INFLUENCE OF FOOD DISTRIBUTION SYSTEMS AND MARKET ACCESSIBILTY ON FOOD SECURITY IN SEMI-ARID THARAKA SUB COUNTY, KENYA

KIBETU DICKSON KINOTI , MSc

SUPERVISORS:

PROF. JULIUS MBURU HUHO

DR. TOM ODHIAMBO OUNA

Introduction

- **Food produced globally is enough and** can feed all the people in the world (Leathers & Foster, 2009).
- Current world food **system** of agricultural production, food processing, distribution and sale of food **does not meet food needs** of increasing world's population (FAO, 2011).
- **Strategies** embraced do not ensure guaranteed **access to food** or **maintain stability in food commodity flow**
- In the country, Inefficient distribution systems and market accessibility problems have contributed to the variable scenarios of food insecurity (FEWS.NET, 2018; GoK, 2011)
- **Improving** food distribution systems and accessibility at local levels essential in realisation of food and nutrition security
- **However**, the influence of food distribution systems and market accessibility on food security has not been adequately researched

- By carrying out this study, the **theoretical conceptualization of how physical accessibility to food retail markets and organisation of local food distribution systems** influence localized food security was explored.

- To understand their role in the **eradication of hunger and malnutrition** more so realisation of **all-time access** to safe food of **sufficient quantity** and **quality** to all Kenyans as envisaged in the 2010 Kenyan constitution

- Such studies are **integral** to help inform **local food production and consumption landscape** and enhance **intra-region food commodity businesses**

Problem Statement

- Un met **dietary energy requirement** lead to **food shortage** and **food prices instability** (KIHBS, 2005/2006) .
- Large population of Kenyans rely on **national relief food** in ASALS while **market purchases** is the main food sources in other livelihood zones (Marangu, Audi, Mgonja & Mburu, 2014; KFSSG, 2014).
- **Market purchases** account for over **60%** in **Agro-pastoral areas**, **30%** in **high potential cereal and dairy zones** (GoK, 2016; Jayne, Mysers & Nyoro, 2005)
- Food flow is mostly hampered by **poorly integrated produce markets**, **road networks** and **ineffective food policies**
- In Tharaka Sub county, lack of access to **formal markets, poor transport networks** and **lack of good storage facilities** force farmers to sell their produce at lower market prices post harvesting
- This reduces the volume of food commodities traded in local markets especially between planting period and subsequent harvesting season

Specific Objectives

- To identify biophysical and climatic factors that determine optimal maize and millet production for the realisation of food security in Tharaka sub county
- To investigate how marketing models for maize and millet influence distribution and retention of food stock by households in Tharaka sub county
- To establish the efficiency of physical accessibility to existing open-air markets and its effect on food security in Tharaka sub county
- To examine spatial distribution and utilisation of open-air markets in Tharaka sub county and its effects on food security

Purpose and Hypothesis

The purpose of this study was to assess the influence of local food distribution systems and market accessibility on food security in semi-arid Tharaka Subcounty.

It was hypothesized that no significant relationship existed between;

- Agroclimatic suitability and optimum maize- millet production
- Marketing models used by households and food stock retention
- Physical accessibility to markets and food security
- Open-air markets spatial distribution and their utilisation

Reviewed literature and Gaps

- **1st** National Food Policy Sessional paper 4 of 1981 - emphasized equitable distribution
- **2nd** National Food policy Sessional paper 2 of 1994 - emphasized market intervention approaches.
- Food and Nutritional Security policy (FNSP) of 2011- multi-sectoral approach to all food security issues
- Theories on markets utilisation not well developed (Mazzilli & Davis,2008; Manzoor Hashmi & Mukhtar, 2009).
- Most studies focus on conventional food distribution systems; management strategies of convectional food distribution systems (Kotler & Armstrong, 2006) transportation costs associated with food distribution (Bloom & Hinrichs, 2010) marketing strategies (Onozaka, Nurse & Thilmany, 2010).
- In Kenya studies carried in this field of food security have with food price crisis and interventions (Nyoro, Ayieko, & Muyanga, 2007), food markets efficiency and price transmissions (Omamo & Mose, 2001).
- Studies in the study area have focused on climate variability, Household drought coping strategies (Smucker & Wisner, 2008); farmer groups social networking (Wambua, 2017); conservation agriculture crop production (Gioto, 2018).

PHYSIOGRAPHY OF THE STUDY AREA

- Lie about 610 m to 1220 m asl covering 1569Km^2 (Smucker, 2003).
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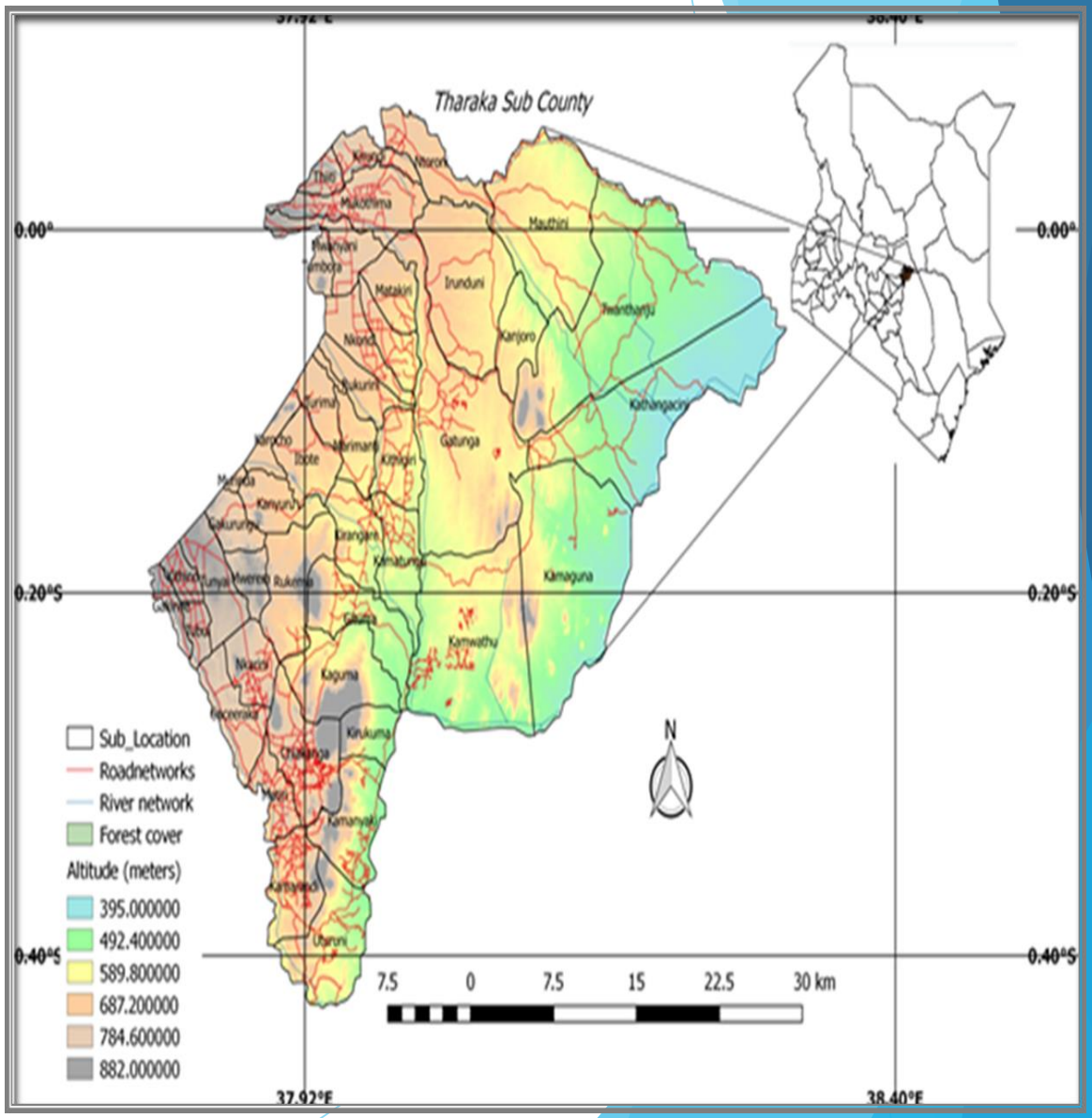
- Has five wards namely; Chiakariga, Marimanti, Nkondi, Mukothima and Gatunga (IEBC, 2012), 21 locations and 44 sub-locations.
- Receives bi-modal rainfall ranging between 500mm to 1000mm .
- A semi-arid area with temperature between 22^{0}C to 40^{0}C (NDMA, 2014).
- Major AEZs are Lower Midland Zone (LM4, LM5) and Inner Low Land Zone (IL5, IL6) (Jaetzold & Schmidt, 1983).
- Major economic activities are crop farming and livestock keeping
- Major livelihood zones; marginal mixed farming (MMF), rain-fed cropping (RFC) zone and the mixed farming (MF) zone (WFP/VAM, 2006).



METHODS: SAMPLE SELECTION AND DATA COLLECTION

- The research used a **cross section survey**
- **31,566 households** from 883 villages in 48 sub locations comprised the target population due to their knowledge base on production and consumption systems
- A **two multi-stage cluster sampling method** was used
- A **sample size of 395 households** distributed proportionately across the RFC,MF,MMF livelihood zones
- A **reconnaissance study** was conducted to acquaint with the physiography, household size distribution and appropriate method of selecting participating households.
- Category of collected data; **geospatial data , statistical data and normative data** on road category and maximum acceptable speed for each road category
- Primary data was collected using **questionnaires**, **key informant interviews**, **GPS, cameras** and **direct observation**.
- Household surveys were conducted in **30 villages** selected proportionately from **28 sub locations** across RFC, MMF and MF
- **Household survey** focused at demographic characteristics of the households, maize and millet production potentials, storage methods and the marketing channels used by the farmers.
- **Key informant interview** focused on the general food security situation in the region, agricultural production and food storage, market accessibility issues, community livelihood dynamics in the context of devolution and the role of ICT in food distribution and supply systems

DATA ANALYSIS

- **Statistical analysis** ;- **Kendall's correlation** used to understand determinants of households' decision to sell food stock.
- **spearman's correlation analysis** was used to test association of temperature, moisture, slope and soil depth on optimization of maize and millet production.
- **Censored Tobit regression** used to analyse market accessibility and household characteristics in the choice of a marketing channel used.
- Objective two data about quantity of maize and millet sold and price variation across all the fourteen open air markets was analysed **descriptively** by computing the coefficient of variation of responses collected from the questionnaires.
- **Spatial analysis**;-categories of GIS analysis used were **reclassification, topological overlay, neighborhood operations and connectivity functions** especially network analysis. Objective one was realized through building and running a geo-processing model in Idrisi Kilimanjaro.
- Objective three achieved using point to polygon overlay analysis.
- Objective four involved travel time estimation in QGIS™ 2.14 version and the calculation of critical accessibility index in SIGEPI™.

RESULTS AND DISCUSSIONS

Objective 1 :BIOPHYSICAL AND CLIMATIC SUITABILITY FOR OPTIMIZED MAIZE AND MILLETPRODUCTION

- Biophysical and climatic factors that determine optimal millet and maize production were: temperature(20-24^{0}C); Moisture index (0.35-0.55); deep to moderately deep loamy and clayey soils (50-120cm) and undulating land with slope less than 12%.
- Six agroclimatic zone as:**ACZ1,ACZ2, ACZ4, ACZ7, ACZ8 and ACZ9**.
- Ntoroni, Thiiti, Tunyai, Mwanyani, Mukothima, Kirundi, Irunduni, Turima, Kathuura, Karocho, Kanyuru, Rukurini, Nkondi, Matakiri, Nkarini and Gaceeraka sub locations lie within the maize and millet producing **ACZ1 and ACZ2** areas..
- ACZ1, ACZ2, ACZ3 and ACZ5 suitable for maize production with a total land size of about 21,056.35Ha.
- Millet was found to do well in ACZ3, ACZ4, ACZ5, ACZ6, ACZ7, ACZ8 and ACZ9 accounted for 126,446.41 Ha.
- Agro-climate zones ACZ3, ACZ5 and ACZ9 for production of maize and millet. 4,189.31Ha
- **ACZ5, ACZ6, ACZ7, ACZ8 and ACZ9** spread across rainfed cropping zone and marginal mixed farming livelihood zones were favourable for the growth of Katumani pearl millet 1, 2 and 3 millet varieties besides its suitability for maize production
- For **optimised production** of maize **RFC** and **MF** livelihood zones should be considered for expanding the acreage under this crop.
- Preferable **maize varieties** with potential are **DHO1** and **DHO2**.
- For millet, **Katumani pearl millet-3** variety should be grown in the **MMF** zones which are moisture stressed areas.

Objective 2: **MARKETING MODELS AND HOUSEHOLD'S FOOD STOCK RENTENTION**

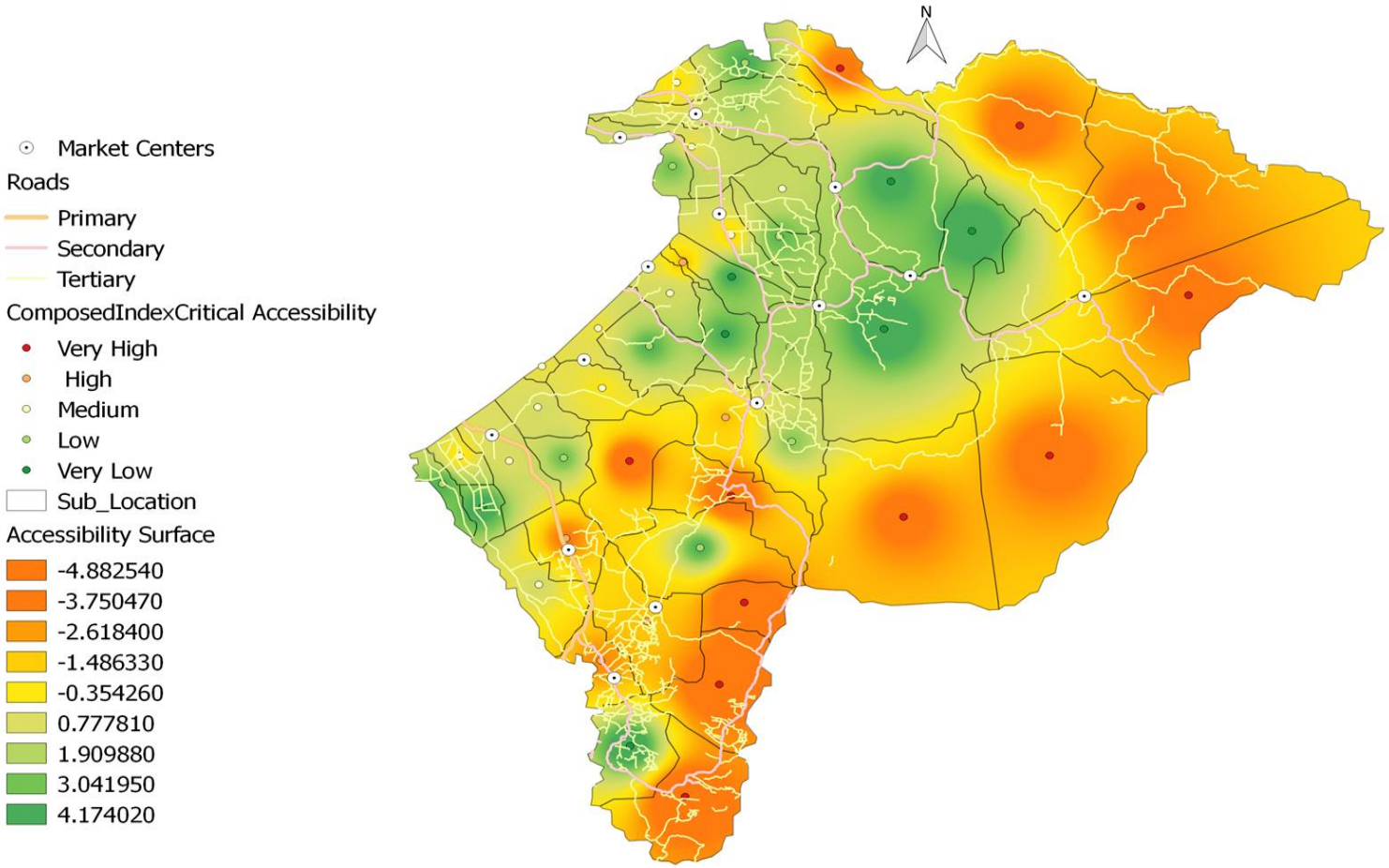
- Marketing models used by households included **formal and informal channels**
- Formal channels comprised of licensed agent traders buying at fixed prices for grain co-operatives in Meru town and wholesale cereal traders in Nanyuki, Embu and Nyamakima.
- Actors in the **informal channel** included farmers, transporters, assemblers and local grain merchants whose capacity to transact was dictated by the market forces of demand and supply
- Households have different **marketing outlets**. 29.9% of the households used Open air markets;. cereal traders comprised 53.9 % and Brokers buying at farm gate at 16.2%
- In the RFC , farm gate assemblers were dominant at 67%, followed by institutions at 33 %.
- In the MMF , farm gate assemblers comprised of 23 % while institutions accounted for 45%.
- In the MF, 58 % of traders were main farm gate assemblers followed by institutions at 17
- Notably, more assemblers were found in RFC zone compared to MF and MMF due to high production of maize within Nkondi, Mwanyani, Thiiti and Mukothima sub locations.
- In the Marginal Mixed Farming livelihood zone, families buying from other households were more (22%) compared to the same in Rain Fed Cropping Zone (6%) and Marginal Mixed Farming (10%). This is explained by constant rain failure in this area resulting to crop failure and over reliance with livestock.
- Interesting to note that 18% of wholesale and retail cereal traders were mostly concentrated within Marginal Mixed Farming livelihood zone because most households were food deficit and therefore sold livestock to purchase food.

Objective3: MEASUREMENT OF PHYSICAL ACCESSIBILITY TO MARKETS

- Composed Index of Critical Accessibility was developed to identify ;**Very High risk, High risk, Medium risk, Low risk and Very Low risks accessibility** areas.
- **33,595** people live in **very high risk** inaccessibility areas; **25,351** in **high risk** zones; **34,325** persons in **moderate risk** regions; **31,888** people in **low risk** inaccessibility areas while **20,755** exist in **Very low risk** inaccessibility areas.
- Two kinds of movement were considered; **pedestrian walking** where no clear roads exist and **motorised transport** on established road network

Composed Index of Critical Accessibility	Total Population	Villages	Average Distance to nearest road (Km)	Travel Time (Min)
Very High	33,595	255	4.43	14.75
High	25,351	113	3.77	12.55
Medium	34,325	159	2.77	9.22
Low	31,888	181	1.01	3.32
Very Low	20,755	175	0.88	0.43

MARKET ACCESSIBILITY SURFACE



- Areas with low accessibility to markets exist in Kathangacini, Mauthini, Twanthanju, Kamaguna, Kamwathu, Kirukuma, Kamanyaki, Uturini, Gituma, Rukenya, Nkarini, Matiri and Ntoroni sub locations

- High accessibility regions are in Gatunga, Kanjoro, Irunduni, Marimanti, Rukurini, Ibote, Tubui, Gakirwe, Kaguma, Kamarandi, Tumbora, Kirundi, Mukothima, Kithigiri, Kamatungu and Mwerera sub locations.

OBJECTIVE 4: SPATIAL DISTRIBUTION AND UTILISATION OF MARKETS

- Food assembly markets exist in densely population areas with between 263 to 342 persons /km2
- Food and livestock market occur in areas with moderate dense population of about 224 to 303 persons/km2.
- Livestock markets exist in low population density areas with between 66 to 145 persons/Km2 .

- Markets are randomly distributed across the study area with a linear pattern of spatial spread with location being along transit routes connecting trading centers

- Utilisation levels of open-air markets revealed that farm and livestock markets have a higher patronage of 42%, followed by farm produce markets at 39% and then the livestock markets at 19%.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

- Local food distribution systems and physical accessibility to food retail markets greatly influence intra livelihood zones household food availability and accessibility
- Farm produce specialised service markets have a higher usage in the study area followed by dual purpose farm produce and livestock markets while livestock markets have the least patronage.
- Rain Fed Cropping and Mixed Farming livelihood zones are suitable for optimisation of maize production because of agro climatic and geophysical conditions appropriate for maize growth.
- The composed index (CICA) has shown the number of villages with very high accessibility risk, high accessibility risk, medium accessibility risk, low accessibility risk and very low accessibility risk of physical accessibility problems

RECOMMENDATIONS

- Need to upgrade and expand existing road networks
- Creation of an intra-regional food and livestock market
- Studies which will profile the socio-economic attributes and demographic patterns of food consumers to inform planning of local market expansion programs are important

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THANK YOU FOR YOUR TIME