

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Table 1: Pig trader's business characteristics

Business features	Type of pig trader					
	Butchers	PP[a]	PCO[b]	PT[c]	PR[d]	PCA[e]
i. Full time engaged in pig business (%)	79	72	39	67	50	50
ii. Live pig bought from farmers (%)	78	10	76	41	100	100
iii. Proportion (%) of live pigs bought from other traders (bracketed is name of trader)	19 (PR) 3 (PCA)	0	13 (PR) 11 (PCO)	30 (PCA) 29 (PR)	0	0
iv. Main product sold	Fresh pork	Cooked & fresh pork	Fresh & cooked pork	Live pigs	Live pigs	Live pigs
v. Main customer	Domestic pork consumers & PP	Instant cooked pork consumers	Domestic & instant pork consumers	Butchers & PP	PT	PT
vi. Other customers	PCO	Domestic pork consumers	PCO & PP	-	Butchers	Butchers
vii. Main business location	Urban	Urban & peri-urban	Rural	Peri-urban, urban &rural	Peri-urban, urban &rural	Peri-urban, urban &rural

[a] pork processors, [b] pork centre operators, [c] pig transporters, [d] pig retailers, [e] pig collecting agents

Table 2: Farmers' acquisition of new stock in Mbozi and Mbeya rural districts

Pig acquisition variable	Number of households (%)
No. pig farmers acquired pigs during 2007 (N=299)	135 (45)
Location where pigs were acquired (N=135)	
Within the village	91 (67.4)
Neighbouring villages	36 (27.0)
Far away villages	16 (12.0)
Other districts within the region	1 (2.0)
Neighbour regions	2 (1.0)
Sources of live pigs (N=135)	
Other pig farmers	131 (97.0)
Pig traders	2 (1.5)
Institutes (religious, & Mbeya rural council)	2 (1.5)
Place of exchange (N=135)	
Pig farmers household	133 (99)
Market place	2 (1)
Purpose of pig acquisition (N=135)	
Breeding	115 (85)
Fattening	24 (18)
Direct slaughter	2 (2)
Means of pig acquisition (N=135)	
Purchase	124 (92)
Gift	6 (4)
Borrowing [a]	5 (4)

[a] Involved acquisition of female(s) pig mainly for breeding purposes from another pig keeper with the understanding that any offspring was shared

Table 3: Price (in Tanzanian Shilling (TZS)) for different ages and weights and its relationship to specific weight and age groups of pigs bought by pig farmers from January to August 2008

Age and weight of pigs	No. pigs (%)	price per age and weight category (Mean ± SD)	Regression Coefficient β	P value and significance	95 % Conf. Interval of beta
Age group (months)					
2 - 3	23 (33)	17 900±4,689	Ref [a]		
3.1 - 5	14 (20)	20 050±7,833	229	0.915	-4 051 - 4508
5.1 - 8	18 (26)	23 972 ± 9104	-4941	0.068	-10 268 - 387
8.1 - 12	5 (7)	18 000 ± 7842	-8140	0.021*	-15 008 - -1273
12.1 - 16	6 (9)	26 750 ± 4645	-17707	< 0.001***	-28 207 - -7206
16.1 - 26	3 (4)	40 000 ± 0.0	-6040	0.356	-19 109 - 7029
Weight group (kg)					
7 – 10	22 (34)	16 580 ± 2328	Ref[b]		
10.1 – 15	14 (22)	17 000 ± 5639	1 715	0.394	-2 307 - 5736
15.1 – 20	9 (14)	17313 ± 7116	6 257	0.045*	137 - 12377
20.1 – 25	8 (13)	25286 ± 3592	14 591	< 0.001***	8 170 - 21011
25.1 – 30	6 (10)	33500 ± 5925	23 157	< 0.001***	16 911 - 29403
30.1 – 63	5 (8)	33000 ± 7036	29 491	< 0.001***	17 834 - 41147
Constant			16 550	< 0.001***	14 276 - 18823

* P < 0.05, ** P< 0.01, *** P< 0.001, [a&b] Reference categories

Table 4: Determinants used by pig farmers to select pigs to buy and prices to pay (n=300)

Determinant	Selection of pigs to buy No. pig farmers (score)	Prices to pay No. pig farmers (score)
Body size	163 (497)	153 (445)
Sex	137 (352)	75 (176)
Breed	110 (306)	99 (264)
PC[a]	83 (295)	-
Healthy status	57 (146)	74 (157)
Body length	48 (138)	41 (79)
Performance background	41(116)	0(0)
Season of the year	0 (0)	62 (76)
Body fat	0 (0)	18 (27)
Coat colour	25 (47)	13 (4.3)
Location where pig was bought	0(0)	3 (4)

[a]Porcine cysticercosis

Table 5: Price for different ages and weights groups of pigs sold by pig farmers in 40 monitored households

Age and weight groups	Pigs No (%)	Price per kg live body weight (Mean ± SD)	Regression Coefficient (β)	P value and significance	95 % Conf. Interval of beta
Age group (months)					
2- 4	31 (21)	1765 ± 681	Ref[a]		
4.1 – 6	15 (10)	1008 ± 210	-3171	0.384	-10347 - 4004
6.1 – 8	34 (23)	1074 ±189	-298	0.843	-7154- 6559
8.1 – 12	39 (26)	1052 ±162	-447	0.900	-7499 - 6604
12.1 – 16	5 (3)	958 ± 249	-2193	0.693	-13158 – 8773
16.1 - 20	13 (9)	1232 ± 167	-15932	0.001**	6946– 24918
20.1 – 51	13 (9)	939 ± 155	411	0.931	-8917 – 9739
Weight group (kg)					
7 - 10	28 (19)	1810 ± 704	Ref[b]		
10.1 – 20	40 (27)	1086 ± 198	2033	0.530	-4351 – 8418
20.1 – 30	19 (13)	1018 ± 116	12501	0.002**	4641 – 20361
30.1 – 40	20 (13)	1103 ± 250	23135	< 0.001***	15149 – 31121
40.1 – 50	18 (12)	1050 ±166	31692	<0.001***	23100 – 40284
50.1 – 60	7 (5)	963 ± 90	41529	<0.001***	31294 – 51765
60.1 - 110	18 (12)	1068 ± 229	67856	<0.001***	59047 – 76665

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, [a&b] Reference categories

Table 6: Determinants used by pig traders to select pigs and pork to purchase

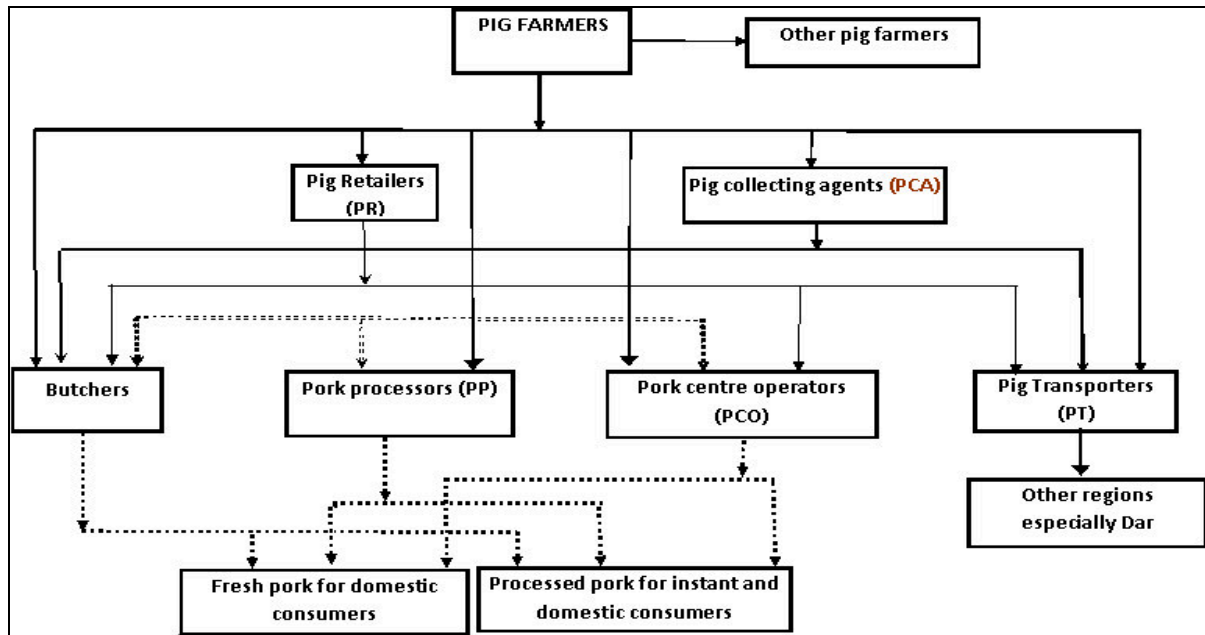| Determinant	Traders using the determinant (n = 124)
	No. pig traders (Score)
Presence of PC[a]	108 (287)
Body size score	102 (195)
General health status	48 (67)
Body length	28 (46)
Proof that a pig and pork was inspected by meet inspector	14 (14)
Type of feed fed to pig	7 (9)
Background history of a pig	3 (5)
Coat colour	2 (1)

[a]Porcine cysticercosis

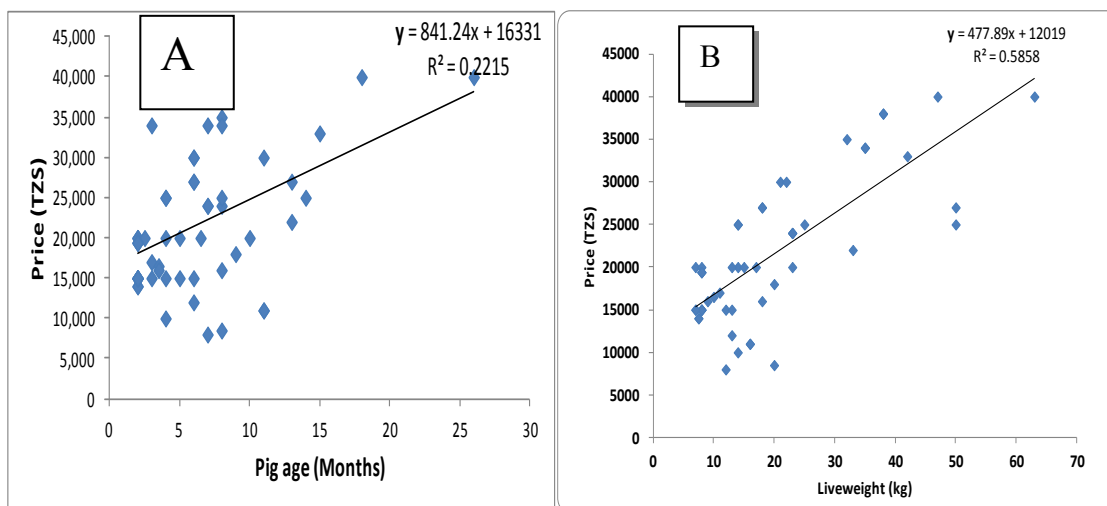Figure 1: Market channels for pigs and pork in smallholder pig marketing systems

Figure 2: Scatter plots and regression lines on relationship between purchasing price (Tanzania shilling (TZS)) and pig age (months) (A) or live weight (kg) (B) for pigs bought by pig farmers
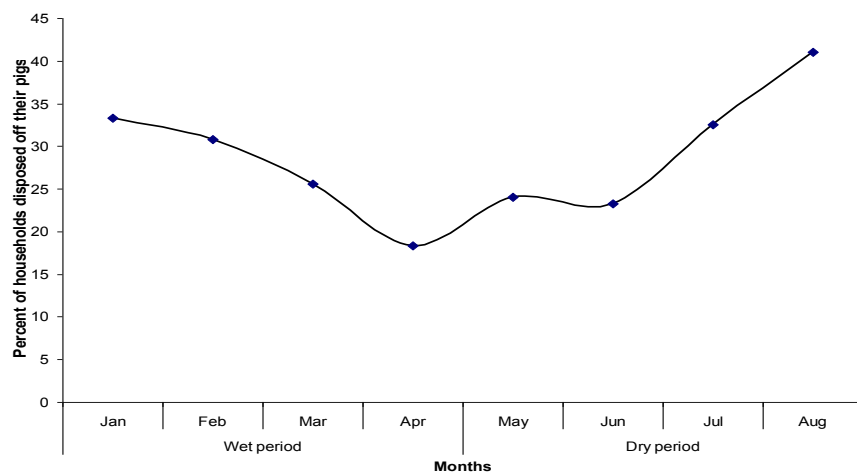
Figure 3: Seasonal variation on sales of pigs by 40 monitored households
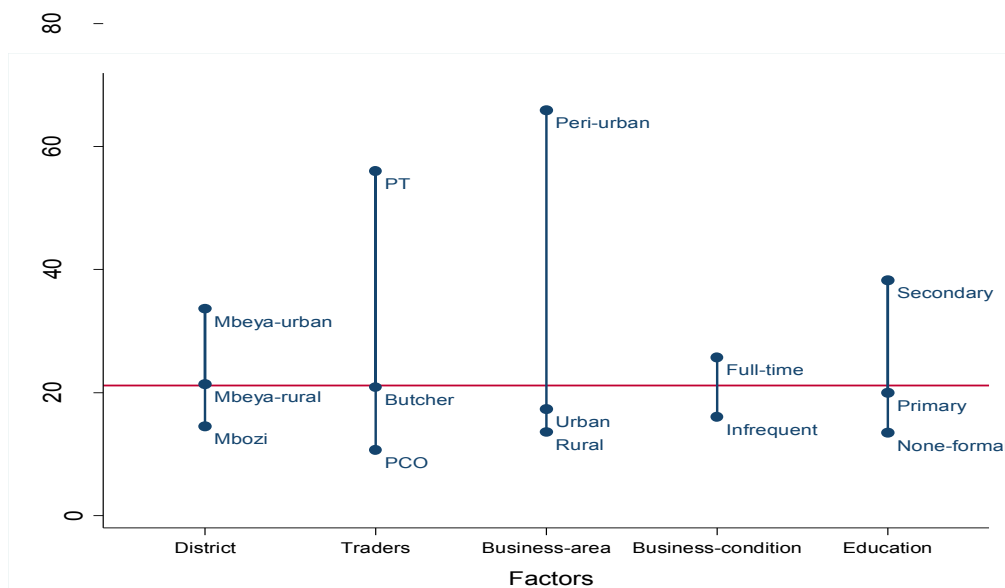

Figure 4: Effects of different factors on the mean number of pigs purchased per month by pig traders. Vertical lines indicate a variable (factor) deviation (±) from overall mean number (21.2) of pigs purchased per month.