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By Nicholas E. Nikusekela & Hija W. Mwatawala

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*Strictly as per the compliance and regulations of:*



# Multivariate Analysis of Agricultural Market Access and Farming System in Tanzania

Nicholaus E. Nikusekela <sup>α</sup> & Hija W. Mwatawala <sup>σ</sup>

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In a conclusive way, local periodic markets have important role in rural development. In economic dimension, the local periodic markets generates jobs and income and therefore decrease poverty levels. In sellers' motivating dimension, the sellers like their work because money and employment are important reasons for working in periodic markets.

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## 1. INTRODUCTION

### a) Background

Tanzania economy depends on agriculture, which accounts for more than one-quarter of growth domestic product, it provides 85% of exports, and employs about 75% of the work force. The World Bank, the IMF, and bilateral donors have provided funds to rehabilitate Tanzania's aging economic infrastructure, including rail and port infrastructure that are important trade links for inland countries source. Recent banking reforms have helped increase private-sector growth and investment, and the government has increased spending on agriculture to 7% of its budget. Continued donor assistance and solid macroeconomic policies

supported a positive growth rate, despite the world recession as shown in the study by Lokina *et al.* (2011).

To date, however the agricultural sector in Tanzania has contributed little to poverty reduction. Various studies point to numerous reasons for this situation. One of the reasons relates to low natural resource utilisation explained by extremely low land-labour ratios. Despite the abundance of unutilised land, Tanzanian agriculture is dominated by small scale subsistence farming (MAFS, 2001). Smallholders operating between 0.2 and 2 hectares (Tulahi and Hingi, 2006) and traditional livestock holders who keep an average of 50 heads of cattle utilise approximately 85% of the arable land (MAFS, 2001). Tulahi and Hingi (2006) also found that the major limitation on the size and utilisation of land holdings is the lack of access to modern farming methods and heavy reliance on the hand hoe as the main cultivating tool, 70% of farmers still used a hand hoe for tilling the land, 20% used animal draft ploughs and only 10% used tractors.

The second reason relates to low productivity in the sector. Not only are farmers cultivating small plots of land, but yields are low relative to countries with similar natural resource endowments and climatic conditions, indicating inefficient use of the land available. A historical prolonged and deep urban bias led to a distorted pattern of investment. Greater public and private capital was invested in urban areas than in rural areas, with too little capital directed towards raising rural productivity, such distortions have resulted in strikingly different marginal productivities of capital in urban and rural areas (Mnenwa and Maliti, 2010).

For decades, agriculture in developing countries including Tanzania has operated in a context of low global prices for food products coupled, in many countries, with unfavourable domestic environments. Low levels of investment in agriculture, inappropriate policies, thin and uncompetitive markets, weak rural infrastructure, inadequate production and financial services, and a deteriorating natural resource base have all contributed to creating environment in which it has frequently been risky and unprofitable for smallholders to participate in agricultural markets (Eskola, 2005).

Strong links to markets for poor rural producers are essential to increasing agricultural production, generating economic growth in rural areas and reducing hunger and poverty. Improving these links creates a virtuous circle by boosting productivity, increasing

Author <sup>α</sup>: Department of Research and Development, Nkamson Consultancy Co. Ltd, Tanzania. e-mail: [nkamson83@gmail.com](mailto:nkamson83@gmail.com)

Author <sup>σ</sup>: Department of Rural Development and Regional Planning, IRDP in Tanzania.

incomes and strengthening food security. Better access by small producers to domestic and international markets means that they can reliably sell more produce at higher prices. This in turn encourages farmers to invest in their own businesses and increase the quantity and quality of the goods they produce (Elkington, 2008).

For these reasons, improved market access is not an issue of consequence only to better-off producers, and it is not relevant only to cash crop, rather than food crop, production. It is of importance to all rural households, and assisting rural poor people in improving their access to markets must be a critical element of any strategy to enable them to enhance their food security and increase their income (Elkington, 2008).

Rural incomes will not be substantially increased by exclusive emphasis on subsistence food crop production; rather, more market-oriented production systems are needed. These require the intensification of agricultural production systems, increased commercialization and specialization in higher-value crops. And these must be built upon the establishment of efficient and well-functioning markets and trade systems – ones that keep transaction costs low minimize risk and extend information to all players, and that do not either exclude, or work contrary to the interests of, the poor – particularly those living in areas of marginal productivity and weak infrastructure (Gardner and Brooks, 1994).

#### b) *Problem statement and justification*

Given the predominant role of agriculture in the livelihoods of most Tanzanians, any strategy for slashing poverty and hunger in the country must center on rapid growth in the agricultural sector. Farmers clearly need the government to make investments aimed at increasing agricultural productivity. These investments depress commodity prices and farm incomes if they are not linked to market opportunities for farmers. Poorly functioning markets, weak domestic demand, and lack of export possibilities are major constraints on farmers' agricultural growth prospects.

Lokina *et al.* (2011) examine the role of agriculture, and in particular smallholder farming, in economic growth and poverty reduction in Tanzania in the 1990s and 2000s, majority of Tanzanians earned their living from farming over this period, and the relative poverty of farm households compared to non-farm households actually worsened. Household survey data from 1991 to 2007 reveals that occupational shifts away from the agriculture sector made a larger contribution to overall growth than did income growth within agriculture.

It is of this sense this study addressed the agricultural market access and farming systems with specific local contexts, namely small and medium towns in Msalato, Makutupora and Hombolo. From the policy

standpoint, the problem of balanced market growth and farming systems among the smallholder farmers cannot be dissociated, a fortiori within the context of global and national economic integration.

#### c) *Research questions/hypothesis*

- i. What are the farming systems that influence poverty reduction in smallholder farmers in Dodoma city?
- ii. What is the relationship between access to periodic market and criteria determining agricultural marketing in Dodoma city?

This study tested the following hypothesis;

*Hypothesis ( $H_0$ ):* There is no significance relationship between access to periodic market and criteria determining agricultural marketing in Dodoma city.

#### d) *The theory of periodic markets/periodic marketing*

##### i. *The location theory*

Periodic markets are mostly rural because wherever we have periodic markets in urban centers these markets also act as daily ones. For example Veyula market in Makutupora ward which is still used as periodic market is also a daily market; the only difference is that there will be more people from different villages and towns and a variety of goods on a market day. Rural periodic market came into being as a result of the organization of rural markets. Some markets are located in the vicinity of the palace such as Veyula market in Makutupora ward and Hombolo- Bwawani market in Hombolo ward, while some are strategically located in the centre of the community like Msalato market, others are sited on neighbourhood basis as in Hombolo- Makulu in Hombolo ward.

Contribution to the theory of periodic markets and mobile trading can be placed in either an economic or a non-economic tradition. The non-economic emphasis tends to view periodic marketing as a social phenomenon. This is supported by Bromley and Good (1977) that markets are held periodically to coincide with existing periodic institution and that local traders and consumers who are usually producers could not go to market at anytime but have chosen to trade on a traditional rest day or on a day when they were accustomed to converge upon a central place for social and religious activities or to hear proclamations and pay tribute to or receive alms from local authorities. The economic tradition includes two distinct themes, the one steaming from a central place theory interpretation of periodic marketing, the other from the location theory. In both of these, periodic markets and marketing are distinctively economic phenomena with a concern for exchange for profit rational economic behavior.

This is also noted by Hay (1971) that the decision to adopt periodic marketing may have one of three intentions: to achieve viability, to increase excess profits and to lower retail prices or raise producer prices as a move to forestall competition. According to Hay

(1971) periodic marketing" is an attempt to achieve these aims by reducing the total overhead costs which must be covered at a single market place. The first attempt at a theory of periodic markets was contributed by Stine (1969) using the Korean markets. He analyzed periodic markets in terms of central place theory and specifically in terms of minimum and maximum ranges. He then analyzed the distance people are ready to go to obtain a good, how settlements are distributed over space and the tributary or market area, the bigger the settlement, the more the tributary area, but will have area of smaller, tributary nesting within that of a bigger settlement. The minimum range of goods indicates the radius of a circle encompassing the level of demand actually required for a firm to realize profit from offering a central good. The maximum range represents the farthest distance dispersed consumers are willing to travel to purchase a good at a central place. Stine (1969) argues that when the maximum range of a good is greater than or equal to the minimum range the firm will survive and be immobile (fixed).

By contrast if the minimum range of a good is greater than the maximum distance a consumer is willing to travel the firm will either die out, become periodic but remain spatially fixed or become spatially mobile and move among a given series of location or market sites according to a re-established temporal pattern. Furthermore as the degree of mobility increases the difference between these two ranges become greater. The outcome is a mechanism that intensifies exchange in place and time there enabling traders and marketers to attain minimum range (that is survival threshold) for their products.

Stine (1969) argues that the two ranges vary with income density, elasticity of demand and transport cost. But also said that markets are open only once every few days because the per capital demand for the goods sold in the market is low and high transport limit the extent of the market and the aggregate demand is therefore insufficient to support permanent sellers. For the consumers also marketing periodicity lessens the physical distance between him and the goods and services he desires. The issue of transportation is also important because if the cost of purchasing a good is included with transportation as the cost increases there will be a situation whereby people will not want to purchase in the area again, there will have to be an alternative good or another location where goods can be purchased without additional transport cost. A trader that wants to sell more than his competitor must not, therefore let his price exceed his competitors even after the transport cost has been added (Hotelling, 1929).

Apart from Stine's theory, rural markets are also periodic because it is labour intensive, there might not be enough goods to sell if the markets were to meet everyday. Also the market is characterized by low level of specialization; individuals generally perform the role

of producing and marketing. In this case time is needed for them to be able to perform both functions. Abayomi (2008) added that in many rural areas of Nigeria especially in Ondo state the common type of market is the periodic market which specializes in the subsistence goods trading. This is to enable households goods get to individual on periodic basis usually every four days.

#### ii. *The central place theory*

Much of the analysis of marketing functions of cities may be said to be rooted in this theory. The theory postulated by Christaller (1933) made some assumptions. Based on these assumptions Christaller believes that an urban centre exists mainly to provide goods and services for the surrounding areas. Such centers are usually located at the point of minimum aggregate travel of the tributary area and are hence called "central places" the tributary area which is assumed to be hexagonal in shape (six-sided polygon) varies in size according to how large the central place is. The larger the central place the more extensive its tributary area is. In addition higher-order center provide more goods and services than lower order ones.

## II. MATERIALS AND METHODS

### a) *Study area*

This paper is based on a study conducted in 2014 under the title "*Analysis of market decentralization and its effects on poverty reduction*" taking periodic markets in Dodoma city as a case study in three wards of Msalato, Makutupora and Hombolo. The study areas were selected because they host large periodic markets in Dodoma city.

Dodoma city is located in the middle of the country. It is boarded by Chamwino district in the East and Bahi district in the West. It lies between Latitudes 6.00° and 6.30° South, and Longitude 35.30° and 36.02° East. The city covers an area of 2,769 square kms. It is characterized with both Urban and rural qualities. It stands on broad upland plateau with an altitude ranging between 900-1000 meters above sea level, with beautiful stony hills such as Image, Isanga, Mkalama and Mlimwa. It experiences a long draught and short rainfall seasons. Due to unreliable rainfall, the area has scanty vegetation such as shrubs, grasses as well as conspicuous baobab and acacias trees. The climate of Dodoma is semi-arid, characterized by a marked seasonal rainfall distribution with a long dry and short wet seasons, an average annual rainfall of about 550 – 600mm per year, which falls between December and April each year.

The city has moderate drainage soils with Savannah type of vegetation mainly dominated by Baobab trees and Acacia wood lands. The average temperature varies from 20°C in July to 30°C in November each year. There are seasonal rivers, deep and shallow wells including dams in few villages.



Dodoma city is administratively divided into one parliamentary constituency, 4 divisions, 37 wards, 39 villages, 100 mitaa and 222 hamlets. While the original inhabitants of the city are believed to be the Gogo and Rangi, but there are now a quite good number of mixed tribes from neighboring regions; this is due to trade and cultural relationships in the area.

#### b) Data collection methods and tools

This study used a triangulation method whereby data from the same sample in the study area were collected using different techniques including; households' heads interview using questionnaires, key informant interviews, and neighbourhood observations. A document review also formed part of the data collection methods. Under this method various published and non published articles related to decentralization and agricultural marketing were reviewed. A questionnaire was designed as a tool for primary data collection. The questionnaire was designed in order to collect both qualitative and quantitative data as indicated by Leedy and Ormrod, 2004. The questionnaire was then administered to respondents (smallholder farmers household heads) and key informants such as WEOs, VEOs, councillors and hamlet/village chairperson. However, face-to-face interviews were also administered because they have several advantages over the other methods. According to Bless and Smith (2000), an interviewer administered interview is an important tool of data collection because it reduces omission of difficult questions by respondents. In addition, it reduces the problem of word or question misinterpretation (misunderstandings) by respondents and was administered to peasants households who can neither read nor write (Leedy and Ormrod, 2004). The heads of the households for the families chosen to be part of the sample were interviewed. In the absence of the head, the spouse or any family member who is directly involved in the farming activities and management was interviewed. The main respondent provided most of the information, but was allowed to consult other household members where necessary. The rationale for the use of these instruments in data collection methods was to minimize the short comings of using only one instrument hence using a variety of instruments to collect data was to utilize the advantages associated with triangulation.

#### c) Research design

This study used a cross-sectional design. Cross-sectional survey design allows collection of information at one point in time (Casley and Kumar, 1988). The preference was to cross section survey design as opposed to longitudinal survey design which involve trend studies is the convenience of the period allocated for the study. The study was designed to identify the way in which local government authorities (LGAs) facilitate open periodic markets to provide good

price to smallholder farmers households and to show how farming systems influence poverty reduction. The study used a sample of 279 households which was obtained by probability sampling (stratified sampling). The study employed multistage sampling, purposeful and randomly sampling techniques. The sampling procedure started with purposefully sampling (Regnard, 2013; Rwegoshora, 2006), Where one district out of seven in Dodoma region were selected. The second stage also involved purposively sampling to select three wards from the district; this was followed by random sampling to select two *mitaa* in each ward. The criteria for selecting the ward were based on the presence of open periodic markets. The third stage involved random selection of representative households from the selected *mitaa* (Regnard, 2013; Rwegoshora, 2006). Also key informants were selected purposefully.

#### d) Data analysis

The collected data were analysed qualitatively and quantitatively. A quantitative analysis (multivariate analysis) examined agricultural market accessibility in smallholder farmers households and a qualitative analysis (multiple response) scoring method was used in assessing the farming systems in smallholder farmers that have influence in poverty reduction in smallholder farming households in three wards (Msalato, Makutupora and Hombolo) in Dodoma city.

#### e) Model specification

A set theoretical definition of periodic market system as shown by Wanmali (1978) on the study "Periodic Markets in South Bihar" is as follows:

Let  $M$  be a set of periodic markets,  $M = \{m_k | k \in K\}$ .  $M_i \subseteq M$  is a periodic market if:

- At least one trader of each type visits each market of  $M_i$  every week.
- There exists a market  $m \in M_i$  such that more than  $x$  percent of the traders visiting the markets of  $M_i$  are based in this market. For  $x > 50\%$ , this shared base is unique and will be called the center of the periodic market system.

An aggregation of periodic market systems is a set of periodic market systems  $M = \{M_i | i \in I\}$  for some index set  $I$ , satisfying the following conditions:

- For all  $M_i \in M$  there exists at least one  $M_j \in M$  such that:

$$M_i \cap M_j \neq \Phi$$

- Let  $M$  be partitioned into any two sets  $M'$  and  $M''$  such that  $M' \cap M'' = \Phi$

$$\text{and } M' \cup M'' = M$$

For any two sets:

$$(M_i \cap M_j) \cap (M_k \cap M_l) \neq \Phi$$

An aggregate system of periodic markets  $M$  is said to cover the set of markets  $M$  if:

v.  $m \in M$  implies there exists  $M_i \in M$  with  $m \in M_i$

Let  $M^*$  be the universal set of all periodic markets, and  $M^*$  be the universal set of all periodic market systems. An aggregate system of periodic markets  $M$  that covers a set of markets  $M$  is closed if:

vi.  $m \in M$  and  $m \in M_i \in M^*$  then  $M_i \in M$

Although (iii) above is a consequence of (iv) it has been included for emphasis, since in any aggregation of periodic markets there will always be a pair-wise intersecting sequence of periodic market systems between any two market systems in the aggregate. Wanmali's original aggregate system in the study "Periodic Markets in South Bihar" does not cover the set of markets studied in Dodoma city in three wards of Msalato, Makutopora and Hombolo, and it is not closed.

The probability to access periodic market in the study area are estimated as follows:

$$P(A_{i,t} > 0) = \beta_0 + \beta_1(PROD) + \beta_2(MARKX) + \beta_3(INFRS) + \varepsilon_i$$

In above equation the dependent variable  $P(A_{i,t} > 0)$  denotes the probability that the smallholder farmers household access to periodic market  $A$  greater than zero. The dependent variable  $A_{i,t}$  denotes the infrastructure provides by LGAs to a client  $i$  who need to reach the market in time  $t$ .  $\beta_0$  is a constant,  $\beta_1$ ,  $\beta_2$ , and  $\beta_3$  are parameter vectors and  $\varepsilon_i$  denote distributed error terms with a mean of zero and a variance  $\sigma^2$ .

Where;

PROD= Production level

MARKX= Marketing mix i.e processing, packaging, promotion, and standardization

INFRS = Infrastructures i.e transportation facilities, road networks

### III. RESULTS

#### a) Farming system and its influence on poverty reduction

The first aim of this study was to examine the farming related factors and systems that influence poverty reduction in smallholder farmers households. To address this objective a multiple response analysis was used. Most households in the study area practiced mixed farming. This system is an agrarian system that mixes crop farming with the raising of livestock. For example, the same farm may grow cereal crops, and keep cattle, sheep, pigs or poultry. Often the manure especially from cattle is used to fertilize the cereal crops.

Table 1 presents the pattern of poverty in relation to farming system in study area. The figure shows that the proportion of households that were categorised as "poor" and "rich" varied with farming systems. The households practising both crop and livestock systems had the largest (79.4%) proportion of "rich" households while the households practising crop only farming system had the smallest (20.6%) proportion of "rich" households. Also the household in poor category were practising combination of crops and livestock (72.7%) as compared to only 27.3% for crops only as a farming practice. Mixed farming is the dominant system in Msalato, Makutopora and Hombolo wards of Dodoma city where most farms have a mixture of fields and pastures.

Table 1: Farming systems and poverty level in the study area

Category	Farming systems				Total	
	Crops only (Frequency)	%	Crops & livestock (Frequency)	%	Frequency	%
Rich	37	20.6	143	79.4	180	64.5
Poor	27	27.3	72	72.7	99	35.5
Total	64	22.9	215	77.1	279	100

Source: Survey data, 2019

Although the poverty rate varies substantially from one farming systems to another approximately 64.5% of all households fell into the "rich" household category and the rest 35.5% fell into "poor" category. Since poverty is predominsntly a rural phenomenon and agriculture is a major economic activity for rural population, it follows that the level of poverty found in rural areas can in no way be dissociated from the over-dependence of the smallholder farmers in agriculture. In this area there are more rich people than poor people. The results is evidenced by Kisusu (2003) on his study

which concluded that introduction of different breeds of improved dairy cattle and improved rice varieties had a positive impact on household income and food security and significantly contributed to poverty reduction at the household level.

There is inequality between different groups in society. The gap between the rich and poor is significant. Although Dodoma city puts much emphasis on poverty alleviation by tricking down the macroeconomic gains from different development partners to the community level so as to realize the

wellbeing of the city dwellers even though the poverty rate in Dodoma city is estimated to be 25% (URT, 2011).

*b) Access to periodic market by smallholder farmers households*

The second aim of the study was to determine the relationships between access to periodic market and criteria determining agricultural marketing. To address this objective a regression analysis was carried out. The results shows that lack of access to markets - whether due to poor infrastructure or productivity, limited education, or insufficient information - prevents access to both labor and capital. In many rural societies, there are few job opportunities outside of agriculture, often resulting in food and income insecurity due to the precarious nature of farming. Rural workers are largely concentrated in jobs such as owners-cultivators, tenant farmers, sharecroppers, informal care workers, agricultural day-laborers, and livestock herders.

Table 2 presents the results of the regression analysis. The accessibility criteria including production only; marketing mix only with dummy variable of processing, packaging, promotion, transport and standardization found to be insignificant while the combination of both infrastructure, production and

marketing mix found to be significant at confidence interval of 99% or significant level of 1% which means that  $p < 0.01$ . The data further shows that infrastructure criteria, marketing mix only and a combination of both infrastructure, production and marketing mix had a negative relationship with access to periodic market, while production have a positive relationship. This implies that households will not be able to access periodic market without good infrastructures and marketing mix for the products regardless how much they have produced in that season.

The data generally shows that coefficient of correlation,  $R^2$  to be 0.80, adjusted  $R^2 = 0.797$  and F-distribution ( $F = 273.727$ ) which means that there is a perfect fit for the criteria to access periodic market as explained by the regression equation. The issue of transportation is also important because if the cost of purchasing a good is included with transportation as the cost increases there will be a situation whereby people will not want to purchase in the area again, there will have to use an alternative good or another location where goods can be purchased without additional transport cost.

**Table 2:** Multivariate analysis of households to access periodic market in relation to marketing determinant factors

Independent variables	B	Std. Error	Beta	T	Sig.
Constant	1.000	0.128		7.827	0.000
Infrastructure only (i.e. roads, market shed)	-0.082	0.131	-0.069	-0.626	0.532
Production only	-8.614E-14	0.130	0.000	0.000	1.000
Marketing mix only (i.e. processing, promotion, packaging, standardization, transport)	-0.237	0.133	-0.166	-1.785	0.075
Combination of both infrastructure, production and marketing mix	-0.980	0.130	-0.959	-7.558	0.000 *

$R = 0.894$ ,  $R^2 = 0.80$ , Adjusted  $R^2 = 0.797$  and  $F = 273.727$

a. Dependent Variable: Whether household can access or not access market

b. \* indicate significance at 1%

While marketing criteria pose challenges and opportunities for smallholder farmers households, they are not the only criteria which are responsible for market accessibility. Other factors such as the government policies, technology advancement and intensive capital play a very big role in influencing the accessibility of periodic market. In areas where these criteria are not well addressed it is likely that poverty levels will be higher due to inefficiency market accessibility.

## IV. CONCLUSION AND RECOMMENDATIONS

### a) Conclusion

This study shows that the local periodic markets have important role in rural development. In social and cultural dimension, they effect on villagers' social situation, help women empowerment, increase interaction between cities and villages and identify local traditions to visitors. In economic dimension, the local periodic markets produce jobs, income, decrease

poverty and help to sale crops. In sellers' motivating dimension, the sellers like their work but jobs, money and employment are important reasons for working in the market.

Farming systems in Dodoma city is highly intensified towards crop production and livestock keeping, associated with diversification of diet, meeting the changing domestic market demand and increasing the export potential. The resultant diversification which is due to favourable agro-climatic conditions suitable for cultivation of a wide range of cereals and livestock keeping, offers a higher income-generating strategy to a large number of marginal farmers of the region.

#### b) Recommendations

However, to actualize these market access opportunities, reforms have to be brought in agriculture sector to remove all barriers, whether legal or policy induced, which introduce inefficiencies and monopoly trends in the functioning of agricultural markets. Multiple restrictions have not only cascading effect and the prices but also sets a barrier to free flow of materials from farm to the factory and ultimately to the consumers. All these controls are now widely recognized as going against marketing and processing efficiencies. In the present situation these restrictions are acting as a disincentive to farmers trade and industries. Also smallholder farmers should diversify farming because diversified farming also contributes to improved human and livestock nutrition with the inclusion of vegetables, fruits and other micro-nutrient rich foods and feed.

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