

**INSTITUTIONAL DETERMINANTS OF FOOD SECURITY IN TANZANIA:
A CASE STUDY OF SINGIDA REGION**

BY

HAMIS ALLY KINGU

**A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY OF SOKOINE UNIVERSITY
OF AGRICULTURE. MOROGORO, TANZANIA.**

ABSTRACT

Food insecurity is relatively high in Singida Region although there has been an influx of development related institutions, some of which deal with food security. The extent to which the two were linked was empirically unknown. Therefore, the research for this thesis was conducted in Iramba and Singida Districts of Singida Region to determine the role of institutions in improving food security. The specific objectives were to: (i) to appraise qualitatively the role of institutions in food security (ii) identify institutions dealing with food security and their key functions, (iii) determine food security at the household level, and (iv) establish linkages between some institutional factors and food security factors. The main indicator of food security was dietary energy consumed per adult equivalent per day, measured in kCal. Data were collected among 240 households between November 2010 and July 2011, mainly through a household questionnaire. It was found that there were various institutions; including Government departments, NGOs, CBOs and international organisations including FAO; which were related to agriculture and food security by providing support in terms of training communities on agriculture, supply of agricultural inputs, agricultural credit provision and construction of infrastructure. Food security status at the household level in the two districts was 2 179.86 kCal per adult equivalent per day as opposed to the national caloric poverty line that is 2 200 kCal per adult equivalent per day. Based on that caloric poverty line, only 32.3% of the households in Singida Districts were food secure while 67.7% of the households were food secure in Iramba District. About linkages between institutional factors and food security factors, using an F-test, it was found that dietary energy consumed differed significantly ($p \leq 0.05$) among households with different institutional factors. Moreover, using multiple linear regression, it was found that some various institutional factors (e.g. total food production with institutional support), had significant

effects ($p \leq 0.05$) on food security in terms of dietary energy consumed. Based on these findings, it is concluded that some institutions help substantially improve food security at the household level. Therefore, it is recommended that concerted efforts should be made to strengthen institutions supporting agriculture and food security so that they can better help improve food security.

DECLARATION

I, Hamis Ally Kingu, do hereby declare to the Senate of Sokoine University of Agriculture that this thesis is my original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

Hamis Ally Kingu**(PhD Candidate)**

Date

The above declaration is confirmed:

Prof. Kim Abel Kayunze**(Supervisor)**

Date

COPYRIGHT

No part of this thesis may be reproduced, stored in any retrieval system, or transmitted in any form or by any means without prior written permission of the author or Sokoine University of Agriculture in that behalf.

ACKNOWLEDGEMENTS

The completion of this PhD programme owes much to the Ministry of Community Development, Gender and Children (MCDGC), which, through Community Development Training Institute (CDTI) – Tengeru, funded this study. I am greatly indebted to my Thesis supervisor, Prof. Kim Abel Kayunze, for his committed guidance and critical challenges whenever deemed necessary. My sincere gratitude is due to the Institute's Governing Board chairperson, Ndeshukurwa Sumari, for granting me the permission to undertake this long-term programme and approving the budget for my study. Appreciation also is due to the Director of Community Development Eng. Leoni G. Msimbe, for frequent advice and follow-up of my academic progress. This increased my morale to study hard.

My gratitude also goes to in-charge officers of the following offices for cordial documentary material, which I needed for my study: Tanzania Food and Nutrition Centre (TFNC), the National Strategy for Growth and Reduction of Poverty (NSGRP), National Bureau of Statistics (NBS), National Planning Unit (NPU) and Sokoine National Agricultural Library (SNAL). Besides, I thank all staff at the Development Studies Institute (DSI) of SUA for their good cooperation that was an input to the success of this thesis. In a special way, I thank the teaching staff of DSI, Dr. Jonathan S. Mbwambo, Dr. Justin K. Urassa, Dr. Emmanuel E. Chingonikaya, Dr. K. M. K. Bangesi and Mr. Raymond J. Salanga. They gave me invaluable comments on the conceptual framework of the PhD research and on the preliminary drafts of the thesis thereby giving me opportunities to reflect on the same for improvement. Lastly, but not least, I thank everyone else who contributed to the success of the thesis in one way or another. However, I bear all responsibility to any shortcomings found in the thesis.

DEDICATION

This thesis is dedicated to my wife, Asha Stephano Msengi Wuli, and our daughters Zaituni Hamis Ally Misinzo and Asha Hamis Ally Misinzo and our son Abu-Ali Hamis Ally Misinzo and my mother Asha Mkumbo Sham Sha-nzii whom I am indebted to for excelling in my PhD studies. It is also dedicated to my late grandmother, the late Munzulugu Namakiiya; my father, the late Mr. Ally Misinzo Lyanga Gyunnah and my beloved daughter the late Zainab Hamis Ally Misinzo who both passed away on 26 March 1999. May the Almighty God rest their souls in eternal bliss?

TABLE OF CONTENTS

| | |
|--|---------------|
| ABSTRACT | ii |
| DECLARATION | iv |
| COPYRIGHT | v |
| DEDICATION | vii |
| LIST OF TABLES..... | xiv |
| LIST OF FIGURES..... | xvi |
| LIST OF APPENDICES..... | xvii |
| LIST OF ABBREVIATIONS AND ACRONYMS..... | xviii |
| CHAPTER ONE..... | 1 |
| 1.0 INTRODUCTION | 1 |
| 1.1 Background Information | 1 |
| 1.2 Statement of the Problem | 6 |
| 1.3 Justification of the Study | 7 |
| 1.4 Objectives of the Research | 9 |
| 1.5 Hypotheses Tested..... | 9 |
| CHAPTER TWO..... | 11 |
| 2.0 LITERATURE REVIEW | 11 |
| 2.1 Institutions and Food Security Concepts | 11 |
| 2.2 Theoretical Discussions on Institutions..... | 14 |
| 2.3 Theoretical Discussions on Food Security | 16 |
| 2.4 Measurement and Food Security Indicators | 20 |
| 2.4.1 Food security indicators | 20 |
| 2.4.2 Food security measurements | 27 |

| | | |
|----------------------------|--|-----------|
| 2.4.2.1 | Food availability..... | 27 |
| 2.4.2.2 | Food access..... | 29 |
| 2.4.2.3 | Food utilization..... | 30 |
| 2.4.2.4 | Food stability..... | 33 |
| 2.4.2.5 | Food safety | 35 |
| 2.5 | Linkages between Institutions and Food Security..... | 35 |
| 2.6 | Theories on Linkages between Institutions and Food Security..... | 51 |
| 2.7 | Gaps in Literature Surveyed..... | 59 |
| 2.8 | Conceptual Framework | 61 |
| CHAPTER THREE | | 64 |
| 3.0 | METHODOLOGY..... | 64 |
| 3.1 | Location of the Research Area | 64 |
| 3.2 | Research Design..... | 71 |
| 3.3 | The Sample and Sampling Procedures | 72 |
| 3.3.1 | Population..... | 72 |
| 3.3.2 | Sample size and sampling unit | 72 |
| 3.3.3 | Sampling strategy | 74 |
| 3.3.3.1 | Sampling strategy for Focus Group Discussions | 74 |
| 3.3.3.2 | Sampling procedure for households | 76 |
| 3.3.3.3 | Sample selection for key informant interviews..... | 76 |
| 3.4 | Instruments for Data Collection | 77 |
| 3.4.1 | Household questionnaire | 77 |
| 3.4.2 | Focus group discussion guide..... | 77 |
| 3.4.3 | Key informants interview checklist..... | 78 |
| 3.5 | Types and Sources of Data | 78 |

| | | |
|---------------------|---|-----------|
| 3.6 | Data Collection Procedures | 79 |
| 3.6.1 | Pre-test for data collection..... | 79 |
| 3.6.2 | Data collection procedures by objectives | 80 |
| 3.7 | Data Management Procedures and Analysis | 82 |
| 3.7.1 | Qualitative data analysis..... | 82 |
| 3.7.2 | Quantitative data analysis..... | 82 |
| 3.7.3 | Descriptive data analysis | 83 |
| 3.7.4 | Inferential data analysis..... | 83 |
| 3.8 | Limitations of the Study | 84 |
| CHAPTER FOUR | | 86 |
| 4.0 | FINDINGS AND DISCUSSION | 86 |
| 4.1 | Socio-Economic and Demographic Characteristics of the Households | |
| | Surveyed..... | 86 |
| 4.1.1 | Demographic characteristics | 86 |
| 4.1.2 | Socio-economic characteristics of the households..... | 89 |
| 4.2 | Qualitative Appraisal of the Institutions and Food Security Status | 93 |
| 4.2.1 | Appraisal of indicators of institutions availability | 93 |
| 4.2.2 | Appraisal of indicators of households' awareness on institutions | 94 |
| 4.2.3 | Appraisal of indicators of institutions performance | 94 |
| 4.2.4 | Appraisal of indicators of institutional support..... | 95 |
| 4.2.5 | Appraisal of indicators of food supply | 96 |
| 4.2.6 | Appraisal of indicators of entitlement to food..... | 99 |
| 4.2.7 | Appraisal of indicators of food sufficiency | 101 |
| 4.2.8 | Appraisal of indicators of strategies for coping with food shortage | 103 |
| 4.2.9 | Appraisal of prevalence of food insecurity | 104 |

| | | |
|---------|---|-----|
| 4.2.10 | Appraisal of linkages between institutions and food security | 105 |
| 4.2.11 | Appraisal of linkages between food security and some cultural elements..... | 106 |
| 4.3 | Institutions Available and their Key Functions | 107 |
| 4.3.1 | Institutions available in the study area | 107 |
| 4.3.2 | International Organisations | 107 |
| 4.3.3 | National institutions | 109 |
| 4.3.4 | Institutional Support in the study area..... | 124 |
| 4.3.4.1 | Agricultural extension services | 124 |
| 4.3.4.2 | Attitudinal change among farmers through education and training..... | 124 |
| 4.3.4.3 | Provision of agricultural facilities and services | 125 |
| 4.3.4.4 | Institutional support in credit provision to household members | 126 |
| 4.3.5 | Efficiency and effectiveness of institutional support to households | 127 |
| 4.4 | Food Security Status at Household Level | 129 |
| 4.4.1 | Food security equation | 130 |
| 4.4.2 | Food security in terms of food availability | 131 |
| 4.4.2.1 | Import dependency ratio (IDR) | 134 |
| 4.4.2.2 | Food crops varieties in the two districts | 134 |
| 4.4.2.3 | Food availability and frequency of institutional support in sampled villages | 135 |
| 4.4.3 | Food security in terms of food access | 136 |
| 4.4.4 | Food security in terms of food utilization | 137 |
| 4.4.4.1 | Basal Metabolic Rate approach to food utilization | 138 |
| 4.4.4.2 | Body Mass Index approach to food utilization | 139 |

| | | |
|--|--|------------|
| 4.4.4.3 | Food utilization based on Dietary Diversity Score (DDS) of meals | 141 |
| 4.4.4.4 | Traditional vegetables supplement and food utilization..... | 141 |
| 4.4.4.5 | Food crops utilization pattern in the study area | 143 |
| 4.4.4.6 | Food utilization and dietary energy consumed in the study area..... | 144 |
| 4.4.4.7 | Food utilization versus traditional norms, values and practices..... | 148 |
| 4.4.4.8 | Common Coping Strategies Resorted to by Households during Food Shortage | 149 |
| 4.4.5 | Food security in terms of food stability..... | 151 |
| 4.4.6 | Extent of household food insecurity..... | 152 |
| 4.5 | Linkages between Institutional Factors and Food Security Factors..... | 153 |
| 4.5.1 | Description of institutional factors and food security factors used | 153 |
| 4.5.2 | Institutional factors and comparison of DEC per adult equivalent | 154 |
| 4.5.3 | Correlation between some institutional factors and DEC per adult equivalent | 155 |
| 4.5.4 | Regression results of DEC per adult equivalent on selected institutional factors | 158 |
| 4.6 | Irrigated farming and crop production per adult equivalent..... | 163 |
| 4.7 | Gender labour participation in agricultural activities and DEC per adult equivalent | 163 |
| 4.8 | Contribution of Thesis..... | 164 |
| CHAPTER FIVE..... | | 166 |
| 5.0 CONCLUSIONS AND RECOMMENDATIONS | | 166 |

| | | |
|-------------------------|--|------------|
| 5.1 | Conclusions | 166 |
| 5.2 | Recommendations | 167 |
| 5.3 | Suggested Areas for Further Research | 169 |
| REFERENCES | | 170 |
| APPENDICES | | 194 |

LIST OF TABLES

| | |
|--|-----|
| Table 1: Classification of adult underweight, overweight and obesity according to BMI | 23 |
| Table 2: Spatial distribution of respondents in the two districts | 74 |
| Table 3: Cross-tabulation of marital status of household heads | 87 |
| Table 4: Percentage distribution of respondents by age group | 88 |
| Table 5: Age dependence ratio among different groups of respondents..... | 89 |
| Table 6: Distribution of respondents by level of education | 90 |
| Table 7: Extent of relationship between institutions and food security | 105 |
| Table 8: Budget allocation for DADPs and ASDPs for 2010/11-2014/15 | 111 |
| Table 9: Awareness of DC's Office enforcement on acres cultivated during 2010/2011 | 116 |
| Table 10: Awareness of households on agricultural policy related components | 118 |
| Table 11: Efficiency and effectiveness of selected institutions in the study area..... | 128 |
| Table 12: Amounts of grains produced food security status based on them..... | 132 |
| Table 13: Production of crops diversities in 2010/11 | 135 |
| Table 14: Number of times support provided by institutions in 2010/11 | 136 |
| Table 15: Main sources of income of households in the two districts | 137 |
| Table 16: Mean BMR for Singida and Iramba Districts | 139 |
| Table 17: Distribution of respondents by groups of weight..... | 140 |
| Table 18: Traditional vegetables used as meal supplement in the surveyed area | 142 |
| Table 19: Dietary energy consumed (DEC) and food insecure households | 148 |
| Table 20: Responses on food security friendly and unfriendly traditions | 149 |
| Table 21: Coping strategies resorted to by households..... | 150 |
| Table 22: Monetary value of coping strategies resorted to by households | 151 |

| | |
|--|---------------|
| Table 23: Food security levels based on various methods (%)..... | 152 |
| Table 24: Differences in dietary energy consumed (DEC)[T-test]by selected institutional factors | 154 |
| Table 25: Correlation between Dietary energy consumed (DEC) and some independent variables | 156 |
| Table 26: Regression of DEC per adult equivalent on some institutional variables.. | Error! |
| Bookmark not defined. | |

LIST OF FIGURES

| | |
|---|-----|
| Figure 1: Linkages between Institutions and Food Security. | 39 |
| Figure 2: Social norms, rules and organizations for coordinating human behaviour towards food security. | 62 |
| Figure 3: Location of Singida Region in Tanzania..... | 70 |
| Figure 4: Singida Region Map and its Boundaries..... | 71 |
| Figure 5: Distribution of respondents' by monthly income per adult equivalent | 92 |
| Figure 6: Distribution of household heads by occupation..... | 93 |
| Figure 7: Size of land (acres) owned by the households in 2010/11..... | 117 |
| Figure 8: Opinions by respondents on Councils' reinforcement of policies, rules and regulations related to agriculture and food security. | 119 |
| Figure 9: Pattern of food utilization in the study area. | 144 |

LIST OF APPENDICES

| | |
|--|-----|
| Appendix 1: Distribution of Main Source of Household Income | 194 |
| Appendix 2: Energy Content per 100 Grams of Edible Portions, Selected Foods | 195 |
| Appendix 3: Household Food Access model | 196 |
| Appendix 4: Food Utilization at the Individual level | 197 |
| Appendix 5: Food Utilization at individual level with associated parameters | 198 |
| Appendix 6: Recommended Daily Caloric Intakes | 199 |
| Appendix 7: Nutrition Contents of Selected Vegetables in mg..... | 200 |
| Appendix 8: Rural Household Food Security Model | 201 |
| Appendix 9: Sources of Risk to Household Food Security | 202 |
| Appendix 10: Adult Equivalence: Index of Calorific Requirements by Age and Gender for East Africa..... | 203 |
| Appendix 11: Household Economics of Scale Constants | 204 |
| Appendix 12: Definitions of Food Security and Insecurity, 1975 – 1991 | 205 |
| Appendix 13: Household Questionnaire on Institutional Determinants for Food Security in Singida Region | 207 |
| Appendix 14: Guiding Questions for Focus Group Discussions on Institutional Determinants of Food Security in Singida Region | 216 |
| Appendix 15: A checklist of items of discussion with key informants for Research on Institutions Determinants of Food security in Singida Region..... | 217 |
| Appendix 16: Nutritional value of common mushroom per 100g..... | 218 |
| Appendix 17: Tanzania: Food Consumption Score by regions..... | 219 |

LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---------|--|
| ADR | Age Dependency Ratio |
| AEU | Adult Equivalent Unit |
| ALP | Agricultural and Livestock Policy |
| AMSDP | Agricultural Marketing System Development Programme |
| APP | Average Physical Product |
| ASA | Agricultural Seeds Agency |
| ASDP | Agricultural Sector Development Programme |
| AUC | African Union Commission |
| AVRDC | Asian Vegetable Research Development Centre |
| AWAWISI | <i>Asasi ya Wanawake Wilaya ya Singida</i> (Singida District Women Institution) |
| BFS | Bayport Financial Services |
| BMI | Body Mass Index |
| Ca | Calcium |
| CAADP | Comprehensive Africa Agriculture Development Program |
| CBO | Community-Based Organization |
| CBTI | Community Based Transportation Initiatives |
| CDOs | Community Development Officers |
| CDTI | Community Development Training Institute |
| CFCs | Chloro-Fro hydro-Carbons |
| CGC | Common Wealth Grants Commission |
| CHAMWAI | <i>Chama cha Mikopo kwa Waalimu Iramba</i> (Credit Association for Iramba District Teachers) |
| CO | Carbon Monoxide |

| | |
|-----------------|---|
| CO ₂ | Carbon Dioxide |
| COMESA | Common Market for Eastern and Southern Africa |
| CRS | Catholic Relief Service |
| CSIF | Community Self Initiative Fund |
| CSO | Civil Society Organization |
| CWFS | Committee on World Food Security |
| DADPs | District Agricultural Development Programmes |
| DALDO | District Agricultural and Livestock Development Officer |
| DC | District Council |
| DCDO | District Community Development Officer |
| DD | Dietary Diversity |
| DDS | Dietary Diversity Score |
| DEC | Dietary Energy Consumption |
| DEI | Dietary Energy Intake |
| DESA | United Nations Department of Economic and Social Affairs |
| Df | Degrees of freedom |
| DfID | British Government's Department for International Development |
| DRTE | Department of Research, Training and Extension |
| DSI | Development Studies Institute |
| D-W | Dubin-Watson |
| F | Fisher's Ratio |
| FANTA | Food and Nutrition Technical Assistance |
| FAO | Food and Agriculture Organisation |
| FBO | Faith Based Organisation |
| Fe | Ferrous (Iron) |
| FEG | Food Energy Gap |

| | |
|------------------|---|
| FEWS | Famine Early Warning System |
| FFE | Food for Education |
| FFL | Food for Life |
| FGD | Focus Group Discussion |
| FHH | Female-Headed Household |
| FME | Food Monitoring and Evaluation |
| GHGs | Green House Gases |
| GMO | Genetically Modified Organisms |
| H ₂ O | Hydrogen Oxide (water) |
| HFBS | Household Food Balance Sheet |
| HFE | Household Food Evaluation |
| HFIAS | Household Food Insecurity Access Scale |
| HFME | Household Food Monitoring and Evaluation |
| HIES | Household Income and Expenditure Survey |
| HIV | Human Immuno-deficiency Virus |
| HSPH | Harvard School of Public Health |
| HYVs | High Yielding Varieties |
| IDC | Iramba District Council |
| IFAD | International Fund for Agricultural Development |
| IFPRI | International Food Policy Research Institute |
| IGA | Income-Generating Activities |
| ILO | International Labour Organisation |
| IMF | International Monetary Fund |
| IS | Islamic States |
| KII | Key Informant Interview |
| KIWOHEDE | Kiomboi Women and Home Economics Development |

| | |
|------------------|---|
| MAFSC | Ministry of Agriculture, Food Security and Co-operatives |
| MCDGC | Ministry of Community Development, Gender and Children |
| MDER | Minimum Dietary Energy Requirement |
| MDGs | Millennium Development Goals |
| MFEA | Ministry of Finance and Economic Affairs |
| MHH | Male-Headed Household(s) |
| Mil. | Million |
| MLDF | Ministry of Livestock Development and Fisheries |
| MNRT | Ministry of Natural Resources and Tourism |
| MOID | Ministry of Infrastructure Development |
| MP | Members of Parliament |
| MPP | Marginal Physical Product |
| MUCCoBS | Moshi University College of Co-operative and Business Studies |
| MUHAS | Muhimbili University of Health and Allied Sciences |
| MWI | Ministry of Water and Irrigation |
| N | Nitrogen |
| NBS | National Bureau of Statistics, Tanzania |
| NEM | Never Ever Married |
| NEPAD | New Partnership for Africa Development |
| NFPCSP | National Food Policy Capacity Strengthening Programme |
| N ₂ O | Nitrous Oxide |
| NGOs | Non-Governmental Organisations |
| NSGRP | National Strategy for Growth and Reduction of Poverty |
| O & OD | Opportunities and Obstacles to Development |
| P | Phosphorus |

| | |
|-----------------|--|
| PADEP | Participatory Agricultural Development and Empowerment Programme |
| PLP | Practitioner Learning Programme |
| PRIDE | Promotion of Rural Initiatives and Development Enterprises |
| PRS | Poverty Reduction Strategy |
| PSI | Poverty Severity Index |
| RAA | Regional Agricultural Advisor |
| RAFFS | Rural Agricultural Finance and Food Security |
| RIU | Research into Use |
| SACCOS | Savings and Credit Co-operative Societies |
| SADC | Southern African Development Co-operation |
| SAFE | Sasakawa Africa Fund for Extension Education |
| SAP | Structural Adjustment Program |
| SDT | Stochastic Dominance Test |
| SO ₂ | Sulphur Dioxide |
| SPFS | Special Program on Food Security |
| spp | Species |
| SPSS | Statistical Package for Social Sciences |
| SUA | Sokoine University of Agriculture |
| TACRI | Tanzania Coffee Research Institute |
| TAFSIP | Tanzania Agriculture and Food Security Investment Plan |
| TAHA | Tanzania Horticultural Association |
| TANROADS | Tanzania Roads Agency |
| TANSEED | Tanzania Seed Company |
| TFNC | Tanzania Food and Nutrition Centre |
| TKT | <i>Tele Kwa Tele</i> (Much and Much) |

| | |
|--------|---|
| TNBC | Tanzania National Business Council |
| TNNGO | Tanzania Network of Non-Governmental Organizations |
| TOSCA | Tanzania Official Seed Certification |
| TPP | Total Physical Product |
| TPRI | Tanzania Pests Research Institute |
| TZS | Tanzanian Shillings |
| UN | United Nations |
| UNU | United Nations University |
| URT | United Republic of Tanzania |
| USA | United States of America |
| USAID | United States Aid for International Development |
| VC | Village Council |
| VEO | Village Executive Officer(s) |
| VICOBA | Village Community Bank |
| VSLA | Village Savings and Loan Associations |
| VSLAFS | Village Savings and Loan Associations and Food Security |
| WB | World Bank |
| WDC | World Development Council |
| WEO | Ward Executive Officer |
| WFP | World Food Programme |
| WHO | World Health Organization |
| WV | World Vision |

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Institutions are the rules and organizations, including informal norms that control human actions. Institutions can be classified as formal or informal according to the structure they exhibit. According to World Bank (2003), formal institutions include a country's codified rules and laws, and the procedures and organizations for making, modifying, interpreting, and enforcing the rules and laws (from the legislature to the central bank); but informal institutions include trust and other forms of social capital (including deeply rooted norms governing social behaviour) to informal mechanisms and networks for coordination. Institutions are the kinds of structure that matter most in the social realm, as they promote sustainability of social life. They enable ordered thoughts, expectations and actions by imposing forms and consistency of human activities. Institutions both constrain and enable human behaviour. It is the interaction between institutions and organisations that shapes the institutional evolution of an economy (World Bank, 2003).

Institutions function by promoting human well-being through generating information, giving citizens' ability to act, responding to feedback, and fostering learning processes on how to master the socio-economic environment challenging people. Institutions are usually engaged in exploring people's needs, problems, likely solutions and balancing interests among diverse groups of people. By structuring, constraining, and enabling individuals' behaviours, institutions have the power to mould the capacities and behaviour of agents in fundamental ways: they have a capacity to change aspirations instead of merely enabling or constraining them. Habits are the key mechanisms in this transformation. Institutions are social structures that can involve reconstitutes downward

causation, acting to some degree upon individual habits of thought and action. Insofar as institutions lead to regulation of behaviour, concordant habits are laid down among the population, leading to congruent purposes and beliefs. In this way the institutional structure is further sustained. Because institutions simultaneously depend upon the activities of individuals, constrain and mould them, through this positive feedback they have strong self-reinforcing and self-perpetuating characteristics. This does not mean, however, that institutions stand separately from the group (World Bank, 2003). Besides, their functions institutions principles include: balance of power, social identity, cooperation and co-existence, efficiency and effectiveness, equity, reciprocally binding constraints, collective action, morality and responsiveness to the future challenges, functionality and interconnectedness, justice, fairness, equality and protection of the vulnerable individuals and groups (Reus-Smit, 1999).

While the information in the previous three paragraphs is about institutions, the information in this paragraph and in the following one is about the concept of food security. The concept of food security came increasingly in the focus, especially of the food and nutrition policy debate, in the mid-1970s, following a world food crisis in the early 1970s. The crisis prompted the Food and Agriculture Organisation (FAO) of the United Nations (UN) to organise the World Food Conference in 1974, which, among other deliberations, recommended an international undertaking on World Food Security, which was adopted by the United Nations (UN) General Assembly the same year (Eide, 2005). The main concern of the 1974 World Food Summit was secure flows of basic foodstuffs at stable prices. Therefore, the Summit defined food security as: “Availability at all times of adequate world supplies of basic foodstuffs...to sustain a steady expansion of food consumption and to offset fluctuations in production and prices” (United Nations, 1975, cited by Pottier, 1999).

In 1986 a World Bank report defined food security heeding the same challenge as that of the 1970s, which was guaranteeing access to food and hence the report defined food security as: “Access of all people at all times to enough food for an active healthy life”(World Bank, 1986, cited by Pottier, 1999). The European Union took this approach too, but emphasised the importance of household food security hence defined food security as: “The ability to acquire enough food to satisfy minimal nutritional requirements at both national and household levels” (Tuinenburg, 1987, cited by Pottier, 1999). In 1996 the World Food Summit in Rome defined food security as follows: “A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO *et al.* (2014). This is so far the most comprehensive definition of food security and comprises five dimensions of food security, which are food availability, economic and physical access to food, food utilization, food stability over time, and food safety.

After the descriptions of institutions and food security given above, let's now look briefly at linkages between institutions and food security generally and particularly in Tanzania and in Singida Region where the research for this thesis was done. Food security is an outcome of food systems operating efficiently. Efficient food systems contribute positively to the five dimensions of food security listed just above. For each of the five dimensions, institutions have a role to play to improve food security.

However, there are some factors which constrain effective and efficient performance of institutions towards achieving food security. Such factors include, *inter alia*, insufficient resource base, shorter duration of intervention, different systems most of which are inherently heterogeneous, unstable social and political environments that preclude

sustainable economic growth, war and civil strife, macroeconomic imbalances in trade, natural resource constraints, poor human resource base, gender inequality, inadequate education, poor health, natural disasters, such as floods and locust infestation, and the absence of good governance. All these factors contribute to either insufficient national food availability or insufficient access to food by households and individuals (Mwaniki, 2003).

In Tanzania, achieving food security presents a big challenge to the government to implement social and economic policies to meet household dietary requirements due to one or more of the factors aforementioned. In Tanzania, there are various institutions and organizations that deal with agricultural development and hence fostering food security. These include: Ministry of Agriculture, Food Security and Cooperatives (MAFSC); Ministry of Livestock Development and Fisheries (MLDF); Ministry of Water and Irrigation (MoWI); *Mtandao wa Vikundi vya Wakulima Tanzania* (MVIWATA) which means Farmers' Groups Network in Tanzania; Tanzania Seed Company (TANSEED); Special Programme on Food Security (SPFS), Tanzania Network of Non-Governmental Organizations; Agricultural Seeds Agency (ASA); Tanzania Food and Nutrition Centre (TFNC); Sasakawa Africa Fund for Extension Education (SAFE); Department of Research Training, and Extension (DRTE); Tanzania Official Seed Certification Institute (TOSCI); Tanzania Horticultural Association (TAHA); Participatory Agricultural Development and Empowerment Programme (PADEP) and Savings and Credit Cooperatives Societies (SACCOS), among others.

Despite the presence and functions of the institutions listed above in Tanzania, still there is food insecurity in Tanzania, 9.7% of the population and 7.2% of the households in 2012, according to the 2011/12 National Household Budget Survey (NBS, 2014). These

incidences of food insecurity show an improvement in comparison with food insecurity incidences in Tanzania reported in the previous National Household Budget Survey of 2007 when 11.8% of the population and 8.7% of the households had food insecurity.

In Singida Region rain fed agriculture is a prominent system of both food and cash crop production. It is, therefore, evident that erratic rainfall patterns keep the region vulnerable to drought and persistently food insecure. The effects of drought, combined with structural weaknesses of the agricultural sector and institutions, place a substantial part of the population in the region at higher risk of chronic food insecurity (WFP, 2004). This thesis discusses food security at both the regional and household level emphasizing the latter. Like in Tanzania in general, in Singida Region both Governmental and Non-governmental institutions deal with food security. The government, through the Ministry of Agriculture Food Security and Co-operatives, provides policies and plans to guide food security. Other institutions include Farmers' Savings and Credit Co-operative Societies (SACCOS), Village Community Banks (VICOBA), World Food Programme (WFP), World Vision (WV), PRIDE-Tanzania, CARE (T), International Food and Agricultural Development (IFAD), and Food and Agriculture Organization (FAO). In the region, institutions have a great role to play with regard to food security. The Department of Agriculture and Livestock Development plays a crucial role in agricultural development and food security, through its famous District Agricultural Development Plans (DADPs). The department, through District Authorities, sets by-laws which promote agriculture and foster food security. Other institutions in the region which deal with food security include Tanzania Christian Refugee Services (TCRS), World Vision (WV), World Food Programme (WFP), International Fund for Agricultural Development (IFAD), Food and Agriculture Organization (FAO) and The World Bank (WB).

In Singida Region, institutions have a great role to play pertinent to food security. The Department of Agriculture and Livestock Development plays a crucial role in agricultural development and food security, through its famous District Agricultural Development Plans (DADPs). The department, through District Authorities sets by-laws which promote agriculture and fosters food security. The linkage between institutions and food security in the region can be traced in terms of the former providing support, including policies, guidelines, inputs, extension services, consultancies, training programmes, financial resources, infrastructure development and land ownership legal rights to the latter. Institutions are vital in excelling food security as they provide a friendly environment for sustainable agricultural production and expansion as well as other income generating activities, non-farm inclusive, which are sources of income to increase food security through buying inputs to produce food and cash income that is used to buy various foodstuffs which households do not produce. More emphasis in this research is given on formal institutions because they are more standard, unlike informal institutions that are very variable depending on local socio-cultural factors.

1.2 Statement of the Problem

Despite the presence of various institutions addressing agriculture that is the main source of food in Singida Region, food insecurity in the region remains relatively high. The proportion of food insecure households in the region is high, 28% in 2010, unlike 16.6% for Tanzania in 2007 (URT, 2009). The proportions were based on the cut-off point of 2 200 kCal per adult equivalent per day (below which people are said to be food poor in Tanzania) as documented in the 2007 Household Budget Survey Report (NBS, 2009). To date in the region, food security remains precarious, burdened with unproductive workforce, heavily reliant on traditional inputs and lack of technical innovation. A critical examination of the food security status from 2000 to 2010 reveals that the region failed to

meet aggregate regional food requirements from domestic production in two out of every five years (URT, 2009). This represents a 40% probability of annual food shortage in the region (URT, 2005).

The probable causes of food insecurity in the region include dependency on rain fed agriculture, low level of education, poor agricultural input support systems, inadequate extension services, rudimentary technology, and ineffective institutions such as those supporting agriculture and food security. Institutions are perpetuated not simply through convenient coordination rules that they offer; they are perpetuated because they confine and mould individuals' aspirations and create a foundation for their existence upon many individuals' minds that they taint with their conviction (Hodgson, 2006).

However, it is not known whether any of the factors listed above as probable causes of food insecurity holds. Moreover, even if some of them hold, the extent to which they do so and their distribution across the population are not known empirically. The intention of the study, therefore, was to generate empirical information, particularly institutions, on the extents to which various factors affect the situation of food security in Singida Region.

1.3 Justification of the Study

The vitality and vigour of any nation depends upon a well fed population which receives adequate food calorific intake per day. People need food both in quantitative and qualitative terms in order to be able to participate fully in development activities. If this is to be achieved, there must be clear institutional frameworks and viable strategies to ensure food sufficiency. The right way of ensuring food sufficiency at the household level is to explore and find the inter-linkages among institutional factors influencing the

status of food security. The study had potential to gauge empirically extents to which various determinants of food security explain food insecurity in Singida Region, through studying institutional and other factors affecting food security in that area so as to come up with recommendations on institutional framework for addressing food insecurity. In addition to this, the study contributes to an on-going national call for green revolution (KILIMO KWANZA) with its ten pillars stipulated as: The political will to push agricultural transformation; enhanced financing for agriculture; institutional reorganization and management of agriculture; a paradigm shift to strategic agricultural production; land availability for agriculture; incentives to stimulate investments in agriculture; industrialization for agricultural transformation; science, technology and human resources to support agricultural transformation; infrastructural development to support agricultural transformation; and mobilization of Tanzanians to support and participate in the implementation of Kilimo Kwanza (TNBC, 2009).

The study explored a workable framework which may contribute to assuring food security in Singida Region as per the first goal of the Millennium Development Goals [MDGs] (UN, 2010) that aims at eradicating extreme poverty and hunger with the target of halving, between 1990 and 2015, the proportion of people whose income is less than one USD per day and the first objective of the National Agriculture Policy of enhancing food security through increasing production of sufficient quantity and quality of food through institutions and goal number four, cluster 1 of the National Strategy for Growth and Reduction of Poverty (NSGRP) (URT, 2012) which aims at ensuring food and nutrition security, environmental sustainability and climate change adaptation and mitigation. The study goes hand in hand with the goal of the Tanzania Agriculture and Food Security Investment Plan which is to contribute to the national economic growth,

household income and food security in line with national and sectoral development aspirations (URT, 2011).

1.4 Objectives of the Research

1.4.1 General objective

The general objective of the research was to determine the role of institutions in household food security.

1.4.2 Specific objectives

The specific objectives of the research were:

1. To appraise qualitatively the role of institutions in food security.
2. To identify institutions dealing with food security and their key functions.
3. To determine food security at the household level.
4. To establish linkages between some institutional factors and food security factors.

1.5 Hypotheses Tested

The following two hypotheses were tested in line with the third and fourth objectives that were analysed inferentially:

1. **H₀: Null Hypothesis one:** Food security in terms of grains obtained per year and food utilization in terms of dietary energy consumed per adult equivalent per day do not differ significantly among households having different institutional factors.

H₁: Alternative hypothesis one: Food security in terms of grains obtained per year and food utilization in terms of dietary energy consumed per adult equivalent per day differ significantly among households having different institutional factors.

2. **H₀: Null hypothesis two:** Amount of food produced with institutional support does not have significant effect on food security in terms of dietary energy consumed.

H₁: Alternative hypothesis two: Amount of food produced with institutional support has significant effect on food security in terms of dietary energy consumed.

.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Institutions and Food Security Concepts

Institutions are structures and mechanisms of social order and cooperation governing the behaviour of a set of individuals within a given human society collectively. They are identified with a social purpose and permanence, transcending individual human lives and intentions and with the making and enforcing rules governing diverse human behaviour. They are essential for sustainable and equitable development. When they function well they enable people to work with each other to plan a future for themselves, their families and their larger communities, but when they are weak or unjust, the result is mistrust and uncertainty (World Bank, 2000). This implies that for any development effort, institutions should function well in such a way that particular goals including achieving food security are realized. However, it is quite evident that human behaviours are complex entities and hence need very strong and well spelt institutional rules and norms to counteract any negative efforts which may deter the pattern of development.

Food security is a concept that has evolved considerably over time, and there is much literature on potential household food security indicators (Hoddinott, 1999). Many development practitioners and agencies regard the concept of household food security as a guiding principle for designing project interventions in rural areas (Hoddinot, 1999). The roots of concern with food security can be traced back to the World Food Crisis of 1972-74 and beyond that, at least to the Universal Declaration of Human Rights (UDHR) in 1948 which recognized the right to food as a core element of an adequate and decent standard of living of any human being (Maxwell and Frankenberger, 1991). In the 1970s, food security was mostly concerned with national and global food supplies. However, in

the 1980s, the focus shifted to the questions of access to food at household and individual levels. It was during this period when the concept of household food security emerged as a potentially useful development objective (Maxwell and Frankenberger, 1991).

Food security refers to access by all people at all times to enough food for an active, healthy life (World Bank, 1986). Food security includes at minimum, the ready availability of nutritionally adequate and safe foods, and an assured ability to acquire acceptable food in socially acceptable ways that is without resorting to emergency food supplies, scavenging, stealing, or other coping strategies. Food security means having, at all times, both physical and economic access to sufficient food to meet dietary needs for a productive and healthy life. A family is food secure when its members do not live in hunger or fear of hunger (USAID, 2010).

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life (WFP, 2006). However, Shiva and Bedi (2002) assert that a household is food secure if food which is culturally accepted is available in the system; the household has the ability to buy the food; the household has the freedom to choose what food to buy from the available food; and there exists institutional licence to access the available food, and the available food the required nutritional value. The most comprehensive definition, however, comes from FAO (2010), which is "food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." Household food security is the application of this concept to the family level, with individuals within households as the focus of concern. It is obvious that these definitions are operational in developed countries, but in developing countries,

especially sub-Saharan Africa, the definitions become restrained with prevalent hunger and malnutrition due to abject poverty.

Furthermore, food security and institutions are inseparable concepts as institutions provide well defined structures, explicit rules, vibrant regulations, and workable organizations for food security systems in terms of production, distribution, exchange, pricing and marketing of agricultural products. On the other hand food insecurity exists when people do not have adequate physical, social or economic access to sufficient, safe and nutritious food that meets dietary needs and food preferences for an active healthy life. The situation leads to under-nourishment which exists when caloric intake is below the minimum dietary energy requirement (MDER).

Despite all these definitions, achieving food security seems an illusion, especially in developing countries; no country could hope to reach it in reality. Therefore, for specific programmes/projects or particular nations, definition of food security should be something achievable or measurable at least for certain attributes and duration. But these definitions should cover the basics of all possible food dimensions. No matter how we define food security, having enough to eat regularly for an active and healthy life is the most essential thing, just like food security is a human need. Many developing countries, including Tanzania, haven't been able to fulfil this vital need even today. The aim of the Millennium Development Goal (MDG 1), Target 1, is to halve, between 1990 and 2015, the proportion of people who suffer from hunger (FAO, 2010 and WFP, 2010) This is a fantasy in Tanzania and elsewhere, where food insecurity is often rooted in poverty and has long-term impacts on the ability of families, communities, and countries to develop. Prolonged under-nourishment leads to stunted growth, slows cognitive development, and increases susceptibility to illness (FAO, 2010).

2.2 Theoretical Discussions on Institutions

The term institution has a long history of usage in the social sciences, dating back at least to Giambattista Vico in his *Scienza Nuova* of 1725 (Hodgson, 2006). According to Hodgson, institutions are the kinds of structures that matter most in the social realm, as they make up the stuff of social life. Institutions enable ordered thought, expectations and actions by imposing form and consistency of human activities. Institutions both constrain and enable human behaviour. Hodgson (2006) defines institutions as systems of established and embedded social rules that structure social interactions. Rules are socially transmitted and customarily normative injunctions. He adds that organizations are special institutions that involve: criteria to establish their boundaries and to distinguish members from non-members, principles of sovereignty concerning who is in charge, and chains of command delineating responsibilities of each member. This implies that institutions have their own incumbents governed by strict rules, principles and regulations coupled with well-defined rules of conduct.

Vatn (2005) defines institutions as "...conventions, norms, and formally sanctioned rules of a society. They provide expectations, stability and meaning essential to human existence and coordination, regularize life, support values, and produce and protect interest." The use of the term institution has become widespread in the social sciences and globally; institutions function by promoting human well-being through generating information, giving citizens' ability to act, responding to feedback, and fostering learning processes on how to master the socio-economic environment challenging people. Institutions are usually engaged in exploring people's needs, problems, likely solutions and balancing interests among diverse groups of people. However, to date there has been no unanimity in the definition of this concept. Furthermore, endless dispute over the definitions of key terms such as institution and organisation have led some writers to give

up matters of definition and propose getting down to practical matters instead (Hodgson, 2006). Wells (1970, cited by Hodgson, 2007) puts it thus: "Social institutions form an element in a more general concept, known as social structure". However, Veblen and Commons (1970) understand institutions as a special type of social structure with the potential to change agents, including changes to their purposes or preferences.

North (1990) wrote on institutions as follows: "Institutions are rules of the willing in society or, more formally, are the humanly devised constraints that shape human interaction. In consequence, they structure incentive in human exchange, whether political, social, or economic. "It is obvious that North (1990:15) reasonably sees organizations as including political parties, firms, trade unions, schools and universities as they are organized structures with clear vision, mission, objectives and strategies to carry out their goals. Some people have interpreted North (1990:15) as saying that organizations are not institutions". When North wrote that organisations are made up of groups of individuals bound together by some common purpose he simply ignored the social instances when this might not hold (Hodgson, 2006). These authors' definitions have one thing in common, rules and structures guiding human propensity to particular action. Based on this resemblance, there is no shrill distinction among them. However, these definitions touch very little, if any, on inter-personal relations, economic aspects, education, marriage and religious beliefs as being part of institutions.

Globally, international institutions function by promoting human well-being through spawning information, giving citizens' ability to act, responding to feedback, and fostering learning processes on how to master the socio-economic environment challenging people. Institutions are usually engaged in exploring people's needs, problems, likely solutions and balancing interests among diverse groups of people.

Institutional development is one of the main focus areas of the National Food Policy Capacity Strengthening Programme (NFPCSP).

Reddy (2001), Gopinath (2001), and Behera (2001, cited in Jain (2001) defined institutions as formal and informal rules and structures of an organization. Formal rules are devised by human beings such as socially recognized and sanctioned expectations by everyone in the society with regard to *de jure* or *de facto* legal relations that define the choice sets of individuals with respect to sets of others. The informal (conventional) ones are the conventions and codes of behaviour that is a structured set of expectations about behaviour, driven shared and preferences for the outcome as opposed to the means by which that outcome is achieved (Bromley, 1989 as cited by Jain, 2001). However, other authorities define institutions as regularized patterns of behaviour between individuals and groups in society, or complexity of norms, rules and behaviour, which serve a collective purpose (de January *et al.*, 1989).

It is obvious that literature has provided a variety of meanings, types and functions of institutions. However, most of them are based on enhancing or constraining individual behaviour towards a particular purpose but neglect the characteristics and dynamism of groups or communities in their endogenous environment. The definitions also did not show the difference between institutions and organizations whereby the latter are the part of the former.

2.3 Theoretical Discussions on Food Security

Food security is a multi-faceted concept, variously defined and interpreted. At one end of the spectrum, food security implies the availability of adequate supplies at the global and national levels; at the other end, the concern is with adequate nutrition and well-being

(FAO, 2003, Idris, *et al.*, 2012). Recent initiatives have aimed at improving the food security situation of the poor. This has been stimulated by the fact that although food availability for direct human consumption grew by 19% between 1960 and 1994-96 to 2 720 kCal/day per adult equivalent per day (against an estimated minimum daily energy requirement of 2 200 kCal/day per adult equivalent per day), availability is still very uneven (FAO, 1999). In sub-Saharan Africa (SSA) caloric intake is still only 2 150 kCal/day per adult equivalent per day compared to 2 050 kCal/day per adult equivalent per day in 1980. In contrast, the average calorie consumption in South Asia rose from 2 000 kCal/day per adult equivalent per day to 2 350 kCal/day per adult equivalent per day in the same period (FAO, 1999). It is obvious that caloric intake per day measured per adult equivalent vary from continent to continent, from country to country, but it is lower in sub-Saharan Africa, possibly due to high prevalence of abject poverty, destitution, hunger and malnutrition.

However, during the 1990s per capita growth of world agricultural production slowed down. World cereal output, for example, fell from a peak of 342 kg per person per annum in the mid-1980s to 311 kg per person per annum in 1993-95, although it rose to 323 kg per person per annum in 1996-98. In 1995-97, 820 million were estimated by the FAO to be undernourished, with 790 million living in developing countries. Although the number of undernourished people in developing countries actually fell by 40 million people between 1980/82 and 1995/97, this improvement was also uneven, being attributable to a reduction of 100 million in 37 countries, whilst in the remaining countries the numbers increased by 60 million (FAO, 1999). In addition, the fall in absolute numbers is too low to achieve the World Food Summit goal of reducing the numbers of undernourished by half by 2015, since this would require an additional reduction of 20 million undernourished individuals each year.

FAO and WFP (2010) indicate that the proportion of undernourished people remains unacceptably high at 16% representing a total number of 925 million people worldwide. The State of Food Insecurity (SOFI) in the World 2012 (FAO, 2012) presents new estimates of under-nourishment food poverty incidence showing that 870 million people are under-nourished. The UN Food and Agriculture Organization estimates that 239 million people in sub-Saharan Africa were hungry or undernourished in 2010. Africa was the continent with the second largest number of hungry people, as Asia and the Pacific had 5 million people, principally due to the much larger population of Asia when compared to sub-Saharan Africa.

Sub-Saharan Africa actually had the largest proportion of its population undernourished with an estimated 30% in 2010, compared to 16% in Asia and the Pacific (FAO, 2010). Thus, almost one in three people who live in sub-Saharan Africa were hungry, far higher than any other region of the world, with the exception of South Asia. The percentage of the population whose food intake is insufficient to meet dietary energy requirements continuously (prevalence of undernourishment) in Tanzania was reported at 34% (World Bank, 2008).

Poverty and food insecurity are the main drivers of chronic undernourished in Tanzania, which, in 2012 - 14, was 34.6%, according to FAO *et al.* (2014). However, the National (Tanzania) Household Budget Survey of 2011/12 (URT, 2014) reports that food insecurity in Tanzania in 2012 was 9.7%, based on the national food poverty line of TZS 26 085 per adult equivalent per month. Although the 9.7% food insecurity incidence reported by URT (2014) is quite different from the one (34.6%) reported by FAO *et al.* (2014), it is the official information; they are so different because they were based on different methods. Under nutrition diminishes the ability of children to grow, learn and

earn income as adults. It is caused primarily by inadequate access to a diverse and quality diet and insufficient daily feeding practices and behaviour at the household level [<http://www.feedthefuture.gov/country/Tanzania>].

The Tanzania Development Vision (TDV) 2025 targets at attaining food self-sufficiency and food security through the agricultural strategy which advocates a multi-sectorial approach through its Agriculture Sector Development Programme (ASDP) which encompasses all possible interventions needed to stimulate investment, technology development, productivity and production, marketing and value addition (ESRF, 2008). These targets could be attained if the interventions had well defined strategic options which were strategic enough to raise production in the agricultural sector. This implies there must be a strong linkage between institutional factors and food security factors.

In Singida Region food insufficiency is anchored in the widespread reliance of households on subsistence agriculture. Approximately 75% of the population depends on underdeveloped smallholder primary agricultural production characterized by small cultivation, use of hand tools, and reliance upon traditional rain fed cropping methods and animal husbandry. It is also evident that more than 90% of the total population in rural areas in the region is prone to food insecurity (URT, 2005). These statements mean that in rural areas of Singida Region people are more prone to food insecurity due to their dependence on rain fed agriculture and use of rudimentary technology. The situation is probably compounded by institutional weaknesses and market forces as stipulated by Woldemeskel Theory as an important component of food security.

2.4 Measurement and Food Security Indicators

2.4.1 Food security indicators

Food security indicators have been developed by different authors as follows:

(i) *The Household Dietary Diversity Score (HDDS)*. This indicator measures the total number of different food groups eaten in the previous 24 hours by all household members at home, including food prepared at home but eaten outside (Maxwell, 2013). The study used the USAID (2006), approach to group food types found and eaten in the study area with the score of either 0 or 1 as follows: Cereals = A; Roots and Tubers = B; Vegetables = C and Fruits = D. Others were Meat, Poultry, and Offal = E. Eggs = F, Fish and Seafood = G. Pulses, legumes, and nuts = H, Milk and milk products = I. Oil and Fats = J. Sugar and Honey = K and Miscellaneous = L.

The food groups covered by the HDDS are meant to reflect a range of foods, from those that do not contribute to a nutritious diet but require resources to acquire, such as sugar, sweets, beverages and condiments, to foods that contribute to the quality of the diet in terms of essential nutrients. These latter foods include staples, fruits and vegetables, fats, oils and animal source protein. This indicator is suitable in assessing food security as it shows the extent of balanced diet consumed at the household level.

(ii) *The Household Food Insecurity Access Scale (HFIAS)*

This covers three main themes: experiencing anxiety and uncertainty about the household food supply, altering the quality of the diet and reducing quantity of food consumed. The HFIAS is a tool to assess whether households have experienced problems in food access in the preceding 30 days (Riber and Hamrick, 2003; USAID, 2007). Three themes are covered by the tool: 1) experiencing anxiety and uncertainty about the household food supply, 2) altering quality of the diet, and 3) reducing quantity of food consumed.

The respondent is ideally the person in charge of food preparation or the head of household who answers on behalf of all household members. Based on the responses to the nine questions and frequency of occurrence over the previous 30 days, households are assigned a score that ranges from 0 to 20. The following ways show that households experience food insecurity (access) in one manner or another (Radimer *et al.*, 1990, Radimer *et al.*, 1992, Wehler *et al.*, 1992, Hamilton, 1997): feelings of uncertainty or anxiety over food (situation, resources, or supply); perceptions that food is of insufficient quantity (for adults and children); perceptions that food is of insufficient quality (including aspects of dietary diversity, nutritional adequacy, preference); reported reductions of food intake (for adults and children); reported consequences of reduced food intake (for adults and children); and feelings of shame for resorting to socially unacceptable means to obtain food resources. A higher HFIAS score is indicative of poorer access to food and greater household food insecurity.

One of the significant constraints to achieving food security through accessibility is poor infrastructure in some areas and in Tanzania as a whole. Most of the feeder roads in rural areas are unpaved, and many routes become impassable after heavy rains, only passable during dry seasons. Poor transportation infrastructure impacts negatively on food accessibility in many areas as it restricts the flow of food commodities from surplus to deficit areas, which result in food commodities being not efficiently distributed, inaccessible or unavailable in some areas.

The situation also increases transport costs for farmers (in surplus areas) and traders and hence causes higher prices to food commodities in deficit area. Another factor that might be a significant constraint to food commodities accessibility is market structure. In many areas there are no modern market structures, but local markets like auction markets and

informal market places (*soko mjinga* in Kiswahili) are available to meet the demand (URT, 2012). This situation was evident in the study area as there were only 14 informal market places in the two districts where farmers and other people could sell their agricultural products or purchase them. These are important points where peasant farmers, pastoralists and other people get their necessities, including foodstuffs.

(iii) *The Body Mass Index (BMI)*

A BMI Chart or Body Mass Index Chart is a useful tool for visualizing the ranges for *underweight*, *healthy weight*, *overweight*, and *obesity* based on a person's height. The formula does have its shortcomings because it does not take into account age, frame size, gender, or muscularity. This is an indicator of the nutritional status of adults reflecting chronic energy deficiency (Shetty and James, 1994). BMI was invented between 1830 and 1850 by the Belgian polymath Adolphe Quetelet during the course of developing "social physics". The formula is universally used in medicine to produce a unit of measure of kg/m^2 . For a given height, BMI is proportional to weight. However, for a given weight, BMI is inversely proportional to the square of the height. So, if all body dimensions double, and weight scales (naturally coupled with the cube of the height), then BMI doubles instead of remaining the same.

These result in taller people having a reported BMI that is uncharacteristically high compared to their actual body fat levels. In comparison, the Ponderal index is based on this natural scaling of weight with the third power of the height. However, many taller people are not just scaled up than short people, but tend to have narrower frames in proportion to their height. It has been suggested by WHO (2003) that instead of squaring the body height (as the BMI does) or cubing the body height (as the ponderal index does), it would be more appropriate to use an exponent of between 2.3 and 2.7. A frequent use

of the BMI is to assess how much an individual's body weight departs from what is normal or desirable for a person of his or her height. The weight excess or deficiency may, in part, be accounted for by body fat (adipose tissue), although other factors such as muscularity also affect BMI significantly.

WHO (2003) regards a BMI of less than 18.5 as underweight and may indicate malnutrition, an eating disorder, or other health problems, while a BMI greater than 25 is considered overweight and above 30 is considered obese. These ranges of BMI values are valid only as statistical categories when applied to adults. Body Mass Index is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m^2). For example, an adult who weighs 70 kg and whose height is 1.75 m will have a BMI of 22.9, i.e. $70/(1.75)^2 = 70 / 3.06 = 22.9$. Table 1 shows categories of BMI.

Table 1: Classification of adult underweight, overweight and obesity according to BMI

| Classification | BMI (kg/m^2) | |
|-------------------|--------------------------------|--|
| | Principal cut-off points | Additional cut-off points |
| Underweight | <18.50 | <18.50 |
| Severe thinness | <16.00 | <16.00 |
| Moderate thinness | 16.00 - 16.99 | 16.00 - 16.99 |
| Mild thinness | 17.00 - 18.49 | 17.00 - 18.49 |
| Normal range | 18.50 - 24.99 | 18.50 - 22.99 23.00 - 24.99 |
| Overweight | ≥ 25.00 | ≥ 25.00 |
| Pre-obese | 25.00 - 29.99 | 25.00 - 27.49 27.50 - 29.99 |
| Obese | ≥ 30.00 | ≥ 30.00 |
| Obese class I | 30.00 - 34.99 | 30.00 - 32.49 32.50 - 34.99 |
| Obese class II | 35.00 - 39.99 | 35.00 - 37.49 37.50 - 39.99 |
| Obese class III | ≥ 40.00 | ≥ 40.00 |

Source: Adapted from WHO (1995, 2000, 2003, 2004, 2006)

BMI values are age-independent and the same for both sexes. However, BMI may not correspond to the same degree of fatness in different populations due, in part, to different body proportions. The health risks associated with increasing BMI are continuous, and the interpretation of BMI grading in relation to risk may differ for different populations.

(iv) The Socio-Economic Status Index (SESI)

It measures household main source of income, possessions, land holdings, education and quality of residential structure. A higher score is indicative of a higher SES index (Australian Government, 2012). The scores always range from 0 to 10. This is normally an asset based indicator used to determine a households' physical quality of life over a specified period of time, normally one year. At the household level, food insecurity has always been associated with low socio-economic status, inadequate dietary intake and poor nutritional status. Low socio-economic status is often reflected in a household with low monthly income, low income per capita, low educational level (Zalilah, Sharif and Merlin, 2001) unemployment among adult household members, single female-headed households and other factors (Kennedy and Peters, 1992; Lino, 1996; Olson *et al.*, 1997).

Inadequate dietary intake means food consumption is limited in quantity, quality or both, which may lead to deficiencies in nutrients (Emmons, 1986; Kendall *et al.*, 1996). Both inadequate dietary intake (quantity and quality) and poor growth status are usually seen in children from low-income households as direct or indirect consequences of household food insecurity (Kennedy and Peters, 1992; Baer and Madrigal, 1993). As poverty is the principal cause of food insecurity, it becomes a common problem among low-income households. These households are focused because of their lower socioeconomic status

and vulnerability to food shortages, which may affect the household's allocation of resources, particularly food, to household members (Tweeten *et al.*, 1992).

Hassan and Babu (1991) have found that the level of asset ownership in a household is an indication of its endowment and provides a good measure of household resilience in times of food crisis, resulting from famine, crop failures, or natural disasters. This is because a household can easily fall back on its assets in times of need by selling or leasing them. Farm plots were the most common asset owned by households, followed by animals, farm implements and mobile phones. This is indicative of improved economic welfare among the households. The small proportion of households that owned ox ploughs and work bulls in the project area suggests that most farming households did not practise mechanized or semi-mechanized farming. Instead, they still relied on hand implements in their farm production. The indicator is in line with Woldemeskel's, Sen's and Boserup's theories. Woldemeskel's argument was based on food resources availability, possessions of any kind, institutional aspects (legal element, rules, traditions, norms) and market forces based on demand and supply. It conforms also to Sen's theory which stressed on resource endowments, means of getting them and their components and Boserup's theory stressed on the use of improved technology to enable increased productivity hence food security.

(v) Food Sufficiency Ratio (FSR)

It measures the ability of food production to meet demand. It compares the volume of domestic food production against food requirements of the household population. Food self-sufficiency ratio is usually calculated on a calorific supply base (Riber and Hamrick, 2003). Different foodstuffs, such as grains, vegetables, and meat are converted into the common measure of energy, or calories, and the ratio that can be

supplied domestically is calculated. This is an indicator of food availability defined as ensuring sufficient food for all people through production (crop, livestock and fisheries), stocks, trade and food aid. In Tanzania the major source of food supply is from local production. On average Tanzania produces about 95% of its food requirements (URT, 2012). On the other hand, one of farmers' most important task is to produce food of sufficient quantity (that is, enough calories) and quality (with the vitamins and minerals needed by the human body) to feed all of the planet's people sustainably so that they can lead healthy, productive lives. This is effectively one of the goals of agriculture, although it is rarely made explicit (Fan and Pandya-Lorch, 2012).

(vi) Food Balance Sheet (FBS)

This is used to measure the expected food deficit or surplus over one year period by considering food: opening stock, production, imports (supplies), domestic utilization, exports and closing stock (Davies *et al.*, 1991). The utilization of all the information which was assembled for the construction of a food balance sheet often ends up in a rather long list of food commodities. This is certainly very useful in order to select the appropriate food composition factors which are required for expressing per capita food supplies in terms of energy, protein and fat content (Davies *et al.*, 1991). On the other hand, this detailed presentation no longer has the advantage of showing a comprehensive picture of a country's food supply. This dilemma can be solved by standardizing the detailed food balance sheet. Standardization can be achieved by showing only primary commodities, i.e. processed commodities are converted into their originating primary commodity equivalents. Because the statistical information for processed commodities is mostly limited to trade, the commodity list can be confined to primary commodities except for sugar, oils, fats and alcoholic beverages. Whenever possible, trade in

processed commodities is expressed in the originating/parent commodity equivalent. This procedure greatly facilitates the analysis of food balance sheets with no loss of pertinent information (FAO, 2001).

This is a sort of tool that planners and economists are concerned with in the preparation of development plans in the food and agriculture sector. Food security is one dimension of poverty when assessing whether a household can meet its food needs and its vulnerability to shocks (URT, 2007). Measurement is necessary at the outset of any development project to identify the food insecure, to assess the severity of their food shortfalls and to characterize the nature of their insecurity whether seasonal or chronic. This indicator shows the movement of food within the household, i.e. food inflow and food outflow. This measures food stability at the household level over time as it shows food opening stock and food closing stock.

2.4.2 Food security measurements

Food security is the outcome of food systems operating efficiently and effectively. Efficient and effective food systems contribute positively to all dimensions of food security. These dimensions are food availability, food access, food utilization, food stability and food safety as discussed hereafter.

2.4.2.1 Food availability

In this context, availability refers to the physical existence of food, be it from own production, from markets or free food donations by relatives, neighbours or food relief programmes. At the national level food availability is a function of the combination of domestic food stocks, commercial food imports, food aid, domestic food production as well as the underlying determinants of each these factors. Use of the term availability is

often confusing, since it can refer to food supplies available at both the household level and at a more aggregate (regional or national) level. However, the term is applied most commonly in reference to food supplies at the regional or national level (Riely *et al.*, 1999). Sijm (1997) analyses the definition as follows. Firstly, it entails two essential determinants of food security, which are the availability of food (through domestic production, storage and/or imports), and b) the ability to acquire food (through subsistence production, market activities, food and/or income transfers). Secondly, the phrase by all people emphasises the importance of assessing food security at a disaggregated level of individuals, households or vulnerable groups.

Food security is also determined based on process indicators and outcome indicators, which Maxwell and Frankenberger (1992) define as follows: Process indicators include variables that reflect food supply by providing information on the likelihood of a shock or disaster that will adversely affect household food security. They include such things as inputs and measures of agricultural production (agro-meteorological data), access to natural resources, institutional development, market infrastructure, and exposure to regional conflicts or their consequences (e.g. influx of refugees).

Outcome indicators at the household level are grouped into direct and indirect indicators. Direct indicators of food security include those, which are close to food consumption rather than to marketing channel information or medical status. Indirect indicators are generally used when direct ones are either unavailable or too costly in terms of time and money to collect. The main direct indicators of food security are: a) money spent on food and kilocalories contained in the foods eaten; (b) household perception of food security and extent of self-provisioning whereby people are asked whether they have access to their culturally accepted food and the number of months their food produce and receipts

in kind lasted and c) food frequency whereby people are asked about the number of meals per day and about the frequency of consuming specific food items deemed to be inferior or superior.

The main indirect indicators of food security according to Maxwell and Frankenberger (1992), are: a) food storage estimates and comparing the amounts stored with the amounts specified to be sufficient per household per year; b) Subsistence potential ratio in households which produce most of their food, which is a ratio of the amount of food produced at the household level in terms of energy to the amount of energy requirements of the household per year (Frankenberger, 1985, cited by Maxwell and Frankenberger, 1992); and c) Nutritional assessments, whereby anthropometric measures are used to determine food consumption. However, anthropometric measures do not always correlate directly with food availability and access. This is because nutritional status is a result of many factors besides food consumption. For example Staaz *et al.* (1990, cited by Maxwell and Frankenberger, 1992) carried out a nutritional survey in Mali using anthropometric measures but found no correlation between them and household food security. Conversely, food availability may be constrained by inappropriate agricultural knowledge, technology, policies, inadequate agricultural inputs, family size, etc (Hoddinott, 1995)

2.4.2.2 Food access

Access emphasizes on having sufficient resources to obtain appropriate foods for a nutritious diet. It is the way different people can obtain the available food. Normally, access to food is through a combination of home production, stocks, purchase, barter, gifts, borrowing or food aid. Food access is ensured when communities and households and all individuals within them have adequate resources, such as money, to obtain

appropriate foods for a nutritious diet (Riely *et al.*, 1995). Access depends normally on income available to the household, the distribution of income within the household, and the price of food. Other determinants of food security worth mentioning are individuals' access to market, social and institutional entitlement/rights (Riely *et al.*, 1999).

2.4.2.3 Food utilization

Food utilization refers to the ability of members of a household to make use of the food to which they have access (WFP, 2012). Two indicators are used to measure food utilization: i) the diet diversity indicator, calculated as the number of food groups consumed by the household in the last seven days previous the interview and ii) the share of calories consumed from staple food, calculated as the percentage of food energy consumed from staples (cereals, roots, and tubers) on total calories intake. Food utilization has socio-economic and biological aspects. If sufficient and nutritious food is both available and accessible, the household has to make decisions concerning what food is being consumed (demanded) and how the food is allocated within the household. In households where distribution is unequal, even if the measured aggregate access is sufficient some individuals may suffer from food deficiency (Sharma, 2013). On the other hand, food utilization and access could be constrained by economic growth, lack of job opportunities, lack of credit, inadequate training, inadequate knowledge, etc. (Hoddinott, 1995).

Moreover, grain consumption is the focus in most food security studies because grains supply more than 50% of human food energy intake, and they contain some other nutrients (Brown and Kane, 1994). Although the phrase enough food for an active, healthy life emphasises the quantitative aspect of food security (i.e. the amount of calories or energy consumed, it does not exclude the quality aspect, which is indicated by

the composition of required micronutrients in the diet). Through dietary energy intake, a household is food insecure if it consumes fewer than 2 280 kCal per adult equivalent per day. This amount is recommended by the World Health Organisation that the minimum dietary energy intake per day per adult should not be less than 80% of the adequate daily caloric intake of 2 850 kCal (Reardon and Matlon, 1989, cited by Wanmali and Islam, 2002). The above amount (2 280) is 80% of 2850.

In Tanzania, however, the minimum recommended dietary energy intake is 2 200 kCal (NBS, 20 way02). However, Maxwell and Frankenberger (1992) argue that by using energy contained in grains consumed there is too much focus on calories, and too little focus on protein and micronutrients consumption in defining food security. They propose a methodology considering the quality of food consumed by individuals and different nutritional needs of men, women and children. Nevertheless, in spite of the critique, and because there cannot be nutrition security without basic food security, the Food and Agriculture Organisation (FAO) of the United Nations stipulates that dietary energy supply goes on being the indicator of choice in assessing food security and when comparing national data (FAO, 1996, cited by Wanmali and Islam, 2002).

Dietary energy consumed in terms of kilocalories can be expressed per adult equivalent or per capita, both per day. When dietary energy consumed is expressed per capita per day, a household is said to be food insecure if it consumes less than 2 100 kCal per capita per day, which is the global average dietary energy consumption per capita per day (Silke and Hand-Peter, 2005). In both cases of dietary energy consumed per adult equivalent and per capita, the cut-off point formula, which was introduced in 1961 by Sukhatme (Naiken, 2002), is used to separate food secure households from food insecure ones. Another way of determining food security based on grains consumption is comparing

grains available for consumption per capita with the average amount of grains recommended per capita. The amounts of such grains vary in different regions of the world. For example, the amounts for USA, Italy, and India are 800 kg, 400 kg, and 200 kg respectively per capita per year (Brown and Kane, 1994).

The minimum recommended level of grains consumption in Tanzania for a household to be considered food secure is 270 kg per adult equivalent per year (URT, 1999). With regard to access and entitlement indicators, this approach has resulted from the pioneering work on food entitlements by Amartya Sen (1981). The main argument of this approach is that a person is vulnerable to food insecurity if he/she lacks the initial resource bundle, which is transformed via production and trade into food or commodities, which can be exchanged for food (Sen, 1981).

Using this approach, Bne Saad (2000) conceptualizes that households with access to resources including enough rainfall, good soil quality, water availability, forest resources, fish and seafood, livestock, infrastructure, farm implements, land, and other physical assets are more likely to be food secure than their counterparts who either do not have such access or have poorer access to the resources. The same author also argues that households that have larger land areas cultivated and/or irrigated, good supply and use of inputs, more than one cropping seasons, crop diversity, higher food and cash crop yields, various sources of non-farm income and equitable gender division of labour are likely to be more food secure than their counterparts who either do not have the factors or have poor amounts and/or qualities of them.

He also argues that households with good income in terms of total income, crop income, livestock income, wage income, self-employment income, migrant income, producer

prices, good markets of their products, and road access are likely to be more food secure than their counterparts who do not have such income. The concept of secure access to enough food builds on the idea of vulnerability to entitlement failure. The argument is that the most food secure households are those, which achieve adequate access to food while using only a small proportion of available resources; the most food insecure households are those who fail to achieve adequate access even by devoting a large proportion of available resources to food (Maxwell and Frankenberger, 1992).

2.4.2.4 Food stability

Stability or sustainability refers to the temporal dimension of nutrition security (i.e. the time frame over which food security is being considered). In much of the food security literature, a distinction is drawn between chronic food insecurity (the inability to meet food needs on an on-going basis) and transitory food insecurity when the inability to meet food needs is of a temporary nature (Maxwell and Frankenberger, 1992). The phrase at all times refers to the need to assess food security in both the short and long terms. Hence, the definition encompasses emergencies and seasonal fluctuations in access to food as well as the sustainability of access to food in the long run. With regard to secure access to enough food at all times, attention is paid to chronic and transitory food insecurity.

Chronic food insecurity means that a household runs a continually high risk of inability to meet the food needs of household members, unlike transitory food insecurity that occurs when a household faces a temporary decline in the security of its entitlements and the risk of failure to meet food needs for a short duration. Transitory food insecurity is divided into cyclical and temporary food insecurity (CIDA, 1989, cited by Maxwell and Frankenberger, 1992).

Temporary food insecurity occurs for a limited time because of unforeseen and unpredictable circumstances; cyclical or seasonal food insecurity occurs when there is a regular pattern in the periodicity of inadequate access to food. It may be due to logistical difficulties or prohibitive costs in storing food or borrowing. However, Cogill (2003) argues that Weight-for-length (in children up to 2 years of age), which is called weight-for-height (in children over 2 years of age), is appropriate for examining short-term food insecurity effects such as seasonal changes in food supply or short-term nutritional stress brought about by illness. Brigham (2004) contends that underweight, which is a composite measure of stunting and wasting, is a good indicator to assess changes in the magnitude of malnutrition over time.

She supports her argument with Nubé's (2001) findings. Nubé used weight-for-height to study the relationship between the prevalence of underweight in children under five years and the prevalence of low Body Mass Index (BMI) among adult women in 23 developing countries. She found that these measures were highly and significantly correlated (with a correlation coefficient, r , of + 0.88 and a p -value of 0.000), indicating that the nutritional status of children under five is a useful indicator of under nutrition in the population at large.

However, food security measurements based on weight-for-height approach are very unlikely to reflect nutritional status among men and older children because they are not closely associated with the nutrition of mothers like in the above case of Nubé. However, BMI is not a prominent measure of food security because it considers weight and height of an individual only and neglects the aspects of consumption pattern of individuals as well as their age and sex. It is rather a measure of nutrition security.

2.4.2.5 Food safety

This dimension describes the procedures of handling, preparation and storage of food in ways that prevent food borne illnesses (USDA, 1999). Food means a raw, cooked, or processed edible substance, ice, beverage, or ingredient used or intended for use or for sale in whole or in part for human consumption. A safe food is the suitable product which when consumed orally either by a human or an animal does not cause health risk to consumers (USDA, 1999). It is apparent that these measurements of food security are to a great extent extensive in providing a comprehensive definition of food security, but they do not indicate the two types of food insecurity, transitory and chronic food insecurity which are important parameters in dynamism of food system of any country. The measurements do not show the extent which could be considered as the threshold point for attaining such a status of all the five mentioned parameters. They fail to show measurability of the parameters in quantitative, physical or biological terms.

2.5 Linkages between Institutions and Food Security

2.5.1 Conceptual linkages

Generally, there is a direct linkage between institutions and food availability as the former acts as a propellant to the growth and sustainability of the latter by providing policies, guidelines, rules, frameworks, and other conditions conducive for agricultural growth by regulating input support systems, market mechanisms, price systems and incentives to agricultural producers. Institutions have the following functions in ensuring food availability: organization of labour resources for producing more food resources, mobilization of resources to help effective food production, assisting some groups to gain new access to productive resources, secure sustainability in natural resource use, providing social and economic infrastructures at village level, influencing policy institutions that affect them directly or indirectly, providing a link between farmers and

research and extension services, and improving access of rural populations to information.

Globally, international institutions are the overseers and monitors of food systems and food security across different food insecure nations including war-protracted areas such as those in sub-Saharan Africa. The international institutions include international agencies, which support countries with agricultural development and research, financial support, food aid and technical support. These include the World Bank (WB), IFAD, Food and Agriculture Organization (FAO), World Food Programme (WFP), World Trade Organization (WTO), United Nations High Commission for Refugees (UNHCR), European Union (EU), United Nations for International Cultural and Education Fund (UNICEF), United Nations University (UNU) and International Food Policy Research Institute (IFPRI).

Regionally, institutions consist of organizations, which serve for the benefits of the countries located in similar geographical areas or with similar cultural characteristics. In Western Europe, there is a famous European Economic Union (EU), which has been assisting most of Third World Countries in terms of financial and non-financial aid. In Africa a variety of institutions exist to give an impetus to economic and trade spheres. These organizations include African Union (AU), Inter-Governmental Agency for Development (IGAD), Asian Vegetable Research and Development Centre (AVRDC), National Economic Partnership Agency for Development (NEPAD), Common Market for Eastern and Southern African (COMESA), Southern African Development Conference (SADC), Economic Community of West African States (ECOWAS), Economic Partnership Agreement (EPA), African Development Bank (AfDB), etc. All these

institutions intend to boost economic, social and political development of African countries.

In Tanzania most institutions work under the umbrella of Government Ministries. The ministries which are core in agricultural development and food security include the Ministry of Agriculture, Food Security and Co-operatives, Ministry of Infrastructure Development, Ministry of Finance and Economic Affairs, Ministry of Local Government and Regional Administration and Ministry of Finance, etc. They also include Governmental agencies such as National Milling Corporation (NMC), Tanzania Farmers Association (TFA), MVIWATA (*Mtandao wa Vikundi vya Wakulima Tanzania*), Tanzania Livestock Marketing Board (TLMB), Agricultural Sector Development Programme (ASDP) and Participatory Agricultural Development and Empowerment Programme (PADEP).

In analyzing institutions in Singida Region, the broad definition of institutions by World Bank was used. They include: District Councils, Participatory Agricultural Development and Empowerment Programme (PADEP), District Agricultural Development Plans (DADPs), Small Industries Development Organization (SIDO), World Vision (T) (WV), Department of Agriculture and Livestock Development (DALD). Micro Finance Institutions (MFIs) include National Microfinance Bank (NMB), Co-operative and Rural Development Bank (CRDB), Bayport Financial Services (BFS), Promotion of Rural Initiatives Development Enterprises (PRIDE), Small Enterprises Development Agency (SEDA), Savings and Credit Co-operative Societies (SACCOS') and Village Community Banks (VICOBA).

There are also by-laws, regulations, rules, customs, traditional norms, taboos, beliefs and social sanctions. However, the study mostly focused on formal institutions as they were constitutionalized. Institutions are better explained by use of a model linking the aspects deemed to be of central concern to the constituent components of food security in terms of food availability, access and utilization (de Man, 2010). Fig. 1 explicates the inter-linkage between institutions and food security.

Significant institutional factors that influence food insecurity among households, local groups and local actors include poor infrastructure and institutional contexts in which food production operates as a result it fails to maintain food availability, food access, food utilization and food stability. These parameters are linked to social and economic conditions; multiple local institutions and policies; physical and environmental conditions which are an outcome of multiple national institutions; policies and actors which operate under multiple international institutions; policies to maintain food security nexus.

Food security is a product of multiple international institutions, policies and national institutions and actors which reinforce conducive social and economic conditions for multiple local institutions and policies, physical and environmental conditions. This interrelationship facilitates food availability, food access, food utilization and food stability. Improvements in agricultural price, health, industry, transport and education incentives have generally led to increases in outputs (in two-thirds of the cases), but other factors dominated the incentive effect in the other countries (URT, 2011).

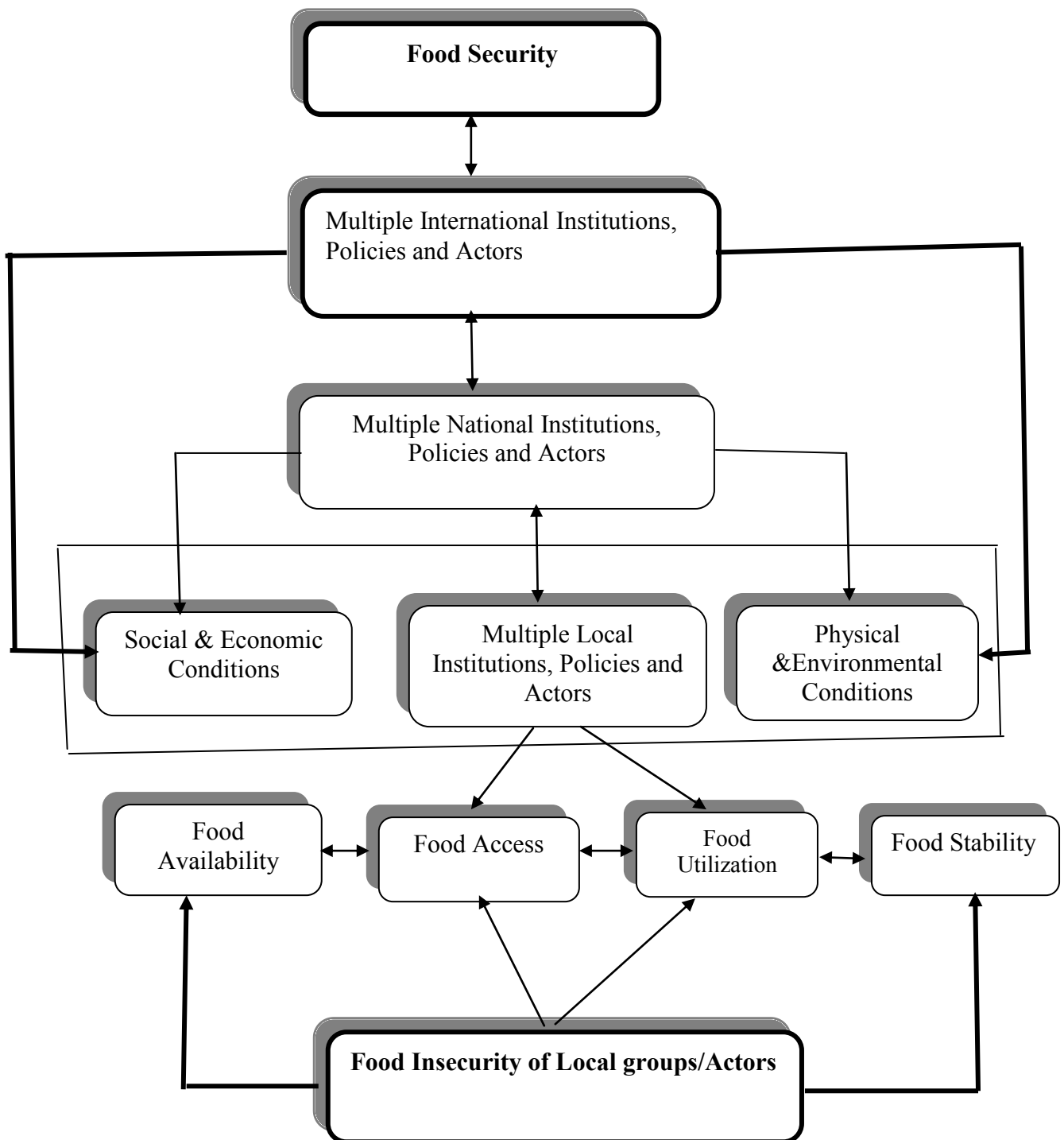


Figure 1: Linkages between Institutions and Food Security.

Source: Adapted from de Man (2010)

However, it had been noted that vegetable production is commonly correlated with stronger rural economies and improved household food security. Smallholder farmers

who grow vegetables often earn higher net incomes than farmers who grow cereals alone (Weinberger and Lumpkin, 2005). Vegetables consumption was a key factor in improving nutritional security and micronutrients and forms a significant part of traditional diets of agricultural communities in Africa (AVRDC, 2005).

2.5.2 Empirical information on linkages between institutions and food security

Different authors have written empirically based information on linkage between institutions and food security. For example, Haapanen (2010), in an abstract of his research titled “Changing Rural Food System in Eastern Tanzania”, focused his study on the food system through which the people living in the case study area of Lugoba Ward, Eastern Tanzania derived their food in the 1990s. During that period socialist approaches in the administration were abandoned and Tanzania’s economy was liberalized, which brought a wave of changes on rural livelihoods and environment. He found that in addition to the structural changes in Tanzania, food system is evaluated in regard to household food availability in terms of supply and demand.

He concluded that failure to foresee the linkages between food system changes, food security and increasing population, access to land, environmental degradation, livelihood diversification and government steering posed a wider context of threat on sustainability of the food system development. It is evident that Haapanen was implicitly talking on inter-linkage between institutional factors and food security though he failed to show the way they influence each other. Kayunze *et al.* (2007), in their paper titled “Entitlement to Food and Food Insecurity in Rufiji District in Tanzania” argue that although Tanzania is mainly an agricultural country and produces much food, there were certain districts where food insecurity was persistent. They added that general causes of food insecurity in Tanzania were known. These included use of low-level technologies. They intended to: 1)

Determine the proportion of food insecure households; 2) Rank some indicators of entitlement vis-à-vis those of Malthusians', Anti-Malthusians', and Woldemeskel's contentions with regard to their relationship with food security; and 3) Determine the correlation between the above indicators of entitlement and dietary energy consumed, which was the main indicator of food security in the research. One of the institutions they analysed with respect to food security was the custom of households giving one another food. On this, they found that this institution was very helpful to the poorer families that had limited means of accessing food.

Based on the findings, it was concluded that food security in the district mainly depends on entitlement to food, particularly buying food. Therefore, it was recommended that, besides helping the citizens of the district use agricultural technologies to produce more food, efforts to improve food security should also support various non-farm income generating activities and livestock production to increase income that would help the people get more access to food through buying it. However, the authors did not show explicitly to what extent non-farm activities should be supported despite their appreciation on the role of institutions on entitlement to be achieved.

FAO *et al.* (2012) argue that the State of Food Insecurity (SOFI) in the World 2012 presents new estimates of the number and proportion of undernourished people going back to 1990, defined in terms of the distribution of dietary energy supply. With almost 870 million people chronically undernourished in 2010/12, the number of hungry people in the world remains unacceptably high. The majority live in developing countries where about 850 million people, or slightly fewer than 15 per cent are undernourished. The state of food insecurity in the World raises awareness about global hunger issues, discusses underlying and malnutrition and enormous progress towards reduction targets established

at the 1996 World Food Summit and the Millennium Summit. It is targeted at a wide audience, including policy-makers, international organizations, academic institutions and the general public with a general interest in linkages between food security, and human and economic development.

The ability of agriculture to support growing populations has been a concern for generations and continues to be high on the global policy agenda. The eradication of poverty and hunger was included as one of the United Nations Millennium Development Goals adopted in 2000. One of the targets of the Goals is to halve the proportion of people who suffer from hunger between 1990 and 2015. Meeting this food security goal will be a major challenge (UN, 2010).

Over the two hundred years following Malthus's projections, famine has overtaken numerous individual regions including Tanzania. Proponents of this theory, Neo-Malthusians, state that these famines were examples of Malthusian catastrophes. On a global scale, however, food production has grown faster than population due to transformational advances in agricultural technology. It has often been argued that future pressures on food production, combined with threats to other aspects of the earth's habitat such as global warming, make overpopulation a still more serious threat in the world future (Boundless, 2014). Predictions of food security outcomes have been a part of the policy landscape since Malthus' theory on population based on *An Essay on the Principle of Population* of 1798. Over the past several decades, some experts have expressed concern about the ability of agricultural production to keep up with global food demands whereas others have forecast that technological advances or expansions of cultivated area would boost production sufficiently to meet rising demands. So far, dire predictions of a global food security catastrophe have been unfounded.

The decline in soil fertility in smallholder systems is a major factor inhibiting equitable development in much of sub-Saharan Africa. In many areas, farmers periodically fallow their land, which is allowing it to lie idle for one or more seasons primarily to restore its fertility (Boundless, 2014). As population increases, fallowing and fallow periods are reduced, continuous cropping becomes more frequent, and crop yields may decline. Cultivation is extended to marginal areas, causing soil degradation. Removal of subsidies on fertilizers in some countries has exacerbated these problems by causing fertilizer use to decline and consequently leading to reduced farm incomes (Boserup, 1981; Cooper *et al.*, 1996; Sanchez *et al.*, 1997 cited in Rosegrant and Cline, 2003). Improved tree fallows, the deliberate planting of trees or shrubs in rotation with crops, has great potential for improving soil fertility in areas dominated by Nitrogen deficiency (Rosegrant and Cline, 2003).

By providing N to crops, tree fallows can help farmers increase their incomes and help nations to improve their food security. They may also help reduce soil degradation and, by providing fuel wood, curb deforestation. As a substitute for Nitrogen fertilizers, they can help save foreign exchange. In areas where phosphate is also a major limiting factor, inorganic sources of P may be an essential input (Jamal *et al.*, 1998). The 2012 SOFI year's report also discusses the role of economic growth in reducing under-nourishment. Sustainable agricultural growth is often effective in reaching the poor because most of the poor and hungry live in rural areas and depend on agricultural production for a significant part of their livelihoods.

However, agricultural growth will not necessarily result in better nutrition for all households. There must be policies and programmes that will ensure nutrition-sensitive growth including supporting increased dietary diversity, improving access to safe

drinking water, sanitation and health services and educating consumers regarding adequate nutrition and child care practices. Nevertheless, many farmers in rural areas do not have the most up-to-date information on how to grow food efficiently, effectively and economically. Improving farmers' knowledge of new techniques and technologies, in addition to providing them with physical resources necessary for using the technologies, can dramatically increase their level of productivity (Rosegrant and Cline, 2003).

Increasing local food availability directly addresses hunger problems that arise when food is not available for people to buy. In rural areas where connections to more productive areas are limited, people depend on food grown by farmers in their own region; if the farmers can't grow enough food, people go hungry. Improved crop yields can both meet the demand of the region and lower the price of food in that region. Lower food prices mean more people can afford to buy the food, and less people go hungry. Approximately 50% of the world's undernourished population is made up of low-income farm households (Shaw, 2005). So, a top priority in addressing hunger problems is to decrease poverty levels among these farmers, and increase their productivity so they can feed themselves and their families. Because the farmers are the price setters, any lowering of prices due to increased productivity should not affect them negatively. Increasing the sustainability of agricultural practices will ensure food security in years to come by preserving and rehabilitating the resources used to produce food, including soil and water.

Feder *et al.* (1987: 685) showed that the Training & Visit system of agricultural extension implemented in India resulted in "a high probability of at least an acceptable rate of return to intensified extension". That is, training farmers pays. Their analysis indicated that the benefits resulted in large part from an improvement in the management of the

farm rather than new inputs. Thus, farmer education can help even without new technologies. Improving agriculture in Africa is a clear priority for addressing the food crisis. Africa has some of the highest hunger rates as well as some of the lowest agricultural productivity rates. Therefore, focusing on farmer education in rural African regions has potential to help improve agricultural productivity hence better food security.

Economic growth takes time to reach the poor, and may not reach the poorest of the poor. Therefore, social protection is crucial for eliminating hunger as rapidly as possible. Finally, rapid progress in reducing hunger requires government action to provide key public goods and services within a governance system based on transparency, accountability, rule of law and human rights. It is an amicable fact that irrigation development in Tanzania is critically important in ensuring national attainment of reliable and sustainable crop production and productivity as a move towards food security and poverty reduction. However, agricultural production in Tanzania has remained unpredictable and of low productivity. This is due to the utter dependence on rainfall which is erratic, unreliable and not uniformly distributed. This dependence on rain fed agriculture has made some developing countries tremendously vulnerable to the vagaries of weather. Maharjan and Khatri-Chhetri (2006) examined food security and its relationship with socio-economic characteristics among rural households in the remote western mountains of Nepal.

Accordingly, the relationship between household's resource endowment and food security status was analysed based on the calorie requirement for all household members according to their sex and age. The food security measures applied in this study are head count method, food insecurity gap, and squared food insecurity gap to capture successively more detailed aspects of the food insecurity status of the household. It was

found that the majority of the households in the region were food insecure and depth and severity of food insecurity varied according to socio-economic characteristics of the households.

Resources are disproportionately distributed in favour of higher castes, and these groups are more food secure as compared to lower caste people. As compared to food insecure households, food secure households have small family size, lower dependency ratio, higher percentage of irrigated land, and more total land and livestock holdings. Hence, they concluded that food security strategies should consider socio-economic characteristics of households in order to achieve more than a marginal reduction in the number of chronically undernourished people.

Diyamett and Njau (2009) did a study, which investigated post-harvest loss and food security, under the title “*Post-Harvest Handling, Storage and Protection of Maize as a Strategy of Poverty Reduction and Food Security*, the case of Babati District in Manyara Region. The findings from the study showed that there was substantial loss of maize grain during post-harvest handling, storage, and protection practices in the study area that ranged between 27% and 37%. They found that small-scale farmers faced different challenges with regard to post harvest loss.

They included the effects of insects’ infestation in the storage facilities, too expensive pesticides as for farmers to afford, lack of proper storage facilities, ineffective pesticides, poor transport facilities, and poor maize handling practice. This situation was attributed to institutional failure to provide appropriate crops harvests handling after harvests. The Ministry of Agriculture, Food Security and Co-operatives did not provide adequate extension services to the smallholder farmers. They concluded that high post-harvest loss

was a contributing factor to poverty and food insecurity among smallholders. They recommended for extensive farmers training on proper handling of harvest, proper storage and use effective pesticides.

In their article “*Addressing Food Self-sufficiency in Tanzania*”, Msuya and Isinika (2011) examined performance of food production and productivity in Tanzania since 2000, in relation to post-structural adjustment programme (SAP) policies. Their discussion assumed that individual households in Tanzania strove to achieve food security through own production as well as purchases from the market. Meanwhile, the government strove to meet national food self-sufficiency of main staples (maize, rice and cassava) from local production, implying that individual farmers must produce a surplus, which is then marketed efficiently so that everybody can access sufficient and good-quality food at all times at affordable prices. Any change in the policy environment changes the opportunity set and hence the choices individuals make, which in turn shape the aggregate performance of economies over time.

It was in this context that the analysis in the paper looked at the performance of food production and marketing, at the micro and macro levels, during the post-SAP period in Tanzania, as influenced by preceding and prevailing policies and institutions, in particular focusing on the magnitude and direction of change. Despite good findings of the authors’ they overlooked the question of strategic options taken by institutions to abate the food insecurity problem in Tanzania.

Akoroda and Teri (1999) studied the effects of structural adjustments and food market reform on agricultural productivity and household food security and found that the two were still contested. They argued that USAID supported researches on the subject present

evidence of a broad economic turn round in Africa, and in particular focusing on increased agricultural productivity, in contrast to the gloomier picture commonly painted about stagnating African agriculture.

Conversely, they insisted on the extent of country's modernization of their agricultural sector. This modernization will be measured by the extent to which rural people move from gaining their livelihood from subsistence farming to doing so from commercial agriculture. This process will require a host of new technologies, institutions and policies. However, the authors acknowledged the role of technology and institutions in maintaining food security, but they failed to consider human resource development for the same.

Kayunze and Mwangeni (2009) did a research on assessment of various methods of determining food security to find out whether they could yield similar results. The methods included household self-appraisal, numbers of meals eaten per day, amounts of grains obtained per capita and per adult equivalent per year (through household production, buying, and receiving grains freely). Other methods were dietary energy consumed (DEC) per capita per day (based on one week's data and on 30 days' data), and DEC per adult equivalent per day (based on one week's data, 30 days' data and one year's data) in Rufiji District Tanzania during the 2005/2006 agricultural season. The specific objectives were to: a) describe methods of food security determination, b) determine food security status, and c) compare levels of food security obtained using various methods of food security determination. They found that the method based on DEC per adult equivalent per day based on 30 days' data gave the best results, followed by the results obtained based on DEC per capita per day based on 30 days' data.

However, they concluded that those levels of food security obtained using various methods did not differ significantly. They argued that DEC per capita based on any time duration could be the best method if the minimum consumption norm was realistic. They recommended that food security determination based on dietary energy consumed per capita per day should be used more than other methods to determine food security since it was more objective. These empirical results attracted the study to apply this indicator for measuring household food security as it is more realistic.

A paper by North (1993) examined the performance of food production and productivity in Tanzania since 2000 in relation to post-SAP policies. This discussion assumed that individual households in Tanzania strive to achieve food security through own production as well as purchases from the market. Meanwhile, the government strives to meet national food self-sufficiency of main staples (maize, rice and cassava) from local production, implying that individual farmers must produce a surplus, which is then marketed efficiently so that everybody can access sufficient and good-quality food at all times at affordable prices. Any change in the policy environment changes the opportunity set and hence the choices individuals make, which in turn shape the aggregate performance of economies over time. It is in this context that the analysis in this paper looks at the performance of food production and marketing, at the micro and macro levels, during the post-SAP period in Tanzania, as influenced by preceding and prevailing policies and institutions, in particular focusing on the magnitude and direction of change.

Floresta and CRC, (2010) undertook a study in rural King'ori ward, in Arusha Region of Northeast Tanzania, to analyse the linkage of social economic context to agricultural production in that area. Agriculture was the leading sector for food and cash, providing livelihoods for 82% of the population. It was revealed that between 2000 and 2010, food

production in the region had fluctuated around low levels due to poor productivity of land, limited technological capacity of farmers and a lack of agriculture technical support services. Deforestation, overstocking and poor farming methods contributed to land degradation, poor soil fertility and low food crop production. Women, who were the main producers and reliable labour force, faced continual oppression and discrimination in accessing production and economic opportunities. The study, therefore, focused on training female farmers with the end result of increasing their access to capital and generating greater incomes.

Floresta-Tanzania and Catholic Relief Service(CRS)–Sierra Leone are partners in SEEP’s Rural Agricultural Finance and Food Security (RAFFS) Practitioner Learning Programme (PLP) and Village Savings and Loan Associations and Food Security (VSLAFS). They jointly conducted a research on rural agriculture, finance, and food security. CRS and Floresta’s hypothesis was that VSLAs contributed to food security by increasing food availability, through improving agricultural productivity, and increasing food access, through an increase in household income (Floresta and CRC, 2010).By analyzing and documenting the linkage between VSLAs and food security, it is the hope that other practitioners will be more informed and able to develop programmes based on sustainable rural and agricultural finance models that stimulate economic growth and food security at the community and household levels. The following loan types were studied by CRS during the research period:

Agricultural Loans: These loans are taken for the purpose of agricultural production, including purchasing inputs (seeds and tools), hiring labour, renting land, building forest plant nurseries, and buying livestock and feeds.

Household Food Security Loans: These loans are taken to purchase food for the household (Floresta and CRC, 2010).

It shows that agricultural and food security loans are crucial for smallholder farmers since they critically fall short of financial resources to uplift their food security status. The study found that there was a great difference between households that received loans and those that did not receive. This is because loans provided to the households built their capacity in sustaining food security. According to URT (2008), the government has established the Rural Financial Services Programme (RFSP) to improve managerial and infrastructural capacities and also support some of the regulatory reforms as the Bank of Tanzania (BOT). This idea corresponds to Woldemeskel's arguments on institutions and markets, whereby it is argued that institutional factors, including access to credits, will help small scale farmers get loanable funds and commercialise their agricultural enterprises and be competitive in the markets.

2.6 Theories on Linkages between Institutions and Food Security

Thomas Robert Malthus was a British economist, demographer, and Reverend whose famous Theory of Population highlighted the potential dangers of overpopulation. In his famous *An Essay on the Principles of Population*, Malthus stated that while 'the populations of the world would increase in geometric proportions, the food resources available for them would increase only in arithmetic proportion [www.Brittanica.com/topic/470323/history]. In simple words, if human population was allowed to increase in an uncontrolled way, then the number of people would increase at a faster rate than that of the food supply. A point would come when human population would reach the limit up to which food sources could not support it. Any further increase

would lead to population crash caused by natural phenomena like famine or disease (Malthus, 1798, cited by Dyson, 1996).

However, Malthus' argument fell short of appreciating the power of knowledge among the population which could outstrip the maladies brought up by growing population. He dwelt more on quantity of population and neglected the quality aspect, including, Human Development Index (HDI) as were the cases of Malaysia and Singapore. However, in recent years, scramble for resources including the war between Israel and Palestine over land and water resources, Tutsi and Hutu in the Republic of Rwanda, Israel and Syria over Golan Heights popularly known as *Beirut syndrome*, Bashar Al-Assad Government versus Western Countries and rebels including the Kurds and Islamic States (IS), Zimbabwe government and White settlers, Nigerian Government versus Boko Haram rebels and cultivation on fragile mountain slopes like in Arusha, Tanga and Manyara Regions in Tanzania are clear evidences of population pressure on land. This shows that the theory still works and will continue to apply. In his book *The Enquirer*, William Godwin (1793:230) portrayed population growth as a means for human beings to attain equality. According to him, an increased population would create more wealth that would provide food for the whole humanity. Scholars of such school of thought believe that both man and society could be made perfect. However, Godwin did not consider knowledge, skills, training, education and attitudinal change as being important in the process of increased output per capita and hence sustainable food security.

Explanations of food insecurity are also given by pessimistic and optimistic theories, which are more popularly known as Malthusian and Anti-Malthusian theories. They are two rivalry positions on the relationship between food availability and population growth. Malthusian thinkers contend that food insecurity is due to presence of too many people

compared to the amount of food produced. By the Malthusian theory, it is argued as follows: “Subsistence (i.e. food production) increases only in an arithmetical ratio. By that law of our nature, which makes food necessary to the life of man, the effects of these two unequal powers (of population and food) must be kept equal.

This implies a strong and constantly operating check on population from the difficulty of subsistence survival. This difficulty (of providing sufficient food) must fall somewhere and must necessarily be severely felt by a large portion of mankind” (Malthus, 1798, cited by Dyson, 1996). However, Malthus was not the first person to argue so; works of Giovanni Botero (1544-1617) influenced him to the extent that Schumpeter (1994, cited by Brigham, 2004: 24) criticises him as follows: “The Malthusian Principle of Population sprang full developed from the brain of Botero in 1588.” The above information by Malthus is largely similar to what Botero wrote in his 1588 “*Delle cause della grandezza delle città*” (i.e. The Cause of the Greatness of Cities). He wrote as follows; “Populations tend to increase, beyond any assignable limit, to the full extent made possible by human fecundity: the means of subsistence, on the contrary, and the possibilities of increasing them are definitely limited. Therefore, it will impose a limit on that increase, the only there is; this limit asserts itself through want, which will induce people to refrain from marrying unless numbers are periodically reduced by wars, pestilence and so on” (Schumpeter, 1994, cited by Brigham, 2004: 45).

However, in the late 1960s Classic Malthusianism became less popular after Ester Boserup (1910-1999), mainly reacting against Malthus’s model of the relationships between population growth and food security argued successfully that technological development could boost food production enough to keep up with population growth for many years. She argued that population growth is a major factor determining agricultural development

(hence food security) and that “...in many cases the output from a given area of land responds far more generously to an additional input of labour than assumed by Malthusian authors” (Boserup, 1965: 35).

Boserup’s contentions are shared by other Anti-Malthusians, for example, Julian L. Simon (cited by Dyson, 1996: 144) who argues as follows: “The ultimate resource is people; skilled, spirited, and hopeful people who will exert their will and imaginations for their own benefit, and so, inevitably, for the benefit of us all. Conversely, if agricultural intensification causes a gain in overall prosperity as Boserup contends, then it will also enhance food security. Boserup suggested that a gain in overall prosperity is a direct consequence to her hypothesis of population-density-driven agricultural intensification, in sharp contrast to the causation from prosperity to population growth and poverty, which was suggested by Malthus. However, the quandary with Boserup’s Theory is in finding the balance between population growth that is ecologically beneficial (encouraging agricultural intensification and *reduction* in cropping area) and population growth that is excessive and ecologically harmful.

Netting *et al.* (1993) adopts the term *Malthusian equilibrium mode* to define this balance: The point of environmental limit at which the diminishing returns to fixed resources and the growing cost of technology and labour outweigh the stimulus to intensification. At this stable point of higher technology, Malthusian checks of limited resources and high population demands prevail over the Boserupian growth dynamic. This implies that, despite its weaknesses, Malthusian Theory still holds.

In 1756, Friderich C. Lütken (cited by Dyson, 1996) wrote: “It is in my opinion that there can never be too many people in a country, and the multitudes of people are the greatest

and most splendid wealth by which all other kinds of wealth can be achieved.” Another Anti-Malthusian scholar who held views similar to Lütken’s before Malthus wrote the first essay was Marquis de Condorcet (1743) who argued that with high population increase “a very small amount of ground will be able to produce a great quantity of supplies of greater utility or higher quality” (Dyson, 1996). In addition, Condorcet argued that education would bring lower birth rates, as rational human beings would see the value of limiting family size, giving their children the prospect for longer and happier lives. Reason, the anti-Malthusians argued, would secure a better balance between people and food (Kennedy, 1993; Sen, 1994, cited by Brigham, 2004).

The first agricultural revolution and the industrial revolution that occurred in Europe during the 18th century and the Green Revolution that occurred in India in the 1970s demonstrated the Malthusian thinking to hardly applicable. However, the debate that Malthus initiated has been so persistent and recurrent since then that even today, especially after the Second World War, there are Malthus’s followers who are known as Neo-Malthusians. Some of the today’s best-known Neo-Malthusians are Lester R. Brown and Hal Kane who, in a book titled *Full House* (1994) that they wrote, estimate that the earth’s optimum carrying capacity is about 5.5 billion people and argue that large parts of today’s developing world are caught in a demographic trap. They describe it as follows: “Once populations expand to the point where demands begin to exceed the sustainable yields of local forests, grasslands, croplands, or aquifers, they begin directly or indirectly to consume the resources base itself. Forests and grasslands disappear, soils erode, land productivity declines, water tables fall, and wells go dry. This in turn, reduces food production and incomes, triggering a downward spiral in a process described as the demographic trap (Brown and Kane, 1994).

Brown and Kane also argue that expansion of food production, like during the green revolution of India in the 1970s is difficult today. This is because the backlog of unused agricultural technology is shrinking, leaving farmers with fewer agronomic options to expand food output; demands for water are pressing against limits of the hydrological cycle to supply irrigation water; and in many countries the use of additional fertilizers on currently available crop varieties has little or no effect on yields.

Neo-Malthusians are very pessimistic about the relationship between food security and population growth; they predict that by 2020 there may be several hundred million excess deaths stemming from hunger and famine due to excessive growth of the global population (Brown, 2004). Nevertheless, anti-Malthusians are very optimistic about the relationship between food security and population growth; hence, their contentions are in stark contrast to those of Malthusians. For example, Dyson (1996) argues that it is not true that several hundred million excess deaths will occur by 2020; he adds that technology for food production, including biotechnology, will definitely make it possible to produce enough food even if population may grow much. Although the above pessimistic and optimistic theories differ in their explanations, both of them focus on food availability (supply), mainly through production.

There are both pessimistic and optimistic contentions about the relations between population growth and food security. Professor Amartya Kumar Sen in his 1981 book titled *Poverty and Famines: An Essay on Entitlement and Deprivation* in which he argues: “People do not usually starve because of an insufficient supply of food at the local, national or international level, but because they have insufficient resources, including money ('entitlements') to acquire it.” Sen classified entitlements into three categories of: 1) Endowments, which are all legal resources that can be used to obtain

food, including money, land, machinery and animals, but also more abstract resources such as labour power, “know how”, kinship and citizenship; 2) Entitlement mapping (or E-mapping). This includes terms of trade between endowments and food, goods, and the ratio between money wages and the price of food, or the input-output ratios in farm production; and 3) Entitlement-set, which represents the basket of food, goods, and services that a person can obtain using his/her endowments (Devereux, 2001, cited by Sijm, 1997).

Sen’s analysis of food security in terms of food access through entitlements rather than food availability, unlike Malthusians and Anti-Malthusians, gave rise to hot debates, most people opposing him. Woldemeskel (1990) argues that the entitlement approach is narrow because it dwells on only possession while food security attainment is contingent upon four determinants, viz.: (a) Availability, (b) Institutional elements, (c) Market forces, and (d) Possessions. Woldemeskel (1990) continues that the entitlement approach recognises the contribution of food availability to food security but dismisses it and completely ignores institutional elements and market forces. Some other writers have also criticised Sen’s analysis.

However, it is a point clear that when Sen was talking about entitlement to food he did not neglect institutional aspects as Woldemeskel argues since Sen mentioned food production, legal systems and marketing which are institutional aspects. Patnaik (1991, cited by Brigham, 2004) argues as follows: “It would be a grave error to ignore or discount long-term decline in food availability, for these trends can set a stage for famine even though famine does not thereby become inevitable.” This shortcoming is closely related to Woldemeskel’s point (a) that Sen recognises but dismisses food availability, and his point (b) that Sen completely ignores market forces. Alexandratos (1997) who

contends that the entitlement to food approach relegates the need to increase food production provides a subsidiary role share of Patnaik's view.

Later, after *Poverty and Famines* elaborated the entitlement approach as an innovative and holistic approach to famine analysis, debates about some of its fundamental assertions remain unresolved. A complementary analysis is required, one that recognizes the importance of non-market institutions in determining entitlements, famine as a social process and an epidemiological crisis, and violations of entitlement rules in the complex emergencies that typify most contemporary famines. The study on determinants of food security in Southern Ethiopia at household level by Feleke *et al.* (2009) showed that in the early 1980s, a paradigm shift occurred in the field of food security, following Amartya Sen (1981) claiming that food insecurity is more a demand concern, affecting the poor's access to food than a supply concern.

Despite a wide acceptance of Sen's thinking, many controversies including the relative importance of supply side versus demand side in causing and solving food insecurity have remained in academic and policy circles. The study developed a recursive household food security model within the framework of consumer demand and production theories following Singh *et al.* (1986), and poses out the relative importance of supply side versus demand side variables in determining household food security in southern Ethiopia. Based on results of a test of reduced model, and the magnitude of change, in conditional probabilities of food security they concluded that supply variables are more powerful determinants of food security than the demand variables.

It is agreeable to assert that Boserup considered that increased population will automatically induce new thinking and new attitude towards agricultural production and

hence attain food security. She was thinking about an institutional context which was effective enough to atomize population industriousness, something which is more ideal than reality. It is the conviction of this study that there is co-existence between institutions and organizations. In order to operate effectively and efficiently the two should be inseparable. Institutions should be organised in a certain absorbent structure and system so as to coordinate human behaviour toward achieving a particular desired goal. It is, therefore, logical to assert that co-existence between these two entities is vital for sustainable food security at the household level. Likewise, it is a matter of fact that advances in technology lead to increased agricultural production. Nevertheless, this can end up with creative destruction, for example innovation of bio-fuels which can lead to food deficits, the GMOs (Genetically Modified Organisms), seed varieties which have un-anticipated outcomes and the expansion of industrial sector leading to increase of Green House Gases (GHGs), such as CFCs, CO, CO₂, N₂O and SO₂, ultimately exacerbate increase of global temperature due to depletion of the ozone layer.

2.7 Gaps in Literature Surveyed

A variety of authors have provided positive arguments on reducing food insecurity through use of effective institutions. Attitudinal changes, coupled with provision of knowledge and skills, and education and training are important wherever one wants to talk about household food security. It was obvious that none of the authors specifically discussed about feasible and viable means of maintaining household food security at household level through institutions. Diyamett and Njau (2009) found great pre-and post-harvest losses among small-scale farmers but did not explore the most feasible and viable ways of alleviating the problem leaving it alone farmers training.

The limitations to Boserup's theory are that her ideas are also on a 'closed' community. In reality, communities are not closed because of migration in and out, and therefore it would be difficult to test Boserup's theory. Boserup failed to appreciate the importance of large households in the food production process and hence food security when the heads of households become aged. Boserup's book is not much more than a simple rejection of Malthus' theory. It aims at explaining all the characteristics of agriculture in any specific area and time according to the resource endowment, i.e. the land/labour ratio.

It is obvious that the authors like Floresta and CRC (2010) failed to link the crucial relationship between the two sex categories, male and female on the aspect of food security. Most African households are extended in nature and managed by both a father and a mother. However, gender relation is crucial in assuring household food security. Failure to link the two variables paralyses the efforts to maintain food security. Moreover, Floresta and CRC (2010) study fell short in appreciating loan procurement training and education as key aspects in the sustainability of any food security and agricultural development programme at the household level. However, it is evident that these authors did not deal with food security theories that explain link between institutional factors and household food security in Tanzania by studying the direct institutional support provided the status of household food security, and the correlation between food factors and institutional factors. This thesis provides a conceptual framework deemed to be an essential tool for providing appropriate approaches of household food security and linkage between institutional factors and food security factors by providing variables which are crucial in improving food security. The linkage between institutional factors and food security factors was a crucial proxy in determining food security at household level.

These research gaps provided a room for this study to explore new knowledge which was not known empirically before. Gender mainstreaming in food security remains an amicable approach towards household food availability, access, utilization and stability. Peoples' traditional norms and values (non-formal institutions) do play a great role towards sustainable food security. Likewise, changing peoples' mind set on food security is vital in management of household food security constantly and monitoring and evaluation of food inventory.

2.8 Conceptual Framework

Food security is a multi-dimensional phenomenon which operates within an institutional frame of reference. The conceptual model presented in Fig. 2 guided the exploration of the roles of institutions in the decision making processes to better utilize the resources by households to ensure their food security. Production theories were utilized to provide insights into such decision making processes (see for example Strauss, 1983; Feleke *et al.*, 2003; Shaikh, 2007). A similar theory can be used to explore decision making for selected household categories (small farmers and landless households).

The institutions were assumed to maximize their utility functions, for a given production cycle. This framework was chosen because it was considered suitable in explaining the relationships between institutional factors and food security factors. Fig. 2 shows the theoretical linkage between food security factors and institutional factors in terms of dietary energy per capita and per adult equivalent.

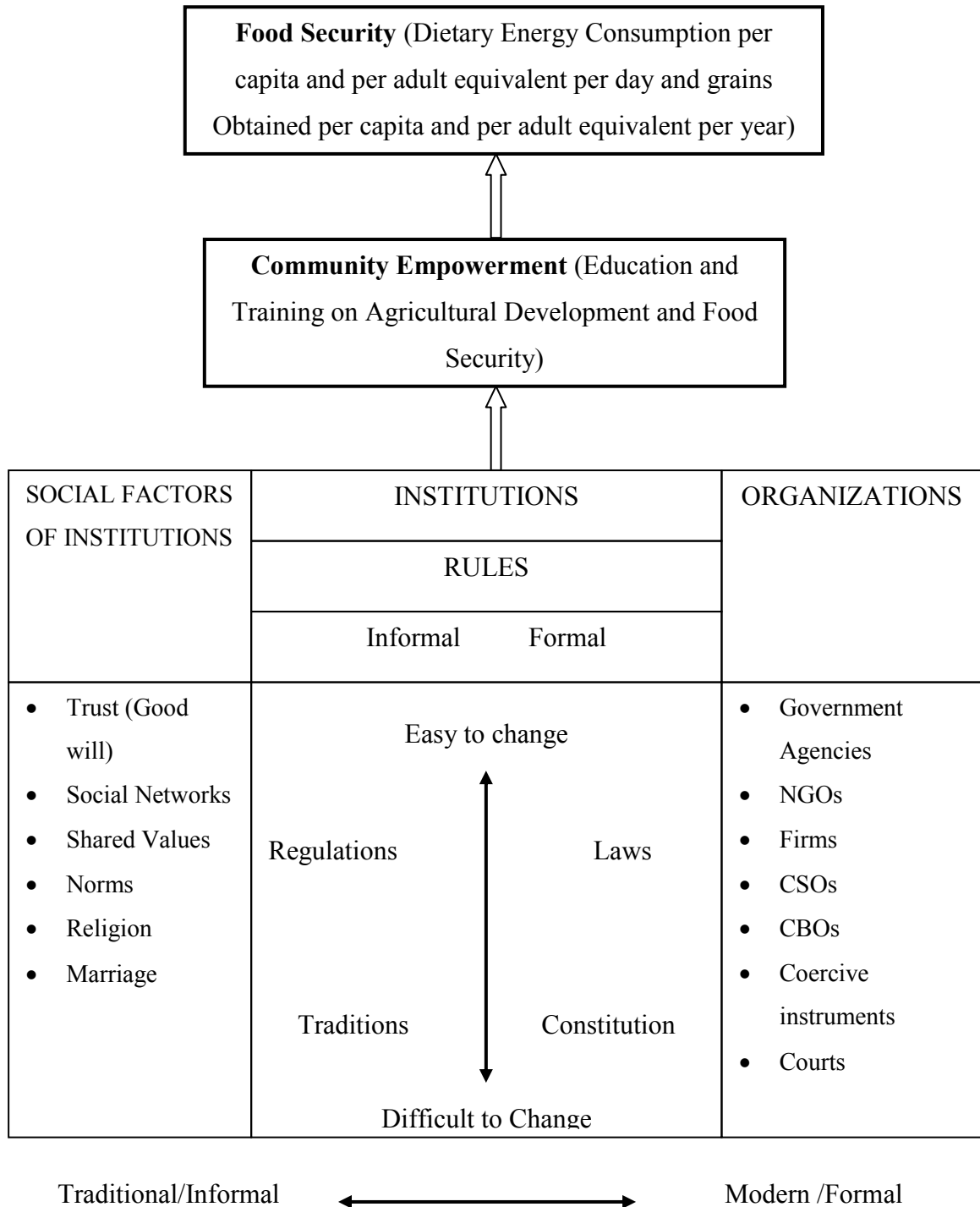


Figure 2: Social norms, rules and organizations for coordinating human behaviour towards food security.

Source: Adapted from World Bank (2003)

The conceptual framework shows that rules (formal and informal), organisations and the cognitive aspects (trust, norms and social networking) are essential in controlling households' behaviour towards food security through empowering households by providing knowledge, skills and attitudinal change hence ability to utilize their food inventory in a well-planned way. An organization is a unit that has a collective goal and is linked to an external environment. The word is derived from the Greek word *organon*, itself derived from the better-known word *ergon* which means "organ". In other words organizations are “social units (or human groupings) deliberately constructed and reconstructed to seek specific goals.”

A norm is something that is generally accepted in society, often taught during primary socialisation. It can be defined as an unwritten rule followed by a group of people. Norms can be positive or negative. Values are defined by one's personal preference, and how they were raised and how they think. A value is something that is more personal and is often linked to norms. Both structural and cognitive aspects of institutions work concomitantly to ensure food security at household level. Trust and social networking have become very crucial in the era of changing technology, especially Information Technology which has been introduced in rural areas.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Location of the Research Area

The study was carried out in Singida Region in Central Tanzania, particularly in Singida and Iramba Districts of the region. The region was purposively selected based on the food and income poverty severity index (PSI) derived from expenditure, adjusted for adult equivalent scales from Tanzania and Zambia, which shows that Singida Region has highest poverty severity index (6.8) in Tanzania, followed by Mara Region (6.8) and Dodoma Region (3.7). The lowest value was 1.0 for Dar es Salaam Region. Singida having the highest PSI in Tanzania and the stochastic dominance test (SDT) carried out using Dodoma as a benchmark, Singida Region showed dominance for all three orders while Mara Region showed none (Mkenda *et al.*, 2004:19), and hence giving justification for selecting Singida Region as a case study.

The region is bordered to the North by Shinyanga Region, to the Northeast by Manyara Region, to the East by Dodoma Region, to the Southeast by Iringa Region, to the Southwest by Mbeya Region and to the West by Tabora Region. It is one of the poorest regions in Tanzania. Singida is itself a region, a district, and a town. From Arusha, Singida is accessible through Babati and Katesh from the West in Region, while from Dar es Salaam it is accessible through Morogoro and Dodoma from the South-East, and from Mbeya it is accessible through Morogoro and Dodoma from the South-West. From Shinyanga and Mwanza, Singida is accessible through Nzega at the North-West in Tabora Region. Although not all the roads are passable all the year round, they are expected to be so in the near future when the connections to Arusha, Dodoma and Mbeya will be graded to the tarmac condition. Otherwise, the road to Shinyanga, Mwanza and

Tabora via Nzega is passable all the year round. Singida Region is deemed to be neither small nor big. It is the 13th in size and occupies about 5.6% of Mainland Tanzania's total area of 881 289 km².

Iramba and Singida Districts of Singida Region were purposively selected to represent other districts of the region since they had the best and the worst food security statuses respectively. More erratic rainfall in Singida District made people more prone to food shortage than in Iramba District. This implied that Iramba District had lower food insecurity severity index (FISI) than Singida District. Singida District is located in central Tanzania lying between latitudes 3⁰ and 7⁰ South of the Equator and longitudes 34⁰ to 35⁰ East of the Greenwich. It has a total area of 12 167 km², and a large part of the area is 900 to 4 400 metres above sea level. The district land use and distribution is as follows: agricultural land covers 7 282 km²; grazing land is 2 375.2 km²; forests and shrubs cover 2 200 km²; land covered by water is 50 km²; hills and rocks cover 89.8 km²; and barren land is 170 km². The landscape of Singida District is made up by tectonic movements since it is bound by the Eastern arm of the Rift Valley (SRP, 2009).

The land area is mainly highlands of the contour plateau along Mtinko and Ilongero Divisions while the rest is lowland and plains running to the southern part of the district. Woodlands of mostly acacia, miombo and Itigi thickets of water logged hyperaemia species. The district is covered by scattered trees and grasses. There are no permanent rivers, and there are few lakes which often dry up when prolonged drought conditions are experienced.

However, Singida District has a great potential in underground water. A large part of the district water table is very high with the exception of the rift valley parts. Generally, the

district is covered by grey red sandy soils. The fertility of the soil is considered low with the exception of the rift valley and upland areas adjacent to Manyara Region. Singida District has an annual population growth of 2.3%, which is below the national average that is 2.7%. According to the 2012 Tanzania National Population and Housing Census, the population of Singida Rural District was 498 480 (Ikungi District Council inclusive) (URT, 2013). Due to its geographical location, the district is one of the parts experiencing prolonged droughts and short rainfall commencing in late November and ending between April and May. The rains are often irregular and are always followed by drought (SDC, 2009).

Normally, there are two periods of drought spell, which occur during the rainy season: a short term drought spell that occurs in December and a long term drought spell that occurs between January and February, resulting into low or poor harvests and often acute food insecurity. The average rainfall is between 600mm and 700mm per annum. It is lower in the rift valley than in upland areas of Ilongero and Mtinko. The district has an annual average temperature of 22.5⁰C. The lowest temperatures are recorded in July while the highest temperatures occur between September, October and November. May to July and August are cold and windy months. Rift valley areas experience high humidity as compared to the other parts of the district. Plains range from 1 000 metres to 1 500 metres above the sea level. Singida Rural is one of the six districts of Singida Region (since 2012) of Tanzania. It is bordered to the North by Iramba District, to the East by Hanang' District, to the South by Ikungi District and to the West by Tabora Region. Administratively, Singida District Council is divided into 7 Divisions, 28 Wards, 146 Villages, and 840 hamlets (SDC, 2009).

In terms of economic activities, proportionately few people are employed in urban areas either by Government organisations or are self-employed, while in the villages most of the people are farmers or cattle herders. Though in the district there are no large farms, the farmers grow mostly maize, paddy, sorghum, bulrush millet, finger millet, wheat, barley, cereals, cassava, sweet potatoes, Irish potatoes, yams, cocoyam, roots and tubers, mung beans, beans, cowpeas, green gram, pigeon peas, chick peas, bambara nuts, field peas.

Other crops grown include; pulses, sunflower, simsim, groundnuts, soya beans, castor seed, oil seeds and oil nuts, okra, radish, turmeric, bitter aubergine, garlic, onions, ginger, cabbage, tomatoes, spinach, carrot, chillies, amaranths, pumpkins, cucumber, eggplant, water melon, cauliflower, fruits and vegetables, seaweed, cotton, tobacco, pyrethrum, jute, cash crops, sugarcane, banana, mango, pawpaw, guava, lime/lemon, pigeon peas, cashew nut, orange, tamarind, nutmeg, *bilimbi*, sorghum, millet, cassava, paddy, and beans as food crops while cotton, groundnuts, finger millet, pigeon nuts, and sunflower are grown as cash crops (URT, 2007; NBS, 2007, MAFSC, 2007).

According to a regional survey conducted by the Regional Agricultural Advisor's Office team in 2008, it was estimated that the area under small scale cultivation was 73.2%, and that the area under grazing was 56.5 % (DALDO, 2009). Iramba District in Singida Region has its headquarters in Kiomboi town, 100 kilometres away from Singida Town, where the Regional Administrative Headquarters are located. Iramba is one of the six districts of Singida Region of central Tanzania since 2012.

It is bordered to the North-West by the Shinyanga Region, to the Northeast by Manyara Region, to the South by Singida Rural and Singida Urban Districts. To the West it is

bordered by Tabora Region. The district borders with Meatu and Mbulu Districts to the North, Hanang District to the East, Singida District to the South, Shinyanga District to the West and Meatu District to the North-West. Iramba District lies between 4° to 4°.3° S Latitudes and 34° E to 35° E Longitudes. The district has a total population of 425,015 (Mkalama District Council inclusive) people according to the 2012 National Population and Housing Census (URT, 2013).

Iramba is the most densely populated district in Singida Region. The average population per square kilometre is 260 people, against the regional average of 28 people and the national average of 51 people per square kilometre, and the average household size in the district as per 2012 Population and Housing Census was 5.4. Administratively, Iramba District council is divided into 7 divisions, 26 wards, 126 villages and 718 hamlets. Plains range from 1 000 metres to 1 500 metres above the sea level (IDC, 2009).

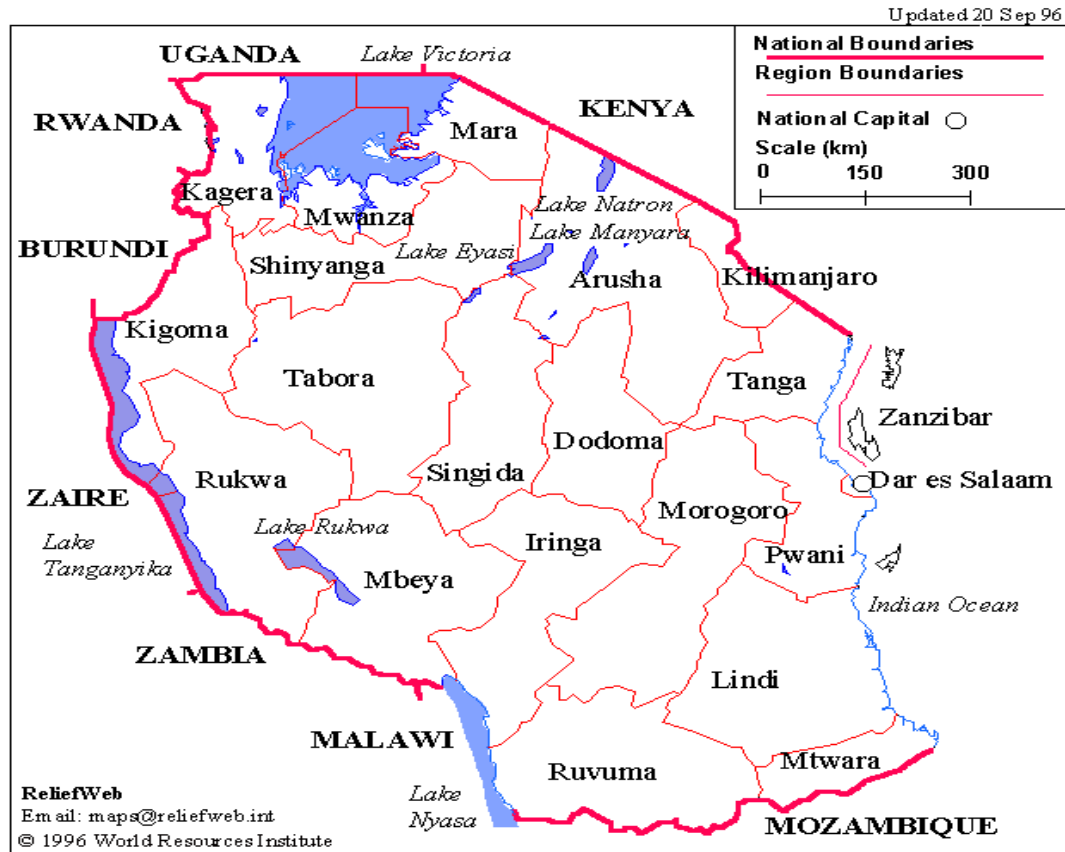
The district has an area of 7 900 km² or 790 000 hectares which are divided for their uses as follows: Arable land is 3 500 km² or 350 000 hectares (44.3% of the total land), but land underutilization is between 1 500 km² and 2 000 km² (19 to 25% of the total land). Grazing land has an area of 3370 km² (42.7% of the total land/area). Forests cover 73 592 km² of land (9.3% of the total land). Area covered by rocks and water is 29 408 km² (DALDO, 2009). Iramba District differs from other parts of Singida Regions it is demarcated by well-defined agro-ecological zones with the following features: a) *The western low lands and Wembere Plateau Zone*- The Wembere low lands plateau is within the great rift valley of Tanzania and shores of Lake Kitangiri with an elevation of 500 m to 1 000 m above the sea level, with black, red and loam soils; b) *Central zone* - The central zone is covered by hills and plateaux with an elevation of 1 000 m to 1 500 m above sea level, with sandy loam soils and c) *The Eastern zone* - The eastern zone lies in

lowlands along the Great Rift Valley with scattered hills and red, black and sandy loam soils.

It mounts an elevation of 1 000 m to 1 500 m above sea level. Most of Iramba District areas receive early rainfalls, which normally range between 500 mm and 850 mm per annum. Rainfall usually starts in mid-November and ends in mid-May. Rainfall is unimodal, and the rain season is interrupted by two notable dry spells in mid-February and mid-March.

Temperature in the district ranges from about 15°C in July to 30°C during October each year. Soils are generally red brown with fairly high fertility status. They include black soils, loam and sandy soil covering the whole district. Iramba District is rich by having a variety of natural vegetation which is found in it; these are Miombo wood lands, acacia wood lands and grasslands. Agriculture is the largest sector of the district's economy; about 85.2% of the population is engaged in it. The main food crops are maize, bulrush millet, sorghum, paddy, cassava, sweet potatoes and beans. The main cash crops grown in the district are sunflower, onions, groundnuts, cotton, simsim, pigeon peas and yellow grams. In general, with all the economic undertakings in Iramba District, still the per capita income is TZS 240 000 annually (IDC, 2009). Fig. 3 and 4 show the maps of Tanzania and of Singida Region, Iramba District and Singida District.

TANZANIA with administrative boundaries

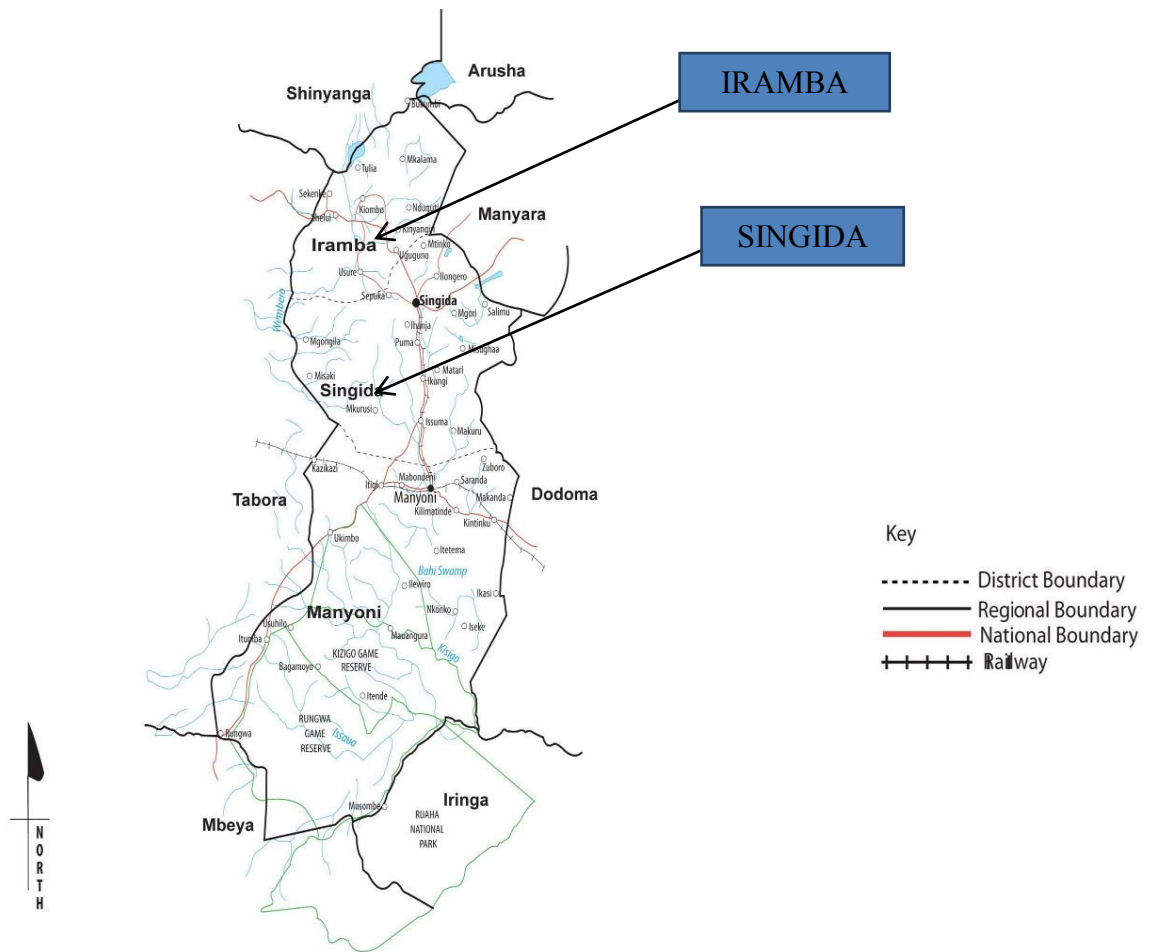


The boundaries and names shown on this map do not imply official endorsement or acceptance by the United Nations or ReliefWeb. These maps may be freely distributed. If more current information is available, please update the maps and return them to ReliefWeb for posting.

Scale: 1:1000000

Figure 3: Location of Singida Region in Tanzania.

Source: Google Search, 23/02/2015



Scale; 1:10000

Figure 4: Singida Region Map and its Boundaries.

Source: Google Search, 20/09/2010

3.2 Research Design

Kothari (2009) defines a research design as the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. In view of that definition, this study used a cross-sectional research design. The design was chosen because it entails collection of data on a number of cases at a single point in time in order to collect a body of quantitative and/or qualitative data about two or more variables (usually many more than two), which are then examined to detect patterns of association (Bryman, 2004). The study involved

asking questions to a representative sample of the population at a single point of time. The instruments used for data collection were household questionnaire, interview checklist and focus group discussion guide. The design was appropriate for descriptive purposes as well as for determination of relationships and effects between and among variables. It helped to uncover the characteristics and attributes of the background variables and independent variables used in the study, and also to explore correlations and differences among variables used in the study. This method was considered to be useful because of time limit and resources that were available for the research hence fulfil the objectives of the study.

3.3 The Sample and Sampling Procedures

3.3.1 Population

The population for the research was all households in the two districts. The households were engaged in production of both crops and livestock. The households included small scale crop producers, mixed farmers and pastoralists.

3.3.2 Sample size and sampling unit

Two districts, Iramba and Singida, were selected using purposive sampling. The two districts were different in terms of agro-ecological zones and levels of food security. The differences gave an opportunity to compare levels of food security in the two districts based on those factors, institutional factors and some other factors. The sample size was 240 respondents from eight (8) villages, eight (8) wards, four (4) divisions, two districts and one region which were involved in the study. The sample size was determined by using the formula developed by Kothari (2008) which is stipulated as:

$$n = Z \cdot N \cdot \sigma_p^2$$

$$(N-1) e^2 + Z^2 \sigma_p^2$$

n = Size of sample

N = Size of population (total number of households in the two districts) = 217,527

z = Standard variant at a given confidence level (95% confidence level) = 1.96

e = acceptable margin of error of estimation. The acceptable error is to be kept within + 3 of the sample mean with 95% confidence, then we can express the acceptable error as $e = z \sigma_p / n^{1/2} = 3.0$, as expressed by Kothari (2004)

σ_p = standard deviation of population = 33.7

$$\frac{1.96 * 217,527 * 33.7^2}{(217,527-1)3^2 + 3^2 * 33.7^2} = \frac{484,336,917.12}{1,962,098.0} = 246$$

The sample size was rounded to 240 households instead of 246 households from the two districts in order to have equal distribution of numbers of households per village since the number of village populations and household characteristics did not differ much. The households ranged between 400 and 450 with population ranging between 3 000 and 3 500 per village. The sampling units were households, key informants and focus groups. The sample size for households was justified on the fact that “too large a sample implies a waste of resources, and too small a sample diminishes the utility of the results” (Cochran, 1977, cited by Bartlett *et al.* 200: 46).

Two divisions were selected purposively from each of the two district, according to agro-ecological zones. Four divisions were selected from the two districts. Ilongero and Mungaa Divisions were selected from Singida District; Shelui and Kisiriri Divisions were

selected from Iramba District. Eight wards were selected randomly through the lottery method, four from each district, out of 54 wards. They were stratified as peri-urban and rural wards. The wards selected in Singida were Merya, Ilongero, Ntuntu, and Siuyu. Those of Iramba District were Mgongo, Shelui, Kiomboi, and Kisiriri. Thirty (30) respondents were selected from each ward. The respondents were distributed spatially in terms of districts, divisions, wards and villages. Therefore, stratified sampling was used to select the villages, wards and divisions formed the strata. All these were selected to be reasonable representative of the two districts Table 2 shows the distribution of the respondents surveyed in the two districts by spatial location.

Table 2: Spatial distribution of respondents in the two districts

| District | Division | Ward | Village | Number of respondents | Percentage distribution |
|-----------------|-----------------|-------------|----------------|------------------------------|--------------------------------|
| Singida | Ilongero | Merya | Merya | 30 | 12.5 |
| | | Ilongero | Kinyamwambo | 30 | 12.5 |
| | Mungaa | Ntuntu | Ntuntu | 30 | 12.5 |
| | | Siuyu | Siuyu | 30 | 12.5 |
| | Shelui | Mgongo | Kizonzo | 30 | 12.5 |
| | | Shelui | Nselembwe | 30 | 12.5 |
| Iambi | Kisiriri | Kiomboi | New Kiomboi | 30 | 12.5 |
| | | Kisiriri | Kisimba | 30 | 12.5 |
| Total | – | – | – | 240 | 100.0 |

3.3.3 Sampling strategy

3.3.3.1 Sampling strategy for Focus Group Discussions

Furthermore, the 240 households for questionnaire administration, 8 groups were selected for qualitative data collection through Focus Group Discussions (FGDs). A focus group

discussion guide was used to collect information from focus group discussants. Each group had 6 to 8 members for effective discussions. This number is recommended by Bryman (2004) and Wilkinson (2004) for effective group discussion. The Village Executive Officers (VEOs) from the eight villages assisted the researcher to pick people for discussion groups. The people selected for discussions included household heads or their representatives and any other eligible members for that purpose. The information obtained during the discussion was used to enrich the information collected from the households using the questionnaires. Focus group discussion helped the researcher to understand the feelings, experience and emotions of the respondents on the issue of food security in households and why some of the households are food insecure while others are not. This also enabled the researcher to get insights into the level of food security. In total, eight discussion sessions were conducted in the four secondary schools. The information gathered from the students helped to validate the information collected from the households as well as clarifying some unclear issues obtained during FGDs with household heads.

The 8 groups were considered to be enough for the research that was more quantitative, unlike in purely qualitative studies, for example using grounded theory, whereby the numbers of groups is determined by theoretical saturation. Theoretical saturation is a phenomenon whereby one carries on sampling theoretically until (a) no new or relevant data seem to be emerging regarding a category, (b) the category is well developed in terms of its properties and dimensions demonstrating variation and (c) the relationship among categories are well established and validated (Strauss and Corbin, 1998, cited by Bryman, 2004). Focus group discussants were chosen to represent people doing various economic activities, men and women, age groups, and various social statuses. The qualitative information collected from the pre-determined numbers of groups in the

communities where questionnaire-based data were collected were considered to add reasonable explanations to the quantitative data that were collected.

3.3.3.2 Sampling procedure for households

The households for the research were selected by using stratified sampling and simple random sampling. These two procedures were used in order to get a sample of households with varying level of food security (highly food insecure, moderately food insecure and food secure). Selection of the wards and divisions was done through random sampling. The lists of households were prepared by using the village registers containing the names of heads of household and their current members.

The names of the household heads for the two districts were chosen by using a lottery method. This process was done for all the eight villages. The households were obtained through direct contact. The villages were Merya, Kinyawambo, Siuyu and Ntuntu in Singida District and Nselembwe, Kizonzo, New Kiomboi and Kisimba in Iramba District. The villages were randomly selected through lottery method. Interview schedules were administered to all 240 respondents; 30 respondents in each village were involved.

3.3.3.3 Sample selection for key informant interviews

Key informant interviews involve interviewing a select group of individuals who are likely to provide needed information, ideas, and insights on a particular subject. Depending on the nature and scope of an inquiry, the investigator identifies appropriate groups from which the key informants are drawn and then selects a few individuals from each group. The key informants were purposively selected. This means that the inquirer selects individuals and sites for study because they can purposefully inform an understanding of the research problem and the central phenomenon in the study

(Cresswell, 2007). The selection of key informants was based on particular persons' knowledge on household, district, region and national food security status in the past, present and future likelihood. The first key informants were officers belonging District Agricultural and Livestock Offices (DALDOs) from the two districts. These officers provided data and information regarding agricultural development, production and food security.

The other key informants included the District Community Development Officers (DCDOs) as the department that deals with mobilization of people for various development activities, including agriculture and food security. Extension workers from both departments were involved in this process at the ward level. There were a total of 18 Key Informant Interviewees (KII). The number of key informants was within the ranges from 15 to 35 stipulated by Kumar (1989).

3.4 Instruments for Data Collection

3.4.1 Household questionnaire

A household questionnaire with both open-ended and closed-ended questions was formulated for administration to the heads of household or their representatives at the household level. The instrument was focused at eliciting information on background variables (age, sex, marital status, education, family size, occupation and economic status), institutional support on food security, food security status at the household level, and inter-linkages between food security factors and institutional factors.

3.4.2 Focus group discussion guide

A checklist of items or topics for discussions with discussants was prepared and used at the village level in all the eight sampled villages. This facilitated in getting in-depth

information regarding the status of food security, transitory food insecurity, marketing system, food price dynamics, micro and macro-nutrients, seasonality and institutions at the household and district levels.

3.4.3 Key informants interview checklist

A checklist of items for discussion was prepared for discussion with district level agricultural officials, Ward Executive Officers (WEOs), Village Executive Officers (VEOs), Community Development Officers (CDOs) and progressive farmers in the form of semi-structured interviews to collect information on agricultural development, food security and institutional issues. This tool helped in getting deeper information on the real situation regarding institutions and institutional support to farmers and status of household food security.

3.5 Types and Sources of Data

The study involved both primary and secondary data. Primary data were obtained directly from household heads or other knowledgeable household members in order to get details about institutions and household food security using both structured and semi-structured interviews. The source of primary data included heads of households in eight villages which were randomly selected from the four selected wards.

Secondary data were obtained from Local government authorities at the district level, Participatory Agricultural Development and Empowerment Programme (PADEP) and other related institutions. The main sources of secondary data were institutions including: Ministry of Agriculture, Food Security and Co-operatives (MAFSC); Ministry of Water and Irrigation (MoWI); Ministry of Natural Resource and Tourism (MNRT), Ministry of

Finance and Economic Affairs (MFEA); Ministry of Infrastructure Development (MOID).

Others included; Ministry of Livestock and Fisheries (MLF); Ministry of Community Development, Gender and Children (MCDGC); Tanzania Food and Nutrition Centre (TFNC); National Bureau of Statistics (NBS); Agricultural Marketing System Development Program (AMSDP) and Participatory Agricultural and Empowerment Programme (PADEP). They were also obtained from Sokoine National Agricultural Library (SNAL) which is based at Sokoine University of Agriculture (SUA), National Strategy for Growth and Reduction of Poverty (NSGRP) situated at MKUKUTA office Dar-Es Salaam, National Bureau of Statistics (NBS), Economic and Social Research Foundation (ESRF), and the Internet.

The data sought through this method were related to prevalence, trend and distribution of food security and undernourishment incidences across international, regional and national administrative boundaries from different books, reports, records and periodicals as well as its linkage with institutions. Data collection procedures followed the official channel seeking permission from regional, district, ward and village council authorities.

3.6 Data Collection Procedures

3.6.1 Pre-test for data collection

The procedure started by making a pre-survey in August 2009 and actual data collection started in January, 2010 in order to test the relevance of the research instruments. The respondents included key informants at both the regional and district headquarters. Specifically, the targeted people included the Regional Agricultural Advisor (RAA), District Agricultural and Livestock Development Officers (DALDOs), District

Community Development Officers (DCDOs), and extension officers from the two departments.

The process was followed by the pre-test of the data collection tools, basically the household questionnaire and the focus group discussion guide. The pre-test was done in Mwankoko A and Mwankoko B Villages, which are in the jurisdiction of Singida Municipality and were not among the eight sampled village. The pre-testing involved a total of 20 respondents who were heads of household or household representatives and two FGDs with eight people in each village. The purpose was to test the appropriateness, validity, reliability and preciseness of the instruments and make some necessary adjustments.

3.6.2 Data collection procedures by objectives

Objective One: To appraise qualitatively the role of institutions in food security. The data for this objective was obtained from the focus group discussions guide which was the tool used to get responses from 8 FGDs that were formed. Questions pertinent to institutions quality and food security were prepared and used to tape information from different groups.

Objective Two: To identify institutions and their key functions. The data for this objective were obtained by identifying institutions in collaboration with key informants available in the study area and their profiles (name, location, vision, mission, goals and objectives of their programmes), in view of getting agricultural development and food security related institutions. The number of clients served by these institutions in 2010/11 was provided by the key informants, types of institutional support provided, institutional support in monetary terms, the frequency of service delivered and the service areas

covered by projects, their efficiency in service delivery and key functions. Efficiency generally describes the extent to which time, effort or cost is well used for the intended task or purpose. It is often used with the specific purpose of relaying on the capability of a specific application of effort to produce a specific outcome effectively with a minimum amount or quantity of waste, expense, or unnecessary effort. In general, efficiency is a measurable concept, quantitatively determined by the ratio of outputs to inputs. Effectiveness is a non-quantitative concept, mainly concerned with achieving objectives. Effectiveness deals with assessing: a) The ability of the institution to achieve its stated mission and its long range plan, b) To assess congruence of external and internal policies and procedures of the institution with its stated mission and c) To assess institutional support efforts to effectively meet organization's needs (Reus-Smit, 1999).

Objective Three: To determine the status of food security at the household level. Data for this objective were obtained by determining the daily food intake per capita and per adult equivalent, and numbers of meals eaten per household per day. Moreover, weekly and monthly meal frequencies and quantities per household, food import dependency ratio (IDR), and amounts of grains obtained per capita per year (through production, buying, and receiving grains freely) were obtained. The principal method that was used to determine food security was dietary energy consumption (DEC) per capita and per adult equivalent unit (AEU) per day on the basis of all foodstuffs eaten by all household members for 30 consecutive days. This method was chosen because dietary energy consumption is the actual indicator of food sufficiency, and the method is commonly used in Tanzania, e.g. by the National Bureau of Statistics in various Household Budget Surveys. Therefore, it is easy to compare the results of this study with national data on food security.

Objective Four: To establish linkages between institutional factors and food security factors. Data for this objective were obtained by selecting institutional factors such as rules, regulations, policies, norms and values, available agencies, organizations etc. and food security factors such as level of production, consumption, dietary diversity score and daily food energy intake per capita etc. The linkages between institutional factors and food security were determined by using inferential analyses, particularly Pearson's and Spearman's correlation coefficients, t-test and multiple linear regressions.

3.7 Data Management Procedures and Analysis

3.7.1 Qualitative data analysis

Marshall and Rossman (1995, cited by Pervez and Kjell, 2005) state that qualitative data analysis is the process of bringing order, structure and meaning to the mass of collected data. Creswell (2007) argues that data analysis in qualitative research consists of preparing and organizing the data for analysis, then reducing the data into themes through a process of coding and condensing the codes and finally presenting the data in figures, tables, or a discussion. Qualitative data were reduced by selecting, focusing, simplifying, abstracting and transforming them into categories, themes and patterns. The data were then organized, compressed, compared and integrated to meaningful tabulations and interpretations.

3.7.2 Quantitative data analysis

Preparations for quantitative data analysis involved the following steps: compilation, classification (attributes, interval), editing, cleaning, sorting (field and central), coding, data entry, verification and tabulation. Then the data were entered into Statistical Package for Social Sciences (SPSS) computer programme.

3.7.3 Descriptive data analysis

Descriptive data analysis was done by computing distributions of individual variables in terms of frequencies, cross-tabulations, means, proportions, variances, standard deviations, coefficients of variation, medians, modes, minima, maxima and ranges.

3.7.4 Inferential data analysis

Inferential analyses involved testing the two null hypotheses stated in Chapter 1. The first null hypothesis, which stated that food security in terms of grains obtained per year and food utilization in terms of dietary energy consumed per adult equivalent per day do not differ significantly among households having different institutional factors, was tested using T-test to compare grains obtained per capita per year and dietary energy consumed per adult equivalent per day between households by different institutional factors to find whether they were significantly different. The second null hypothesis that stated that amount of food produced with institutional support does not have significant in terms of dietary energy consumed was tested by using multiple linear regression to determine impacts (negative and positive) of the independent variables used on food security at the household level. The regression model that was used to test the second hypothesis was specified as follows:

$$Y_i = a_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + b_{10}x_{10} + e$$

Y_i = Dietary energy consumed (DEC) per adult equivalent per day.

a_0 = A constant

$b_1 \dots b_8$ = Coefficients of regression

$x_1 \dots x_8$ = Independent variables

x_1 = The amount of credit provided to the households by institutions

x_2 = Total acreage irrigated by households

x_3 = Total food production with institutional support

x_4 = Total acreage cultivated by households

x_5 = Number of household members who received training

x_6 = Number of training sessions provided to households

X_7 = Total value of infrastructure constructed in million TZS

X_8 = Total times farmers got extension officers advice

e = Regression error term

3.8 Limitations of the Study

The research had three main limitations. One was lack of records of food produced, bought, sold, consumed at home or outside households. It happened that some heads of households sold crops before harvesting by estimating the price and quantity of the crops to be produced (on-farm selling) which made it difficult to report on actual production. Some household heads had habitual tendency of eating food at their neighbours' or friends' homes frequently; this made it difficult to consider them as permanent members of households in terms of food consumption, and made it difficult to determine the number of household members who always ate in-house. The problem was minimized by use of trained data collection enumerators who were able to probe adequately.

Another limitation was lack of standardised measure of some foodstuffs, especially in liquid form such as *togwa*, *magai ma nkata*, *ntulu* and *mtukulu*; which made respondents fail to report precisely the right amounts of such foodstuffs consumed as the unit of measurement was traditional e.g. calabash. These foodstuffs are always drunk by a group of people from different households. This problem was minimized by enumerators finding their equivalence in kg or litres in order to minimise over or under-reporting of shared liquid foodstuff. The amounts consumed were distributed evenly among the group members.

Another limitation was thirty days' recall data on food consumption, bearing in mind that human mind is subject to fallibility due to time lag. The problem is more exacerbated when quantitative data are required. When the household members fail to remember the previous month's consumption pattern hence the questions needed repetitions, the respondents became exhausted with repeated interviews hence they were likely to dodge an interview or give hasty and uncertain answers. This limitation was minimised by the author training the enumerators on data collection for this research and staying in the research area during the data collection exercise process to clarify any difficulties.

CHAPTER FOUR

4.0 FINDINGS AND DISCUSSION

4.1 Socio-Economic and Demographic Characteristics of the Households Surveyed

4.1.1 Demographic characteristics

The research involved households of different categories in terms of family size, age, sex, years of schooling, marital status and occupation of household head. Moreover, household headship was taken into account by including female headed households (FHHs) and male-headed households (MHHs), in order to avoid gender bias in responses. However, MHHs were more numerous than FHHs because the latter are naturally fewer than the former. It was found that 82.9% of the households were male headed and 17.1% were female headed in both districts (Table 3). However, in Tanzania FHHs and MHHs are 24.4% and 75.6% respectively (World Bank, 2010). Household headship in rural areas of the study districts was considered to be one of the determinants of food security since FHHs were less endowed with land entitlement compared to MHHs. The greatest proportion of the FHHs (9.6%) were widows. MHHs being much more numerous than FHHs is a common cultural reality in most African families whereby the community entrusts a man with the responsibility of feeding the family, protecting them against social injustice, clothing them and making shelter for them. Moreover, the significance of marital status in agricultural production can be explained in terms of supply of agricultural family labour. It is expected that family labour would be more available where the household heads are married. Three-quarters (75%) of all heads of household who were married were male (Table 3), which shows that the households surveyed were culturally male dominated.

Table 3: Cross-tabulation of marital status of household heads (n=240)

| Respondents' sex | Marital status of household head (%) | | | | | Total |
|------------------|--------------------------------------|-------------|------------|------------|------------|--------------|
| | Married | Not Married | Widowed | Widower | Divorced | |
| Male | 75.0 | 3.8 | 0.0 | 2.8 | 1.3 | 82.9 |
| Female | 0.0 | 6.2 | 9.6 | 0.0 | 1.3 | 17.1 |
| Total | 75.0 | 10.0 | 9.6 | 2.8 | 2.6 | 100.0 |

Generally, age is a fundamental measure of population structure. Demographers and other social scientists have special interest in the age structure of a population because several social relationships within the community depend on age. The significance of age on farm output has been examined extensively, e.g. by Rougoor *et al.* (1998) who found that the influence of age on farm productivity is very diverse. Some studies have found that age has a positive effect on productivity (Kalirajan and Shand, 1985; Stefanou and Sexena, 1988). Also, a study by Adubi (1992) reveals that age has a significant correlation with the decision-making process of farmers with respect to risk aversion, adoption of improved agricultural technologies, and other production-related decisions. Age has been found to determine how active and productive the head of the household would be. Age has also been found to affect the rate of household adoption of innovations which, in turn, affects household productivity and livelihood improvement strategies (Dercon and Krishnan, 1996).

The age distribution of the household heads ranged from 20 to 79 years, with a concentration between 36 and 64 years and an average age of 46.0 years. The concentration of the age-cohort of the heads of household imply that members of their age group had strong command in managing household assets including land for agricultural production and hence higher possibility of food security. Table 4 shows the percentage distribution of respondents by age group.

Table 4: Percentage distribution of respondents by age group (n=240)

| Age Group (Years) | n | Percent |
|--------------------------|------------|----------------|
| Lowest to 35 | 35 | 15.0 |
| 36 – 64 | 190 | 79.0 |
| 65 to highest | 15 | 6.0 |
| Total | 240 | 100.0 |

Likewise, household size is an important determinant of food requirements per household based on dietary energy consumption per capita per day and per adult equivalent per day. The significance of household size in agriculture hinges on the fact that the availability of labour for farm production, the total area cultivated for different crops, the amount of farm produce retained for domestic consumption, and the marketable surplus are all determined by the size of the farm household. Household size is another factor expected to have influence on food security status of households. It was found that 5% of the households had family sizes of 1 to 2 members whereas one-quarter (25%) of households had family sizes of 3 to 4 members. However, 28% of the respondents' households consisted of 5 to 6 members. Twenty percent of the households had sizes of seven members and above. The minimum household size was one, and the maximum size was 12 members. The mean household size was 5.3, which was above the national average of 4.7 (URT, 2013). Downey (1995) pointed out that large families are not food security friendly; this is because people with more household members can devote less time and resources to each individual member. This shows that members from large households are likely to be more prone to food insecurity and poverty than members living in smaller households.

Similarly, age dependency ratio (ADR) determines the proportion of the household members and the population proportion that depends on the adults for their basic needs,

especially food requirements. When ADR is greater than 100.0%, the household is subject to the risk of food insecurity (Maharjan and Khatri-Chhetri, 2006). The mean ADR for the two districts was 83.9 % (n = 240) whereas it was higher in Singida (97.2%) than in Iramba where it was (70.7%). The ADR for Tanzania is 92 (WB, 2011). Table 5 shows age dependence ratio among different groups of respondents of the households surveyed.

Table 5: Age dependence ratio among different groups of respondents (n=240)

| Category of Respondents | n | Age Dependence Ratio (%) |
|--------------------------------------|-----|--------------------------|
| Male headed households | 155 | 88.0 |
| Female headed households | 85 | 81.7 |
| Crop producing households | 112 | 89.1 |
| Crop and animal producing households | 115 | 71.4 |
| Households with divorced heads | 6 | 141.9 |
| Households with widowed heads | 23 | 114.9 |

The distributions of the household heads studied by sex, marital status and age were important in analysing the demographic characteristics of the respondents. They are all crucial determinants of population growth which might create negative relationship between rapid population and food security as Malthusian and Neo-Malthusian Theories contend. The variables are essential in determining labour force in agricultural and other related sectors as propounded by Boserup (1993).

4.1.2 Socio-economic characteristics of the households

One of the social characteristics used was education. Many studies have revealed that the level of education (years of schooling) helps farmers to use production information efficiently, as a more educated person acquires more information and, to a large extent, is a better producer (Hayami 1969, Lockheed *et al.*, 1980; Phillips, 1994; Wang *et al.*, 1996; Yang, 1997). The level of farmers' education is believed to influence the use of improved

technologies in agriculture and, hence, farm productivity. The level of education determines the level of opportunities available to improve livelihood strategies, enhance food security, and reduce the level of poverty.

It affects the level of exposure to new ideas and managerial capacity in production and the perception of the household members on how to adopt and integrate innovations into the household's survival strategies. Table 6 shows the distribution of the levels of formal education among household heads. Education is a pre-requisite factor in bringing down the population growth and spur the development process as well as food security as explained in Section 5.2 as follows: Marquis de Condorcet (1743-94, cited by Dyson, 1996: 6) argued that education would bring lower birth rates, as rational human beings would see the value of limiting family size, giving their children the prospect for longer and happier lives. However, in view of the author of this thesis, this assumption works only where the population is literate enough to consider the value of few, but well taken care of, children. Table 6 shows the distribution of respondents by level of education.

Table 6: Distribution of respondents by level of education (n=240)

| Education Level | Frequency | Percent |
|-------------------------------|------------------|----------------|
| Informal education | 5 | 2.0 |
| Incompleted primary education | 50 | 21.0 |
| Standard seven | 170 | 71.0 |
| Secondary education and above | 15 | 6.0 |
| Total | 240 | 100.0 |

It was found that 71% of the household heads had completed standard seven and only 6.0% had completed secondary school and above. This indicates that most respondents had low level of education, which might affect food security negatively.

In sub-Saharan Africa, it is common for some farm household members to engage in other non-farm occupations to complement their earnings from farming. A study by Herbert (1996) in Burundi reveals that there is a tendency towards income diversification through extra-agricultural activities which complement farming. In this survey, different farming and non-farming occupations of household heads were identified. In many rural areas in Singida Region, there were highly diversified income-generating activities including off-farm ones.

Similarly, income is crucial in agricultural production and other related activities as it enables farmers to modernize their production and give them opportunity to reduce the risks of food shortage during periods of unexpected crop failures. The income level was also investigated, and the result showed that most (43.3%) of the surveyed households fell within the range of TZS 11 000 to TZS 30 000 per month per adult equivalent with a mean value of TZS 17 864.35, while the national food poverty line was TZS 26 085 per adult equivalent per month in 2012, according to the 2011/12 Household Budget Survey (NBS, 2014). Figure 5 shows the distribution of respondents by monthly income clusters.

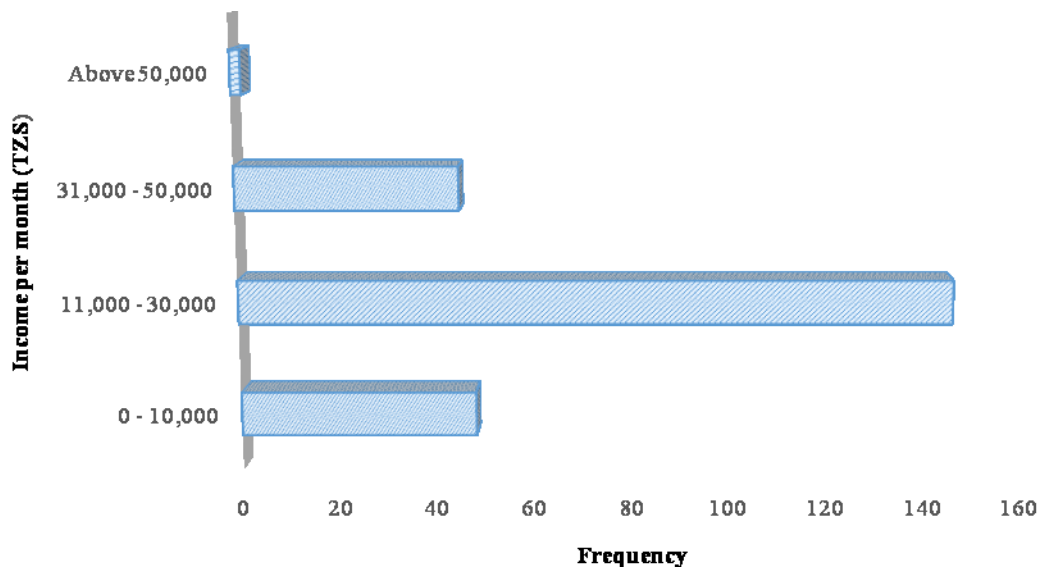


Figure 5: Distribution of respondents' by monthly income per adult equivalent

Another socio-economic variable which was analysed was the main occupation of household head. It was found that mixed farming (production of crops and livestock) was the most important occupation of the household heads (47.9%); crop production was the second most important occupation. This finding has an important implication for farm production decisions by the households. The dependence of families on farming as the predominant occupation may have a positive or negative effect on agricultural production, depending on the availability and allocation of household resources. In a situation where farm families have capital constraints due to low income from farming, there is a possibility of relying heavily on family labour and low input of technology to carry out farming operations. Consequently, in the event of crop failure or low yields from crops, farm families are likely to be faced with the problem of food insecurity arising from unavailability or limited access to sufficient food. This finding is in congruence with Boserup's, Sen's and Woldemeskel's Theories. Figure 6 shows the main activities carried out by respondents.

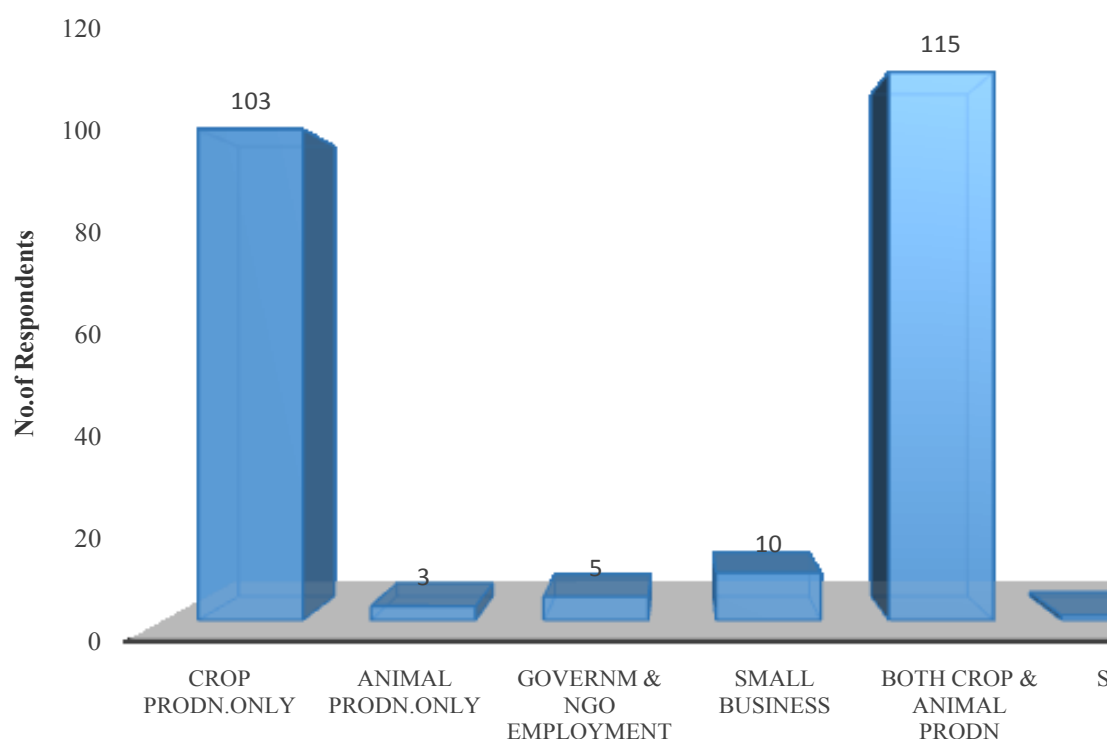


Figure 6: Distribution of household heads by occupation.

4.2 Qualitative Appraisal of the Institutions and Food Security Status

The objective of this section is generally to appraise qualitatively the role of institutions on food security. The other objectives were: to identify institutions dealing with food security and their key functions, to determine food security at the household level and, to establish linkages between some institutional factors and food security factors, as shown in Chapter One Section 1.4. In order to meet first the objective, focus group discussions were conducted in all the 8 villages. The results of the FGDs exercises are presented as follows:

4.2.1 Appraisal of indicators of institutions availability

The indicators of availability of institutions were based on the numbers of areas where they were concentrated as well as the number of clients they served. Institutions were vital in promoting the status of food security in the study areas. Participants in FGDs

asserted that availability of agricultural institutions acted as propellants for food security. In all the villages where data were collected there were institutions, especially government oriented ones. One of the discussants had this to say, ” *Kuna taasisi za kiserikali nyingi lakini hazina meno kwani zimejaa ahadi siyo utekelezaji*”, which literally means there are several Governmental institutions, but they are not effective as they are full of empty promises. The Governmental institutions included the District Agricultural and Development Office (DALDO), District Agricultural Extension Office, etc.

4.2.2 Appraisal of indicators of households’ awareness on institutions

The indicators of awareness included the number of households who were well informed about institutions available in the study area, their key functions, types and magnitude of services and goods they provided. It was found, through focus group discussions, that 80.2% of the participants in the research were aware of the existence of institutions, especially the central government, District Councils and CBOs, but only 64.4% of the households were aware of the key functions, types and magnitude of services and goods that the institutions provided. Only 40% of the discussants were aware of Micro Financial Institutions (MFIs), especially banks and other lending financial institutions. It was narrated by one of the discussants, as follows: "*Taasisi za fedha zimewatupa watu wa vijijini kwani hawaaminiki kwa vile hawana uwezo wa kurudisha fedha pindi wakopapo*". This literally means that financial institutions neglect rural people as they are not able to pay back loaned money.

4.2.3 Appraisal of indicators of institutions performance

There were two types of performance: activity performance and financial performance. It was a fact that the more diverse the activities done by an institution supporting

agriculture were, the more was the likelihood of farmers harvesting more food and hence getting better food security. According to the FGDs discussants, increased agricultural production is enhanced by infrastructure such as roads. This was accentuated by one woman discussant who lamented as follows: "*Barabara nimbeleko ya maendeleo vijijini, lakini huku kwetu tumesahaulika*". That literally means "Development comes from improved transport, but we have been forgotten." She was reflecting on the time when there were no accessible roads and the current situation whereby almost all places are reached by road all the year round. When discussing the issues of efficiency and effectiveness, most discussants (70.0%) said that institutions were both efficient and effective. However, some of them dismissed this idea by saying that there was favouritism in institutions supporting some villages and hence that in some areas the institutions were very inefficient and ineffective, especially in Siuyu Village (Singida District) and Kisimba Village in Iramba District.

4.2.4 Appraisal of indicators of institutional support

Institutional support indicators included the amount of credit given to households, number of times trainings were provided to individual household members, infrastructure constructed, extension services provided per year, and amount of inputs provided or supplied through input support system. However, there was a criticism on the manner in which support was given specifically credits and inputs. One discussant had this to say: "*Mwenye nacho huongezewa; asiyenacho hunyanganywa na kidogo alichu nacho*", which literally means "the one who already has something is the one who is given more; the one who has nothing is snatched even the little he/she has." Another discussant added that, "*Mkono mtupu haulambwi*", which literally, means "an empty hand is not licked". This meant that there was poor governance, lack of prudence, equity and lack of results-orientation implementation among institutions dealing with food security. However, it

was learnt that some of the villagers were not aware of the credit and input support institutions.

4.2.5 Appraisal of indicators of food supply

Food supply indicators are facts whose existence at favourable levels enhances food availability through production or other means. For example, the bigger the size of land cultivated for food production, the more the chances of harvesting more food. According to Maxwell and Frankenberger (1992), food supply indicators include amount of rainfall, agricultural land fertility, availability of water for irrigation, acreage, amounts of food produced and stored, amounts of food bought and received freely, amount of food consumed, amount of food given away and amount of food lost. All the above indicators of food supply were discussed in the 8 villages where data were collected. About rainfall, it was found that rainfall was erratic in some years, and this was one of the factors constraining production of adequate food.

The districts where the research was done normally receive bimodal rainfall whereby there is a short rains period from October to December and a long rains period from February to May. However, during this research in the agricultural season 2010/11, short period rains, which were supposed to rain from November to early January, did not rain sufficiently. One of the participants lamented: "Nowadays, rainfall is inadequate. This has led to decline in food production. For example, most of those who used to harvest 800 kg of maize are harvesting only 400 kg of maize, 200 kg of sorghum per acre and 100 kg of millet per acre."

About land fertility, the FGDs' participants, especially in Singida District's villages said that their land was infertile. It was only in Kizonzo and Mgongo Villages where they said

that the land was moderately fertile. About irrigation, it was found that only few households were producing some crops by irrigation near water sources during the dry seasons. The horticultural crops grown during the dry seasons included tomatoes, spinach and okra. Few of the villagers were also producing maize by irrigation during the dry season. Dry season irrigation was most practised in Kiomboi Village. The maize was being sold to maize roasters; it was not being dried for making flour for stiff porridge. About land pieces owned, acreages and amounts of food harvested per unit area and in total, the FGDs' participants said that the sizes of the plots owned for agricultural production ranged from one to five acres per household, and that most of the villagers were cultivating only about 50% of the land they owned. The amounts of grains harvested were normally 300 to 400 kg of millet or sorghum per acre and 400 to 500 kg per acre for maize. The amounts of harvests were not satisfactory for their households' consumption. However, one said: "In a good year when rainfall is enough and rodents have not devoured one's crops in field, one can harvest even 1000 kg of maize per acre." Another one added: "But these days, due to rainfall unreliability, harvests have decreased by about 50% for many villagers."

They said that the main factors that were behind low production were crop pests especially weeds, armyworms, insects, rats, birds, wild pigs and monkeys; inadequate rainfall that had led to many households being food insecure between 2008 and 2009; farm lands being infertile; people cultivating small plots of one to two acres per household per season; and failure to practise irrigation due to great scarcity of water in most of the villages.

Other factors that were causing low production were said to be use of poor agricultural tools, including the hand hoe by means of which a large area cannot be cultivated; failure

to use fertilizers due to belief that their land did not need fertilisation; gender imbalance whereby women were the ones participating more in agricultural production with little or no support from their husbands, sons and daughters; and inadequate cash capital, agricultural inputs and agricultural implements. The FGDs participants complained about the negligence of young people of agriculture by saying that the youth say that agriculture is punishment. Other factors that were said to be behind low agricultural production were inadequate agricultural extension services; poor agronomic practices; theft of crop products in field; human illnesses; use of unimproved seed varieties; unreliable markets for their food and cash crop products; having big families containing many members in the age dependency group; and practice of patriarchy whereby women's suggestions on how to improve agricultural production were always not considered.

The presence of patriarchy social system was revealed by one female participant who unhappily said: "A woman cannot say anything in front of men". Women nodded their heads in agreement with her, but men just kept silent. It implies that once men are there women's views are neglected. Therefore, sometimes even if women have good suggestions they just shelf them. Other factors behind low agricultural production were said to be most farmlands being far away from home thereby substantial time being lost on the way to and from the farms, and draughty weather with excessive sunny conditions that is locally called *mpasu*, and which had lastly occurred prominently in the agricultural season 1984/1985. From the participants' point of view, a food secure household, if it was an average one comprising five members, was one harvesting 500 kg of maize per acre, 400 kg of sorghum per acre and 300 kg of millet per acre. However, since not all villages had such crops, and due to low production because of the factors outlined above, most households were buying most of the foodstuffs they needed for their own consumption. The participants in FGDs estimated that only about 10% of the households

were harvesting the amounts of crop products listed above, which means that about 90% of the villagers were food insecure, based qualitative appraisal of food security status. The participants also said that food shortage was critical in certain months while there was food abundance in some months. The months of food abundance were said to be May, June, July, September, August; those of food shortage were said to be October, November, December, January, February, March and April. During the months of food abundance, 80% of the households were estimated to eat three meals a day while during the months of food shortage about 30% of the population were estimated to eat three meals a day. About storage of foodstuffs, it was estimated that only about three to 10% of households were storing maize and up to 30% of households were storing sorghum.

In some of the villages, for example, Siuyu, it was initially said that no household was storing foodstuff harvested. Musing over this critically, it is very unlikely since it is hardly true that every household was consuming all its harvests at once. Therefore, probing on the answer was done, and the participants revealed that, in some households, maize and cassava harvested were being stored for a short period of a few weeks to about two months. Storage of foodstuff for a short duration in Singida District was contrary to the duration of food storage in Iramba District. The longer duration of maize storage in the Iramba District is due to the fact that more maize is harvested due favourable weather, unlike in Singida District where the harvests are relatively very little.

4.2.6 Appraisal of indicators of entitlement to food

Entitlements to food are wealth items including productive assets, cash and liquid assets, which can easily be sold to get cash to buy food or can be exchanged for food. Maxwell and Frankenberger (1992) contend that such items include land, livestock, house, and

farm implements. Therefore, the participants in FGDs were asked about villagers' ownership of various assets including the ones listed above.

It was found that all households owned land. But the sizes of the land pieces owned were small: 1 to 10 acres per household. Since, as seen in Section 4.2.1, little proportions (5 to 30%) of land owned were being cultivated, the portions of land that were not being cultivated would have been hired out, if the market for land hire had been good. The money obtained by hiring out land might have contributed to buying some food. But the market for hiring land was not good. With respect to livestock keeping, the major species of livestock kept was chicken. FGD participants estimated that chickens were being kept in about 95% of the households and that only about 1% of the households were keeping goats.

Environmental entitlements can help improve food security by people collecting materials including poles as building materials, firewood, and charcoal, some rocks, and medicinal plants for selling to obtain cash for buying food. Some wild foodstuffs and game can also be obtained for direct consumption. Cognisant of these facts, during FGDs, participants were asked whether some villagers were collecting wild foods. It was found that the collection was very little, and it was mainly of wild fruits locally known as *mabungo* (*Dictyophleba lucida*), *fulu* (*Vitex doniana* and *V. keniensis*), and *zambarau* (*Syzygium guineense* and *S. cuminii*), which were being collected during rainy seasons, especially between December and March. Another wild food was locally known as *mibao*, which is a carbohydrate tuber that was being collected during the late dry seasons, especially from September to November when food was scarce. The fruits were normally being eaten as snacks; the *mibao* were normally being eaten as lunch. However, very few

villagers (at most about 15% of the food insecure households) were estimated to collect such foods. This shows that wild food collection was not a reliable source of food.

About assets ownership, participants estimated that up to 75% of households owned iron sheets roofed houses, and a good number of them owned bicycles while all of them owned farm tools including hand hoes and machetes. A considerable amount of some of the assets owned, including livestock, were being sold during food shortage to buy food.

4.2.7 Appraisal of indicators of food sufficiency

Participants were asked to discuss the amounts of grains they considered to be sufficient. Their views were that 10 to 20 bags (each weighing 100 kg) of maize were sufficient per year for a household containing an average of six members. The amount of 20 bags for six people per year is about three bags per adult per year, which is recommended by Tanzania Food and Nutrition Centre (TFNC) (URT, 1999). This means that although the figures obtained from FGDs were rough estimates, in some cases they were close to the real situation. Food sufficiency was also assessed in terms of amounts of grains consumed per day. About this proxy measure of food sufficiency, the participants said that for a household having five members 1 kg of maize flour, sorghum flour or millet flour was sufficient per meal.

They said that consumption during the months of food shortage was normally less than that during the months of food abundance. It was noted that food shortages in the research area were so common that the residents of the place had coined catchy phrases to signify the shortages. They said that during that period of critical shortage of food a household head who would like to travel from home does not travel because he has

nothing to leave his family with, and the one who would like to go back home does not do so because he has nothing to bring home.

They added that in some worst instances of such critical shortage of food a household head could abandon his household and go away. Moreover, unlike the African traditions, which allow visitors to eat with their hosts once they find them eating or when food is ready for being eaten while visitors are present, during this period people do not give food to visitors; if a visitor comes, they hide the food they were about to eat or which they were eating and postpone eating until the visitor leaves.

The participants also said that a household is food secure if it has an average of three acres of a maize farm, two acres of a sorghum farm and one acre of millet, if it is an average one comprising five members. They estimated that approximately 40% of the villagers owned guava trees. They also said that if a household head had “large-scale business” or he/she was a government employee the household could have enough food without producing it. During the FGDs exercises, participants were also asked to estimate the proportion of income spent on food. They estimated that 70% to 90% of household income was being spent on food items. From this finding, it is obvious that the proportion of income spent on food was high vis-à-vis the proportions of consumption expenditures on food in Tanzania that is 56.3% for 2011/12 (NBS, 2014). The majority of villagers were eating three meals a day during the seasons with bumper harvests. Since such seasons were also common, like seasons with critical shortage of food, there were slogans to signify the seasons. The participants in FGDs were asked to rank the availability of food in the calendar year and give reasons for variation in the availability. Asterisks were used with the highest number of them representing the month of the highest food availability and vice versa.

4.2.8 Appraisal of indicators of strategies for coping with food shortage

During periods of food shortage, the villagers had various ways of coping with the situation. One way of coping with food insecurity was eating one meal per day, instead of two or three meals. Also, doing casual labour work was another way of coping with food insecurity. Those with food insecurity were mostly doing casual labour work in October, November, December, January, February and April when food scarcity was higher than in other months.

Casual labour work was associated with temporary migration for some villagers for the work. Another way of coping with food insecurity was seeking loans for consumption. Most people were doing so in the same months when food security was more severe. Lenders were informal ones, and they were mainly shop/kiosk owners and traders who were lending either cash or food items to their neighbours and relatives. Other villagers were coping with food insecurity by selling some of their assets. This was usually being done from November to April. The assets included chickens, goats, sheep, donkey and cows.

Charcoal making was also said to be another common strategy for coping with food insecurity. This was normally being done any time of the year, but more so during late dry seasons from August to October. Some of the villagers were also engaging themselves in lumbering and others were consuming some wild food varieties, as explained in Section 4.2.2. During extreme shortage of food, some villagers had received food relief from the government in some years including 2004 and 2008. For example, in Siuyu Village in 2004 all the 442 households received food relief from the Government due to famine that was looming.

4.2.9 Appraisal of prevalence of food insecurity

A self-assessment of whether a household was food secure or insecure was based on a questionnaire. One of the questions in the questionnaire asked the discussants to reply 'Yes' or 'No' to a question about their households having had food shortage or not during the period of 12 months from 1st July 2010 to 30th June 2011. The self-assessment was informed by the local indicators (multi-cropping, mixed farming, diversified farming, cash crops growing and family headship or resorted to coping strategies) for a household to be considered food secure or insecure.

Therefore, based on households' self-appraisal, it was taken that food insecurity was 53.4%. In Singida District food insecurity was taken to be 62.4% whereas, in Iramba District food insecurity was considered 45.4%. Although households had food insufficiency it was based on some crops. For example, 8.8% of the households had had insufficient maize while 29.2%, 77.1%, 99.2%, 93.3%, 97.9%, 97.9%, and 99.6% had had insufficiency with respect millet, sorghum, rice, sweet potatoes, beans, peanuts and cowpeas respectively. Based on this proxy indicator of self-appraisal for food security, among households in Singida and Iramba Districts, the proportion of food insecure households was higher (53.4%). The proportion of food insecure households was much higher than the average food insecurity for Tanzania, which was 16.6% in 2001 (NBS, 2009).

Some statements given by participants in FGDs exercises that were part of this research support the high level of food insecurity found. They said that in a few years just before 2010/11 harvests had decreased by about 50% mainly due to in affordability of agricultural input prices and decrease in rainfall. They also estimated that about 31.7% of

the households were buying maize, 42.0% millet and 21.2% sorghum. They also said that 50% to 60% of their daily earnings were being spent on buying food per day.

In order to assess whether food insecurity was a problem in the research area, participants were asked to rank the most critical food shortage months in their villages. The results showed that food insecurity was a substantial problem, which was critical in February and March. During those months food insecurity is very high as the food harvested food last for an average of eight months for most households. It is in those two months when most households embark on various strategies for coping against food insecurity.

4.2.10 Appraisal of linkages between institutions and food security

In the light of the conceptualisation that institutions and food security have mutual effects, the direct relationships were looked into during FGDs by discussing with participants to find whether they thought such direct relationships existed in their villages. Their discussions revealed that direct relationships between institutions and food security existed, as elaborated below. Table 7 shows the extent of relationship between institutions and food security in their villages.

Table 7: Extent of relationship between institutions and food security

| Extent of relationship | Estimated Score |
|-------------------------------|------------------------|
| Very Strong | ***** |
| Strong | ***** |
| Moderate | ***** |
| Weak | **** |
| Very Weak | ** |

The higher the number of asterisks the stronger the relationship between institutions and food security. Each single asterisk represents 10% score.

4.2.11 Appraisal of linkages between food security and some cultural elements

The participants were also involved in discussing whether some cultural practices in Singida District and Iramba District had any effect on food security. They discussed the practices discussed hereunder. One of the traditional practices affecting food security is ceremonies to finalise mourning of a deceased relative. The participants in FGDs said that over 90% of the households were organising such ceremonies 40 days after their relative had passed away. They added that sizeable proportions of food harvested and relatively substantial amounts of cash were being used on such ceremonies. By so doing, it is obvious that the ceremonies contributed to food shortage. The participants estimated that about 100 kg of grains or cereals might be consumed during such a ceremony.

Another cultural practice that was said to have negative effect on food security was initiation ceremonies. This is facilitated by ritual leaders helping some households, whose members believe in the initiation ceremonies of passage from tender age group to adulthood. It was estimated that about 10% of the households were practising this, which is normally done for one or two weeks. Sizeable proportions of food harvested are spent on this type of ritual. Using some foodstuffs for brewing, especially millet and sorghum thereby reducing food that would be consumed in terms of meals, was another practice leading to fast exhaustion of food harvested. It was estimated that about 25% of the households were using some of their food reserves to prepare local brew.

4.3 Institutions Available and their Key Functions

4.3.1 Institutions available in the study area

In the study area there were a number of institutions which were linked to food security and agricultural production. The institutions were identified through key informants by directly interviewing them and probing about the functions of the institutions identified with respect to their roles in food security. A checklist of items for discussion was used for the interviews and probing. The key informants were Regional Agricultural Advisor (RAA), District Agricultural and Livestock Development Officers (DALDOs), District Community Development Officers (DCDOs), Ward Executive Officers (WEOs) and extension workers. Moreover, the researcher visited the places where the institutions were based to verify their presence and functions. These institutions included families/households; Community Based Organisations (CBOs); Non-Governmental Organisations (NGOs); Governmental Ministries, Departments and Agencies (MDAs); Micro-Finance Institutions (MFIs); Faith Based Organisations (FBOs); informal groups; rules, regulations and by-laws; traditional norms, customs, social sanctions and beliefs; international organizations/Organizations; and UN Agencies.

4.3.2 International Organisations

There were International Organisations operating in the two districts dealing with different projects and programmes. These included UN Agencies, among others. The following organisations were present.

(i) FAO

This organisation was dealing with agricultural development through supporting the agricultural programmes and projects operated under the District Council. The cases of PADEP, ASDP and DADPs, were vivid examples supported by FAO in Ntuntu Village

(Singida) and Nselembwe Village-Shelui ward (Iramba) in establishing an irrigation project at Wembere River Basin. In that village people are cultivating rice though at a small scale. This institution helped households increase the sizes of the cultivated plots by supplying some equipment such as ox-driven ploughs and light tractors.

(ii) IFAD

The organisation dealt with financing agricultural projects in Ntuntu Village in Singida District, Nselembwe and Kizonzo Villages in Iramba District. It also dealt with agricultural education, training, and provision of agricultural knowledge and skills (farm planning, production, management, post-harvest loss handling, processing and storage) supporting smallholders farmers in various villages in the study area. This helped the households in increasing their ability to produce more food and ability to solve some farm management related issues.

(iii) WFP (FFE and FFL)

The organisation helped villagers in terms of food aid (Food for Education and Food for Life) whenever critical shortage of food occurred including in 2008/09 in some villages that were out of the scope of this study. These villages were Kimpunda, Kinampanda, Kiomboi, Kisana, Kyengege, Mpambala, Msingi (English meaning: Primary or Foundation), Mtoa and Chemichemi, Migungia, Igonia, Kinankamba, Nyahaa, Munguri, Msingi, and Igengu in the newly established District Council of Mkalama (Eastern part of Iramba). WFP also helped villagers by providing food to primary schools in order to enable children attend schooling during the peak of food shortage such as Siuyu Village in Singida District and Kisimba Village in Iramba District. The two districts experienced food shortage in 2010/11. WFP provided 2000 bags of maize to the two schools for the whole agricultural season.

(iv) WB

The World Bank support was mainly rehabilitating and reconstructing primary schools in order to create conducive environment for teachers, pupils and students for learning. The World Bank had assisted in building decent schools in both districts. The WB had been in the forefront in making sure that rural transport infrastructure was in place. Most rural roads have become passable even during rainy seasons. This has alleviated the transportation problem and people's mobility to search for the market of their agricultural products. In most cases people have reduced the burden of carrying their farm products on their heads or using ox-carts; instead they are using vehicles as there are passable roads.

4.3.3 National institutions

(i) The Central Government

The central government is a necessary player in determining the destiny of the country in the process of socio-economic development at a given period. It is one of the oldest organizations formed by human beings made for controlling the conduct of its subject. The government has three main arms, which control the rule of conduct of the people. These are the executives (governors and administrators), the judiciary (law enforcing instrument-judges and courts), and the parliament (the law making body).

In many countries and areas of operations, governments play a central role in organising dispersed interests, meeting national goals and balancing various vested and competing interests. Unlike social norms and values, government operates a rule making process by which rules can be changed more quickly, with vision and design, and still be forceful (World Bank, 2003). In Tanzania, the Government operates through the Ministries, the

Regional and District Administrations and Ward and Village Councils. The following ministries are crucial in steering agricultural development and food security in Tanzania.

(a) The Ministry of Agriculture Food Security and Co-operatives

This is the central government's institution entrusted with issuing agricultural policies, guidelines, and plans. It is the overseer of agricultural development in the country. Agricultural production is important for food security because it is the source of income for the majority of the rural poor. It is particularly critical in a dozen of countries of Sub-Saharan Africa (WB, 2008). The Ministry was active in both districts having a leading role in translating and implementing agricultural programmes and projects. These included ASDP, PADEP and DADPs. Although the number and nature of guidelines that constitute an agricultural policy are vast and complex, the ultimate goal is to improve the well-being of the people whose principal occupations and ways of life depend on agriculture. The focus of this policy is to commercialize agriculture to increase income levels. The first objective of the National Agricultural Policy is to ensure increased production, productivity and profitability from utilization of the factors of production (land, labour and capital) and the second objective is to enhance food security through production of sufficient quantity and quality of food (URT, 2013). Table 8 shows budget allocation for the two districts in the year 2010/11 – 2014/15 for ASDP & DADPs.

Table 8: Budget allocation for DADPs and ASDPs for 2010/11-2014/15

| Year | Singida (Mil. TZS) | Iramba (Mil. TZS) |
|-------------|---------------------------|--------------------------|
| 2010/11 | 520 | 616 |
| 2011/12 | 720 | 984 |
| 2012/13 | 243 | 362 |
| 2013/14 | 314 | 445 |
| 2014/15 | 234 | 304 |

Source: DALDOs Offices, 2015

The fund was provided for two programmes of the MAFSC which were ASDPs and DADPs as ASDP was phased out in 2010. Nevertheless, the fund provided showed a declining trend which might imply phasing out of programmes in the near future.

(b) The Ministry of Infrastructure Development

This Ministry strove in 2010/11 to improve roads at the level of tarmac for trunk roads and gravel level for feeder roads. Trunk roads included Isuna-Singida (54.0 km) and Katesh-Singida (65.1 km). The regional roads included roads with a total of 1018.3 km. These were Chaya-Itigi (6.0 km), Sekenke-Shelui (7.0 km), Kizaga-Sepuka-Mugungira (10.0 km), Misigiri-Kiomboi (tarmac) (12.0 km), and Ulemo-Gumanga-Sibiti (7.0 km) (TANROADS-Singida, 2010). Improved rural infrastructure (rural roads) is essential in increasing agricultural production, and food security as it is a component of agricultural marketing process. This Ministry has been important in the two districts as it has simplified transport and transportation from one district to another one, one division to another one, one ward to another one and one village to another one in terms of agro-marketing system. Likewise, it has enabled easy availability and accessibility of food to households throughout the year, though the pricing system was a problem due to low

purchasing power of most rural households in the two districts. With the rapid expansion of IT, households members have possessed cellular phones for easy communication and utilise the constructed roads effectively for economic transactions. It was noted by the study that 95.5% of all the households' heads or their representatives possessed mobile phones hence simplified information flow relative to food availability, accessibility, utilization and stability. This conforms to both Sen's Theory on entitlement of any kind is important for food security, Boserup Theory on improved technology as a key to increase productivity and Woldemeskel's Theory on institutions and market forces which foster food security through improved agricultural productivity.

(c) The Ministry of Finance and Economic Affairs

Financial resources are crucial inputs in the process of agricultural development and food security for any society where agriculture is the mainstay of socio-economic development. The agricultural industry needs finances to operate the whole system by acquiring or developing land, purchasing equipment, implements and machinery as well as effective and efficient farm planning and management. In 1991, the Government initiated financial sector reforms in order to create an effective and efficient financial system. The government committed itself to allow banking institutions to operate on a commercial basis, making business and management decisions free from outside interventions within the norms of prudential supervision (URT, 2000).

The financial sector reform included liberalization of interest rates, elimination of administrative credit allocation, strengthening of the Bank of Tanzania's role in regulating and supervising financial institutions, and allowing entry of private banks (both local and foreign). The reforms are in Banking and Financial Institutions Act, 1991. In the same year, the Co-operative Societies Act, 1991 provided the basis for the

development of Savings and Credit Co-operative Societies (SACCOS), which are equity, equality and objective based institutions. Micro-finance addresses the financial needs of major sectors of the Tanzanian population. Payments and other related services are also valuable to low income people and to the residents and institutions in rural areas.

(d) The Ministry of Water and Irrigation

The objective of the Ministry of Water and Irrigation is to ensure that water resources are developed and managed in a sustainable way in collaboration with all stakeholders and to facilitate participatory irrigation so as to enhance sustainable production and productivity, food security, poverty reduction and achieve national economic development. Singida Region is endowed with a total surface area of 49 438 km², out of which 95.5 km² or 0.19% is covered by water bodies of Lake Eyasi, Kitangiri, Singidani, Kindai and Balengida. The remaining 49 342.5 km² is a dry land area, out of which 24 671.2 km² are classified as suitable for agriculture. However, part of the arable land was only marginally suitable for agricultural production for a variety of reasons, including soil erosion, nutrient leaching and drought proneness. Out of 24 671.2 km² suitable for agriculture, only 13 340.5 km² are suitable for irrigation whereby 5362.1 km² are classified as high potential, 4547.4 km² as medium potential; and 3331 km² as low potential. Furthermore, only 31 km² have been provided with improved irrigation infrastructure as of May 2010.

The region is also endowed with numerous and diverse water resources in the form of rivers, lakes, wetlands and aquifers. There is, therefore, a need to have a good management plan of the available water catchments in order to have sustainable irrigation development. The level of irrigation development in the region is still very low, resulting

into marginal use of the available potential for irrigation development due to various reasons such as inadequate financial capital and human resources.

This argument is line with Brown and Kane's argument that expansion of food production like during the green revolution of India in the 1970s is difficult today because the backlog of unused agricultural technology is shrinking, leaving farmers with fewer agronomic options to expand food output; demands for water are pressing against limits of the hydrological cycle to supply irrigation water; and in many countries the use of additional fertilizers on currently available crop varieties have little or no effect on yields.

The agricultural practice in Singida Region is mainly rain fed and affected by vagaries of weather, mainly resulting from climate change. This invariably has subsequently subjected crop production to be low hence the need for an effective means of increasing production and productivity. Irrigation practice, therefore, is the most appropriate and sustainable solution. It will stabilise food and cash crop production and productivity for curbing food shortages and increasing export of cash crop and its products. In this regard, a concise plan and implementation for the development of irrigation infrastructure is inevitable.

Despite the fact that the Government is now giving high priority to irrigation development, which is emphasized in the national policy frameworks, the pace of investment in irrigated farming in Singida Region is still very slow. Given the abundance of water resources and high potential for irrigation in Singida Region, expansion of the area under irrigation is inevitable, for it is one of the effective means for increasing and stabilizing food and cash crop production and productivity for curbing food shortages and increase export of cash crops and its products.

(ii) The Local Government Institutions

(a) The Ministry of Local Government and Regional Administration

This Ministry plays a very crucial role in helping District Councils run their socio-economic projects and programmes. It is the overseer of the District Councils in Tanzania, Singida and Iramba Districts inclusive. It is in the forefront of allocation of both human and physical resources. It always finances training sessions in areas, which seem to be important in different arenas of life, including Opportunities and Obstacles to Development (O & OD) as a participatory method of choice for community development interventions. However, it was noted that the Ministry is constrained by unavailability of enough funds to run various programmes. As a result, it fails to employ extension workers at the ward level as it was stipulated in the Decentralization policy, 1972 and Local Government Act, 1982 that extension workers should be distributed as per ward.

(b) The District Councils

Both the two District Councils of Iramba and Singida deal with the development efforts of their divisions, wards and villages by preparing participatory development projects and programmes. The districts had prepared District Agricultural Development Plans with the purpose of boosting agricultural production and maintaining food security. It was found that 91.9% of the total respondents reported that they were aware of by-laws related to agricultural production and food security, though not all had implemented them. This implies that the district and village authorities did not do enough to create awareness to farmers who were also rural dwellers.

It was observed that 52.9% of the households reported that the enforcement of the council's by-laws (minimum farm acres to be cultivated, planting drought resistant crops, use of improved seed varieties of crops and hybrid animals, sowing seeds in line with

specified spaces and use of fertilizers and ban of use of grains for brew making, to mention a few) was high. However, 4.1% reported very low enforcement whereas 9% gave no response, which implies they were not informed on the by-laws established by the District Council Authorities.

It was found that the voucher system for agricultural inputs subsidies was not well known to the small-scale farmers, and only big farmers were well informed of the procedures to be followed in getting the subsidized inputs. The findings revealed that the awareness of the households on DCs' by-laws on agricultural development and food security during the 2010/2011 agricultural season through acres cultivated was at varying degrees. They were also households which were not aware of the enforcement on the number of acres to be cultivated during the 2010/11 agricultural season at all, as awareness creation was done through meetings conducted by the DC's Office in some villages where others were not part of the sample studied. Table 9 summarises the awareness among households.

Table 9: Awareness of DC's Office enforcement on acres cultivated during 2010/2011 (n=240)

| Response | Frequency | Percent |
|-----------------|------------------|----------------|
| No response | 9 | 3.8 |
| Very low | 10 | 4.1 |
| Low | 11 | 4.6 |
| Moderate | 72 | 30.0 |
| High | 127 | 52.9 |
| Very high | 11 | 4.6 |
| Total | 240 | 100.0 |

Farm size in this study refers to the land area that was actually used for crop production during the survey year. The average farm size in the research area ranged from 0 acres to 14 acres. This shows large disparities in farm sizes among farming households. However, many farm households operated small and fragmented plots. A striking finding is the

large disparity between the minimum and the maximum farm sizes; the minimum size was 0.25 acres, while the maximum was 14.3 acres for all households surveyed in the study. In sum, the study reveals that the average farmer operated small fragmented plots that added up to an average of about 3.2 acre/household. This discourse is line with Sen's entitlement theory stated in Chapter Two stipulating low land entitlement in the study area. It was observed that land was owned through traditional land tenure system whereby two-thirds (69.9%) owned three acres (Fig. 7) and 2.1% owned between 11 and 25 acres.

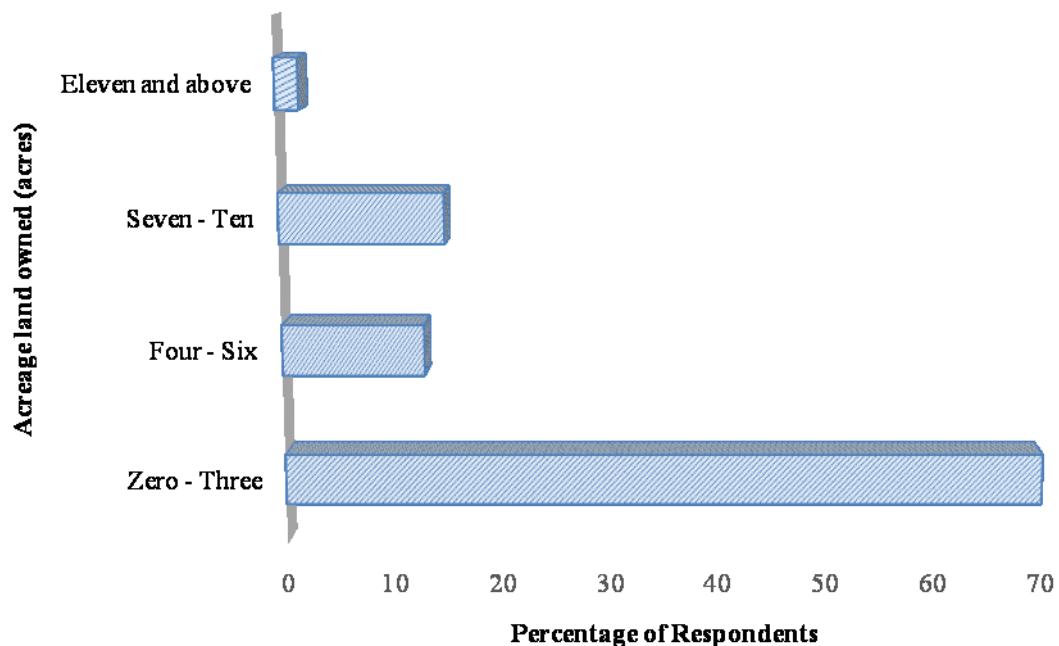


Figure 7: Size of land (acres) owned by the households in 2010/11.

Besides the above information, the respondents were required to react on whether they were aware of the main components of agricultural policies. The results showed that 90% of the total respondents acknowledged that they were aware of the government's policy related to agricultural development in Tanzania. In terms of the policy components,

81.7% of the respondents were aware of KILIMO KWANZA agriculture strategy, while 86.7% were aware of the agricultural inputs subsidies provided through the voucher system and 10.8% of the households were aware of the agricultural research as a component of agricultural policy (Table 10).

Table 10: Awareness of households on agricultural policy related components (n=240)

| Agricultural Policy Component | No. of Responses* | Per cent* |
|--------------------------------------|--------------------------|------------------|
| Use of improved seeds varieties | 210 | 87.5 |
| Food security | 187 | 77.9 |
| Farmers training | 96 | 40.0 |
| Agricultural extension services | 85 | 35.4 |
| Irrigation farming | 69 | 28.8 |
| Agricultural inputs subsidies | 56 | 23.3 |

*Multiple responses

(c) Ward Development Councils (WDCs)

There were WDCs in each ward in the two districts. Their main role was to plan, supervise, formulate and involve villagers in implementing and supervising their development projects. The Ward Development Councils (WDCs) under the Ward Executive Officers were active as they were close to their people in overseeing development activities especially agriculture, livestock, rural transport and water. Ward Councils were the epicentres for the development of the villages in the two districts as they planned for agricultural and livestock development, among other development activities.

(d) Village Councils

The village Governments in all the eight villages were entrusted with responsibilities of mobilising people in the development arena through participatory implementation of development projects and programmes as per Local Government Authority Act of 1982 (IDC, 2010). The Councils' involvement in the eight sampled villages explicated various results as reported below. It was found that 45.8% of the total respondents claimed that Village Governments' reinforcement of implementation of agricultural policies, rules and regulations was high, whereas and 12.5% claimed that it was very low. Fig.8 shows the opinions of households on Village Councils' reinforcement of policies, rules and regulations related to agriculture in their villages:

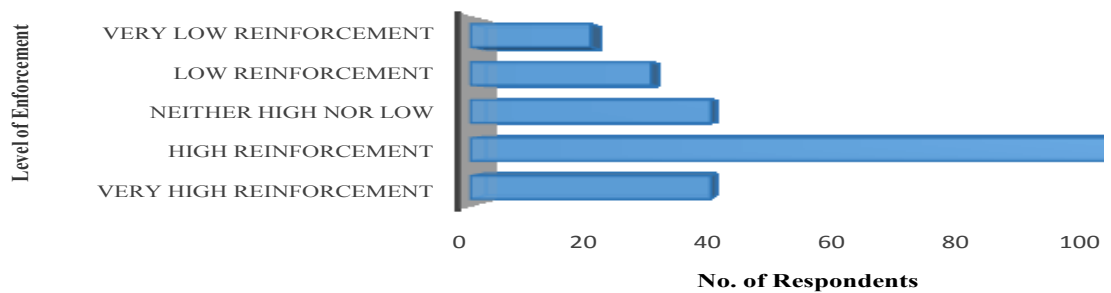


Figure 8: Opinions by respondents on Councils' reinforcement of policies, rules and regulations related to agriculture and food security.

(e) Households/Families

Families/households are institutions that were and are still considered as the focal point in the process of the national and family economy. They are points where individuals are moulded to become responsible leaders and parents of tomorrow. Household economics views the household as a utility-maximizing unit under the altruistic leadership of the household head as ignoring gender-based intra-household inequalities (Niehof, 2004). The unitary model assumes that decisions within a household are made jointly and that the household maximizes a single set of objectives for its members (Ellis, 1988).

Households have a myriad roles related to food security and production. They play productive, economic, ecological, political, protective roles and all other social responsibilities at the primary stage (Barry, 2010). Households were crucial in making main decisions concerning food security and agricultural production in the study areas. The decisions included what types of food and cash crops to be produced, how much to produce, where to produce, how to utilize food harvests, when to produce (first or second rains), when to dispose of food inventory and how to monitor and evaluate food stocks. It was therefore evident that households were central institutions in ensuring food security.

Similarly, households were vital in Household Food Monitoring and Evaluation (HFME), which were both a crucial process and phenomenon in ensuring food security stability at the level of the household. It was found that the HFME was mainly done by household members especially the head of the household or the husband and wife for their own consumption and not otherwise. It was considered a taboo to disclose the food security status of the household to the outsiders.

There was also a superstitious belief that if such information is disclosed some people with supernatural powers would secretly drain out the food inventory. Household Food Evaluation (HFE), rather than monitoring, was done by district and village authorities to countercheck the household food status during the years with crop failure for the sake of providing food aid by the Government or WFP like what happened in year 2008. It was observed that 76.7% of the respondents argued that their households performed HFME on their own basing on their past experience, and 23.3% said that they did not perform any household food monitoring and evaluation.

This implies that most part of this activity is household based. Furthermore, the study found that most households (80.4%) suffered from low capital investments, low access to credits, lack of irrigation infrastructure, inadequate production knowledge and skills, low savings, low productivity due to traditional farming methods, lack of legal land title deeds, untimely availability of inputs and poor agricultural technology. There were institutions which were CBOs or which possessed the basic characteristics of CBOs. It was found that 99.6% of the respondents acknowledged the presence of such institutions in their areas of jurisdiction. These CBOs were as follows:

(i) AWAWISI (*Asasi ya Wanawake Wilaya ya Singida-Singida District Women Association*)

This organisation was established in 2007 to empower women in embellishing Income Generating Activities (IGAs) that would in turn improve their household food security. In year 2010/11, there were 2 680 IGAs in Iramba and 1 972 in Singida District. However, the organisation was operating its activities in Singida District. It was found that 37.5% of the households were aware of the organization. AWAWISI was operational in Singida District only with the main intention of raising the standard of living among rural women through establishment of income-generating activities.

(ii) KIWOHEDE (Kiomboi Women Home Economics Development)

KIWOHEDE was operating in Iramba District, especially in Kiomboi ward, training women in tailoring, embroidery, knitting and housekeeping. The graduates were supplied with sewing machines and other accessories to establish their own businesses. During 2010/11, 20 graduates were given sewing machines. However, three-quarters (75.0%) of the respondents in the district reported that either themselves or their family members were members of KIWOHEDE.

(iii) SACCOS (Savings and Credit Co-operative Societies)

SACCOS were voluntary organisations by members in both the two districts. Their purpose was to create a revolving fund whereby members could get credits with soft conditions (cost of capital) and grace period. During the year 2010/11 season, there were a total number of 14 472 SACCOS in the two districts. The SACCOS in Iramba District were 65% of the total organisations in the two districts whereas 35% were in Singida district. SACCOS membership in the two districts was distributed at varying degrees. However, the total number of SACCOS members outpaced all other CBOs due to the political will of the government to form credit groups which are non-exploitative. Out of the 240 respondents, 235 were members or their household members were, implying that 97.9% were members.

(iv) VICOBA (Village Community Banks)

Village Community Banks (VICOBA) were popular in the study area followed by SACCOS. Nevertheless, VICOBA were both formal and informal. Therefore, most of them were not registered but were the most efficient MFIs in supporting their customers. These rural credit institutions, especially VICOBA which were primarily owned by members, were still volatile and fragile with very poor financial liquidity due to low

members own contributions. The study found that 75.4% of the surveyed households had members of VICOBA.

(v) CHAMWAI (*Chama cha Mikopo kwa Waalimu Iramba*)

This CBO was a formal organization established by primary school teachers. Its purpose was to cater for their daily financial needs. It is an abbreviation of the following Swahili words: “*Chama cha Mikopo kwa Waalimu Iramba*”. Later, the CBO became highly liquid as its membership was very broad and attracted many members. The CBO membership became open to other people who were not teachers. The institution was very strong due to high cohesion of members who were determined to eradicate poverty and maintain food security through own collective efforts. This was the strongest organisation, which determined their destiny. It was found that three-quarters (75.0%) of the surveyed households had members of that organisation.

(vi) Community Self Imitative Fund (CSIF)

This was an informal CBO popularly known as “Kibati” by the members. It was a kind of revolving fund depending on members’ contribution. The organisation was praised for being fair, equality, and equity based. It was very helpful to its members and supported them whenever they were in need. The organization had clear vision, mission, objectives, and strategies that made them loyal to it. Through this institution, members were able to acquire their basic needs and household assets. It was found that 62.5% of households had members of CSFI.

4.3.4 Institutional Support in the study area

4.3.4.1 Agricultural extension services

Agricultural extension service has been defined as the transfer of agricultural technology from experts (including progressive farmers) to farmers, livestock keepers and other stakeholders. The experts are the link between the farmers, livestock keepers and research whereby agricultural technologies are developed, tested and modified. Generally, the experts have three roles: primarily disseminating readily usable technologies and secondly to simplify technologies which cannot be transferred in the form in which they were produced by research institutions and thirdly to get and transfer farmers or livestock keepers' problems to research institutions. The research-extension-farmer, livestock keeper linkages also provides a framework for planning research and extension activities, developing new technologies arising from research and extension experts, and from indigenous knowledge (URT, 1997). In both districts, agricultural extension services were provided, though at varying degrees. The problem arose as these workers were not enough to cater for needs of all the farmers. It was found that 46% of the households acknowledged to have received agricultural extension services in 2010/2011.

4.3.4.2 Attitudinal change among farmers through education and training

Change in attitudes among farmers through education and training are one of the core services for the agricultural sector in Tanzania. Agricultural and livestock commodities will only compete in the overseas market if the industry becomes more efficient, something which will only be possible with improved competence among personnel working in the sector. The traditional sector will only be able to feed the nation if the extension and research staff have enough competence to bring about the technical improvements needed, which depends upon their training.

Correspondingly, farmers and livestock keepers training will increase literacy and general education levels which will promote adoption of new technologies, practices and support the improvement of management both at the level of primary agricultural and livestock production as well as in the processing stage of agricultural and livestock products (URT, 1997). It was realized that some institutions were committed to providing training to farmers, especially on agricultural production, food processing, and food storage and preservation. These included DCs, NGOs and FAO. This is also supported by Boserup and Dyson who insisted on knowledgeable population for increased food security. It was found that 87.3% of the respondents acknowledged that education was crucial in attitudinal changes among smallholder farmers in order to adopt new methods of farming and hence increase in crop productivity and food security.

4.3.4.3 Provision of agricultural facilities and services

The Government continues to promote and encourage agro-mechanization, and modernization in the country through extension services and provision of regulatory services for farm implements including machinery-testing services. It is quite evident that about 70% of Tanzania's crop area is cultivated by hand hoe, one-fifth (20%) by ox-ploughs and one-tenth (10%) by tractor. The government's objective for mechanization will be the promotion of the supply of sufficient farm machinery, equipment and tools to the farming community by the private sector in order to meet demand at reasonable costs. Labour augmenting technologies are a key to agricultural development (URT, 1997).

It is an undeniable fact that improved technology reduces the drudgery farming practices using a hand hoe and reduces the man-farm-hour ratio hence providing a room for non-farm activities that are also beneficial to the household such as petty trading. This is supported by Boserup's theory, which argues that uses of agricultural technologies will

enable people to be food secure. However, three-fifths (60.0%) had obtained facilities from different institutions, and two-fifths (40.0%) responded that they had not received any facility from any institution. It was observed that four-fifths (80.0%) of the facilities given to farmers were targeted to improve both maize and millet production. Twelve per cent (12%) of the facilities provided by these institutions were targeted to millet hybrid seeds improvement only; two per cent (2.0%) were targeted to maize only and 6.0% of the total respondents did not respond showing that they were not aware of the facilities. It was found that 72.0% of all respondents had not received any institutional facility support at the household level. However, 6.2% had received farm inputs in terms of hybrid seeds, fertilizers and packaging materials and 5.4% of the respondents had got facility in terms of advice on modern farming. One-eighth (12.5%) had got preservatives and 3.8% had got both capital and farm inputs. This indicates that most support was directed to provision of preservatives while farmers needed seeds and fertilizers, which are more essential in increasing production and food security.

4.3.4.4 Institutional support in credit provision to household members

The impact of the financial sector reforms, such as the closure of branches during the restructuring programmes and the abandonment of directed credit, have actually reduced the services available to low income people. The government realised that while the financial principles enshrined in the 1991 reforms retained their guiding forces as the basis for sound financial sector development, additional focus was placed on the expansion of financial services to micro-level clients. The restructured NBC resulted in the establishment of the National Microfinance Bank (NMB) for the benefits of the majority of Tanzanians, whose incomes and access to financial services are relatively poor. It also offers the possibility of managing scarce household and enterprise resources more efficiently and effectively, protecting against risks, provision for the future, and

taking advantage of investment opportunities for economic returns. For households, financial resource could facilitate the pursuit of income growth (NMFP, 2000). It was noted from the study that 28.5% only were NMB financial institutions beneficiaries. In absolute terms, only 69 (28.5%) respondents were loan beneficiaries between 2010 and 2011. The numbers of respondents' beneficiaries against their financial institutions were as follows: NMB (17%), CRDB (0%), PRIDE (1%), SEDA (0%), WDF (0%), CARE (24%), RFSP (5%), NEDF (8%), RRF (8%) and BFS (T) (6%).

4.3.5 Efficiency and effectiveness of institutional support to households

The households were asked about the rate of the institutional support and came up with varied responses. The aim was to analyze the efficiency and effectiveness of the institutions' performance (activities and financial versus output or objectives/goals) and the extent of the services and goods rendered by them. A five-tier responses system was used to analyse the effectiveness of institutions' support; the tiers were very low, low, moderate, high, and very high. It was found that 78.9% of the respondents said that the overall support of the institutions on agricultural production and food security ranked 3.6, approximately equal to 4, indicating that the institutions' effectiveness was high in the process of food production and food security.

The respondents were also asked to rate the involvement of those institutions on an ordinal scale of 1 = Very low, 2 = Low, 3 = Moderate, 4 = High and 5 = Very high. Efficiency was estimated using percentage of 0.0 to 100.0. The overall institutions efficiency was found to be 73.3%, whereas effectiveness was 3.6 by rank score equivalent to 72.0% indicating a high value of performance. Table 11 reveals that, among international agencies, WB received the highest score because it had been concerned with agricultural infrastructure development, construction and rehabilitation of rural roads and

financing some agricultural projects. In most parts of the study area, the FAO followed this organization with the same score as it dealt with financial support for agricultural development related programmes and construction and rehabilitation of rural roads, which became accessible throughout the year even in remote areas.

In case of national agencies, MAFSC scored the highest, followed by the MOID. In the case of CBOs, SACCOS and VICOBA scored the highest whereas for the financial institutions RFSF scored the highest as shown in Table 11.

Table 11: Efficiency and effectiveness of selected institutions in the study area

| Institution | Key functions | Scores value of Support | |
|-------------|-------------------------------------|---------------------------|---------------|
| | | Efficiency ($r = P/C$)* | Effectiveness |
| FAO | Agriculture and food security. | 90.0 | 4 |
| IFAD | Agricultural financing | 60.0 | 3 |
| WFP | Food aid & relief | 60.0 | 3 |
| WB | Agriculture and infrastructure | 95.0 | 4 |
| MAFSC | Agricultural policy, programme, etc | 92.0 | 4 |
| MoWI | Water infrastructure Development. | 40.0 | 2 |
| MOID | Infrastructure Development | 80.0 | 4 |
| MNRF | Environmental conservation. | 50.0 | 2 |
| MOLGRA | Extension staff allocation | 85.0 | 4 |
| DCs | Infrastructure & extension | 80.0 | 4 |
| PADEP | Infrastructure and training. | 60.0 | 3 |
| RFSP | Fund agriculture. & other IGAs | 65.0 | 3 |
| CARE | Fund agricultural enterprises | 60.0 | 3 |
| SACCOS | Fund, entrepreneurial activities | 90.0 | 4 |
| VICOBA | Fund variety of enterprises | 90.0 | 4 |
| All | | 73.3 | 3.6 |

P = dietary energy per adult equivalent, C = value of service or resource provided, r = efficient coefficient.

Table 11 shows that most institutions were both efficient and effective in promoting agricultural development and food security. The households received resources and services related to agriculture and food security, infrastructure development, agricultural policy, programmes and plans & extension education, environmental conservation, extension staff allocation and funding agricultural enterprises and entrepreneurial activities. On the other hand, most of the institutions, especially MFIs, faced a problem of financial insolvency hence failed to meet some of their targets. The institutional support at this juncture adheres to both Boserup theory (Based on importance of knowledgeable and skilled population that could back-up agricultural production and food security), Sen's theory (Stresses on basic resource endowments and entitlements deemed necessary to boost food security) and Woldemmeskel's theory (Clarifies the main conditions for food security including role of institutional factors such as legal system, governance, rules and norms; availability aspects; possessions of any kind; and market forces based on demand and supply side of food and its production gadgets).

4.4 Food Security Status at Household Level

The second objective was to determine the status of food security at the household level in the study areas. This section and sub-sections give results meeting this objective. As seen in Chapter 2.0, Section 2.1, from the 1996 World Food Summit's definition that food security comprises five dimensions, which are food availability, economic and physical access to food, food utilization, food stability over time, and food safety; four of the dimensions were used to determine food security and are reported on. Food security in terms of food availability was determined by recording amounts of all foodstuffs obtained per year (through production, buying, and receiving grains freely). Food security in terms of economic and physical access to food was determined by determining income per capita per month. Food security in terms of food utilization was determined by recording

number of meals eaten per household per day and computing dietary energy consumed per capita and per adult equivalent per day based on all foodstuffs consumed by all household members per month. Food security in terms of food stability over time was determined by analysing food balance sheets of households, i.e. agricultural season production, closing and opening food inventory and months the households did not have any food stock.

4.4.1 Food security equation

Foster (1992) provides a different definition of food security supported by the following equation: $(\text{Household food consumption requirement} - \text{Food production}) \times \text{Price of food} \leq (\text{income and liquid assets available to purchase food})$. It is obvious from the equation that the risk of food insecurity in the households presents the probability that the left-hand side of the equation is larger than the right hand side one. Foster (1992) mentioned a list of factors that influence each element in the food security equation, to reflect the fact that food security is a set of dynamics, rather than static relationships. It is the interplay among these factors, as well as the timed-release of assets, that ultimately determines whether a household is, and remains, food secure.

Frankenberger (1992) also has propounded the factor components as follows: First, household food consumption requirements comprise a number of people in a household by, age, sex, and working status of individuals, health status of individuals, child bearing status of women (pregnant, lactating) and activities statuses of individuals. Second, household food production consists of long-term ecological sustainability (natural resource conservation); biodiversity (Cleveland, 1993); endogenous factors including land (including land tenure), technology, education, risk assessment and management strategies; exogenous factors including economic policies (tariffs, price controls, taxes,

subsidies, researches, etc.); additional exogenous factors including shocks (climate change, long-term drought, land degradation, desertification, pollution). Third, price of food entailing size of population (demand), income of population (purchasing power) and economic policies; and fourth, income and liquid assets available to purchase food which considers purchasing power accompanying cash in hand, at bank or livestock inventory.

A complex set of these factors includes: education of household members, capital available to the household, land position, employment opportunities, and attitudes towards work, transportation costs, and health status of household members. In support of these authorities' arguments and paradigms related to food security, in the research from which this thesis is based, a list of factors pertaining to food security were analysed.

Based on the methods of food security determination reviewed just above in this section, food security was determined at the household level, and the findings are presented in the following sections.

4.4.2 Food security in terms of food availability

The food equation discussed in Section 4.4.1 provides a scope to analyse the findings on the four pillars of food security (food availability, economic and physical access to food, food utilization and food stability). The fifth pillar which is food safety is not discussed due to its measurement technicalities based on biological (food poisoning), nutritional status (macro and micro-ingredients) and processes (harvesting, storage, preparation, serving, etc.) criteria. In terms of food availability, amounts of grains harvested, bought and received freely per capita per year and per adult equivalent per year were recorded.

Households which had obtained less than 200 kg of grains per capita per year and those which had obtained less than 270 kg of grains per adult equivalent per year were considered to be food insecure, as seen Chapter Two. On the basis of the two criteria, it was found that, in the two districts, the grains obtained from production, purchasing and receiving freely amounted to averages of 332.06 kg per capita per year and 455.24 kg per adult equivalent per year. The minimum and maximum amounts of grains obtained per capita per year were 2 000 and 2 050.00 respectively, while the minimum and maximum amounts of grains obtained per adult equivalent per year were 34.43 and 2 623.12 respectively. These amounts and those obtained in the two districts are presented in Table 12. On the basis of the amounts of grains obtained per capita and per adult equivalent per year, the proportions of households which were food insecure and food secure are also presented in Table 12. The results show that the surveyed households in Iramba District obtained more grains per capita per year (411.8.kg) and 564.1 kg of grains per adult equivalent per year than Singida District where they obtained 252.3 kg of grains per capita per year and 346.4 kg of grains per adult equivalent per year.

Table 12: Amounts of grains produced food security status based on them

| Place | Grains obtained per capita per year (kg) | Food security incidence based on grains obtained per capita per year (%)* | | Grains obtained per adult equivalent per year (kg) | Food security incidence based on grains obtained per adult equivalent per year (%)** | |
|-----------------------|--|---|-------------|--|--|-------------|
| | | Food insecure | Food secure | | Food insecure | Food secure |
| Singida District | 252.3 | 46.7 | 53.3 | 346.4 | 51.7 | 48.3 |
| Iramba District | 411.8 | 24.2 | 75.8 | 564.1 | 25.0 | 75.0 |
| Both districts | 332.1 | 35.4 | 64.6 | 455.2 | 38.3 | 61.7 |

* Food insecure households obtained less than 200 kg per capita per year

** Food insecure households obtained less than 270 kg per adult equivalent per year

Food security incidence based on grains obtained per capita per year revealed that there were more food insecure households (46.7%) in Singida District than in Iramba District (24.2%), while based on grains obtained per adult equivalent per year in Singida District there were 51.7% food insecure households, which were more than those which were food insecure in Iramba District (25.0%). Moreover, it was found that 14.11% of all the surveyed households sold their grains harvested. In Singida District they purchased 23.12% of the total grains, whereas in Iramba District they purchased 5.10% of the total grains, indicating that Singida District was more food insecure than Iramba District.

The residents in Singida and Iramba districts depended much on three main grain crops considered to be the staples of the region. These were maize, millet and sorghum. The findings showed that there were more maize producers in Iramba than in Singida District. However, it was found that there were more millet and sorghum producers in Singida than in Iramba District. This indicates that there was a great shift from growing drought resistant crops in Iramba District compared with Singida District. The reason behind this situation was that the rainfall in Singida District is more erratic than in Iramba District, leave alone the change in taste among grain consumers in the districts (SRP, 2010). The respondents also explained this production shift as resulting from poor technology used in processing the crop products after harvesting, which is more drudgery for millet, and sorghum; it involves pounding using big sticks. Other drought resistant crops which have been abandoned by farmers include cassava and sweet potatoes. This situation has been caused by shift to horticultural crop production.

4.4.2.1 Import dependency ratio (IDR)

In the course of analyzing the food situation of a particular place, an important aspect is to know how much of the available domestic food supply has been imported and how much comes from the country's own production. IDR is defined as follows:

$$\text{IDR} = \frac{\text{Imports}}{(\text{Production} + \text{imports}) - \text{Exports}} \times 100$$

Using that equation at the household level, imports=food bought and food received freely; exports=food sold and food given away freely. The data were extracted from food balance sheet as developed in the household questionnaire. In Singida Region the value of IDR was 16.0%, implying that the households in the two districts purchased or received food freely at that tune and therefore were able to survive on their own by 84.0%. The value of IDR for Singida District was 20% implying that the households in the district purchased or received food freely at that tune and therefore were able to survive on their own by 80.0%. The value of IDR for Iramba District 11.8% implying that the households in the district purchased or received food freely at that tune and therefore were able to survive on their own by 88.2%.

4.4.2.2 Food crops varieties in the two districts

In both districts, the common food crops were maize, millet, sorghum, cassava, sweet potatoes, beans, rice, peanuts and cowpeas. The dominant food crop was maize, followed by millet, then sorghum, and sweet potatoes. Table 13 shows production of crops varieties in the two districts for 2010/11 agricultural season.

Table 13: Production of crops diversities in 2010/11

| Crop variety (n = 240) | Production(Kg)(in 000) | Percentage |
|-------------------------------|-------------------------------|-------------------|
| Maize | 172.3 | 62.1 |
| Millet | 51.6 | 18.6 |
| Sorghum | 3.2 | 1.1 |
| Rice | 0.8 | 0.3 |
| Sweet potatoes | 4.0 | 1.4 |
| Cassava | 43.0 | 15.5 |
| Beans | 1.2 | 0.4 |
| Peanuts | 0.7 | 0.3 |
| Cowpeas | 5.3 | 0.2 |
| Total | 277.3 | 100.0 |

Likewise, it was found that the amount of different types of crops produced in Iramba and Singida districts were maize, millet and sorghum among others. Iramba District produced more maize than Singida District and surpassed the former in both millet and sorghum production (Table 13).

4.4.2.3 Food availability and frequency of institutional support in sampled villages

There were varieties of agricultural support services aimed at sustaining food security. These included: education and training, credit supply, provision of inputs, extension services, and infrastructure. It was found that there was a great difference in support provided in terms of frequency relative to different villages in the surveyed areas. The results in Table 14 show the frequencies of support given by various institutions in the study area. The results show that New Kiomboi Village in Iramba District scored the highest number of institutional support points in 2010/11 followed by Nselembwe Village and Kizonzo Village, both in Iramba District. This discrepancy with Singida District was due to the fact that formal and informal institutions were more concentrated in the former than in the latter villages.

Table 14: Number of times support provided by institutions in 2010/11

| S/n | Village | Number of times support was provided in the year 2010/11 | | | | | Total |
|-----|--------------|--|-----------|-----------|-----------|-----------|-----------|
| | | Inputs | Credit | Ext serv | Train. | Infrastr | |
| 1 | Merya | 1 | 0 | 0 | 1 | 1 | 3 |
| 2 | Kinyamwambo | 1 | 1 | 1 | 2 | 1 | 6 |
| 3 | Ntuntu | 1 | 0 | 1 | 0 | 1 | 3 |
| 4 | Siuyu | 1 | 0 | 0 | 0 | 1 | 2 |
| 5 | Kizonzo | 2 | 3 | 6 | 4 | 3 | 18 |
| 6 | Nselembwe | 3 | 4 | 8 | 4 | 3 | 20 |
| 7 | New Kiomboi | 3 | 7 | 0 | 6 | 11 | 27 |
| 8 | Kisimba | 1 | 2 | 0 | 1 | 1 | 5 |
| | Total | 13 | 17 | 16 | 18 | 22 | 86 |

Number of times support was provided increased the probability of a household having adequate food stock hence food secure. Those households which had no or low number of support provided by different institutions were more likely to be food insecure as support given helps to build household's capacity of food production.

4.4.3 Food security in terms of food access

Access to food was considered as a result of the ability to express food needs (beyond subsistence production) as effective demand (purchasing power i.e. income) and market availability. Food security was considered as a situation whereby both food supply and demand were sufficient to cover food requirements on a continuous and unwavering basis. There were varieties of income sources in the two districts, Singida and Iramba. Table 15 shows the main sources of income of households in the two districts.

Table 15: Main sources of income of households in the two districts

| Source of income | Singida District (%) | Iramba District (%) |
|---|-----------------------------|----------------------------|
| Sale of food crops | 14.2 | 46.7 |
| Sale of cash crops | 43.4 | 23.3 |
| Sale of livestock | 8.3 | 6.3 |
| Sale of charcoal | 3.2 | 3.2 |
| Sale of timber/pole | 3.2 | 1.2 |
| Sale of wild products (honey, medicinal plants) | 5.7 | 0.0 |
| Wages and salaries | 1.4 | 2.5 |
| Sale of local brew | 15.0 | 10.4 |
| Casual labour | 4.0 | 0.0 |
| Cash remittance | 5.0 | 5.0 |
| Petty trade | 5.0 | 0.8 |
| Charity | 1.6 | 0.8 |
| Fishing | 0.0 | 0.8 |
| Total | 100.0 | 100.0 |

Most households in Singida District depended on sale of cash crops whereas in Iramba District they depended on sale of food crops. In Iramba District none of the households depended on sale of wild products as the main source of income whereas, in Singida District none of the household depended on fishing as the main source of income.

In terms of food access, food secure and food insecure households were segregated by using a national (income) poverty line of TZS 26 085 per adult equivalent per month. Any household falling below that amount is considered to be food insecure and the one falling within or above was said to be food secure. It was found that food insecurity incidence in both districts was 67.2%, and the incidence in Iramba District it was 57.8% whereas in Singida District was 76.8% indicating that the latter earned less income per adult equivalent per month than the former.

4.4.4 Food security in terms of food utilization

Besides analysing food availability and food accessibility, food utilization was also analysed because availability and accessibility are means to enable food utilization. Food

utilization is multidimensional; it has various facets on which it can be determined which are analysed below.

4.4.4.1 Basal Metabolic Rate approach to food utilization

BMI Calories (2015) calculated daily personal recommended calorie intake based on three main factors: person's weight measured in kg; the amount of muscle possessed by an individual; and person's activity levels. It was argued that weight matters because everybody burns up calories just to keep the body going. The heavier one is, the more calories one needs. Muscle mass is also important: a kilogram of muscle may burn up to an extra 50 calories per day, compared with a kilogram of fat. Finally, an activity level needs to be taken into account: someone working on a building site and hitting the gym for hours at the weekend will be burning off many more calories than those of us with desk job. In order to come up with one's personal calorie requirement, there's a formula that is used. This formula gives one's Basal Metabolic Rate. It should be multiplied by a certain percentage to reflect one's activity level e.g., sedentary (no exercise, sit at a desk most of the day): BMR x 1.2, moderately active (moderate exercise): BMR x 1.3, very active (hard exercise): BMR x 1.4, and extremely active (very hard exercise): BMR x 1.5. Since data were collected during the farming season the level of activity taken was very active with a BMR factor 1.4. Using the Cunningham formula: $BMR = 500 + 2.2 \text{ LBM}$; where BMR = Basal Metabolic Rate, LBM = Lean Body Mass (BMI Calories, 2015). Table 16 shows the mean energy intake (BMR) in kCal.

Table 16: Mean BMR for Singida and Iramba Districts

| District | Mean energy intake (BMR)(kCal) | Minimum (kCal) | Maximum (kCal) |
|-----------------------|---|-----------------------|-----------------------|
| Singida | 2236.9 | 1878.8 | 3239.6 |
| Iramba | 2288.0 | 1999.7 | 3725.5 |
| Both districts | 2262.5 | 1939.3 | 3482.6 |

It was found that by using the two cut-off points of 2,100 kcal per capita per day and 2 200 kcal per adult equivalent, 15.8% and 28.3% had less energy intake per day in Iramba District whereas in Singida District, it was found that 14.5% had energy intake less than 2 100 kCal per capita and 26.7% had less than 2 200 kCal per adult equivalent per day. However, Iramba District was better-off than Singida District. Nevertheless, this method fell short by depending on pulse rate considered to be a constant 66.0 rpm for all respondents. However, the reliability of this method rests on the fact that any activity level needs different amount of dietary energy consumption.

4.4.4.2 Body Mass Index approach to food utilization

The assessment of food security prevalence is based on direct information on the nutritional status of individuals, mainly in the form of anthropometric data on height and weight, generally in combination with information on age in the case of children (Nubé, 2010). In the two districts, determination of household food security used this approach as there is a direct relationship between nutritional status, height and weight of an individual. However, BMI cannot be averaged, but minimum value and maximum values for individuals in the two districts could be found.

The minimum BMI value for Singida District was 19.10 and the maximum value was 37.87 while the minimum BMI value for Iramba District was 19.49 and the maximum

value was 38.40. The normal range for a person who is neither underweight nor overweight is $18.5 - 25.0 \text{ kg/m}^2$ according to WHO (2003). The Table 17 shows the distribution of respondents in three different groups.

Table 17: Distribution of respondents by groups of weight (n=240)

| Group of weights | Singida District | | Iramba District | | Both Districts | |
|-------------------------------|------------------|------|-----------------|------|----------------|-------|
| | n | % | n | % | n | % |
| Underweight (< 18.50) | 120 | 0.0 | 120 | 0.0 | 240 | 0.0 |
| Normal weight (18.50 – 24.99) | 120 | 75.8 | 120 | 90.0 | 240 | 82.81 |
| Overweight (≥ 25.00) | 120 | 24.2 | 120 | 10.0 | 240 | 17.1 |

It was found that 0.0% of the total respondents in Singida District were underweight; 75.8% had normal weight and 24.2% were overweight whereas in Iramba District; 0.0% of the total respondents were underweight; 90.0% had normal weight and 10.0% were overweight. This shows that undernourishment was more severe in Singida District than in Iramba District. This shows that Iramba District was better-off in terms of nutrition and food security than Singida District. The absence of underweight group might have arisen due to the fact that the ones who were interviewed were household members whose age was above 20 years hence had declined in terms of Basal Metabolic Index and increased in weight (BMI Calories, 2015). Another reason might be that most heads of households were males (89.2%) who had control over, access to, and ownership of productive assets including food inventory which added their weights through high utilization of food resources.

4.4.4.3 Food utilization based on Dietary Diversity Score (DDS) of meals

The food groups consumed were assigned one each as follows: A = 1, B = 0, C = 1, D = 1, E = 1, F = 0, H=1, I = 1, J = 1, K = 1 and L=0. These totalled to nine. USAID system considers a food group of 12 and is a proxy measure of the nutritional quality of household and individual diets. It was found out that some of the food groups were not consumed during the survey period because they were not available or not mature for eating.

Using the criterion of the availability of food richest households whose DEC per capita and per adult equivalent i.e. those that did not reduce the amount of food for their own consumption per reference period of 2010/11 who were 72 only then:

$$\text{The HDDS indicator} = \frac{\text{Sum (HDDS)} \times 100}{\text{Number of food richest hh}} = \frac{9 \times 100}{72} = 22.5\%$$

The answer is 22.5%, which is below the recommended 33.3% (WHO) showing that a large proportion of the population (77.5%) in the study area suffers from micro and macronutrients deficiency hence food insecure.

4.4.4.4 Traditional vegetables supplement and food utilization

The varieties of traditional vegetables consumed within household diets were the highest in Singida region where on average nearly two different vegetables had been consumed per day due to drought which led to annual food deficit, which constituted 78.6% of the total traditional vegetables consumption share (Keding *et al.*, 2007). This is due to the fact that the region is a semi-arid area and food insecurity is high as noted in Chapter One Section 1.3. AVRDC (2005) supports the vegetable consumption among the poor households as it writes, “Vegetables contribute highly to nutrition and food security for

the world's poorest households by ensuring vitamins-rich and health promoting varieties''. It was found that jute mallow was the most frequently consumed wild vegetable in year 2010/2011 with the mean of 1.77 followed by pumpkin leaves with mean 0.604, and then African spider flowers with mean 0.5708, cowpeas leaves with mean 0.517, okra mean with 0.471 and cassava leaves mean with 0.458.

The least consumed varieties were false sesame with mean 0.458 and okra with 0.471, due to their scarcity and hence less availed. The households reducing the amount of grains and increasing the amount of wild vegetables commonly used the wild traditional vegetables to supplement the demand of locally produced grains. However, it was found that wild mushrooms were the most preferred wild vegetables though its availability was so temporal lasting about three months in alternating years. It was more found in Iramba District than in Singida District. Mushroom were eaten both as a meal or food relish. The most prevalent types of these vegetables were as shown in Table 18.

Table 18: Traditional vegetables used as meal supplement in the surveyed area

| Local Name | English Name | Scientific Name | Rank* | |
|---------------|-----------------------|-------------------------------|------------------|-----------------|
| | | | Singida district | Iramba district |
| Mlenda | Jute mallow spp. | <i>Corchorus olitorius</i> | 1 | 2 |
| Mgagani | African spider flower | <i>Gynandropsis gynandra</i> | 3 | 5 |
| Mnavu | African Night Shade | <i>Solanum villasum</i> | 8 | 7 |
| Mchungu | Bitter Lettuce | <i>Launea cornuta</i> | 9 | 14 |
| Mkunde | Cowpea | <i>Vigna unguiculata</i> | 6 | 6 |
| Kishonanguo | Black Jack | <i>Bidens pilosa</i> | 15 | 15 |
| Matango mwitu | Bur gherkin | <i>Cucumis anguria</i> | 11 | 10 |
| Kisamvu Mpira | Cassava Leaves | <i>Manihot graziovii</i> | 5 | 4 |
| Maboga | Pumpkin | <i>Cucurbita pepo</i> | 4 | 3 |
| Ngogwe | African Eggplant | <i>Solanum villasum</i> | 14 | 13 |
| Mronge | Drumstic tree | <i>Moringa oleifera</i> | 10 | 9 |
| Kumbo | Wild simsim | <i>Sesam angustifolium</i> | 12 | 12 |
| Ntalianda | False sesame | <i>Ceratotheca sesamoidas</i> | 13 | 11 |
| Bamia | Okra | <i>Cabelmoschus spp</i> | 7 | 8 |
| Uyoga | Mushroom | <i>Agaricus bisporus</i> | 2 | 1 |

* Calculated from 240 households in the field

It was found that mushrooms was ranked number one in Iramba District and number two in Singida District. The reason behind this difference was that the vegetable did not naturally grow in Singida District in the 2010/2011 agricultural season and therefore imported from Iramba District. Mushrooms and jute mallow scored the first rank 1.5. The importance of traditional vegetables in food security was marked more during months of critical food shortage in the region, i.e. February and March. The households which were highly food insecure had to reduce grains consumption by supplementing with traditional vegetables as a food coping strategy. This implies that wild vegetables were less consumed by food secure households than those which were food insecure. It was obvious that, for food insecure households, eating more vegetables was one way of coping strategies as use of grains was reduced.

4.4.4.5 Food crops utilization pattern in the study area

Food crops products were mainly used for feeding the families. However, some of them used it by disposing at farm gate price or market price. Others used it for local brewing, traditional cold drink making (*togwa*). Some of them gave a part of food stock to their relatives or needy neighbours whereas others reserved for seeds for next season. Very few of them used food for animal feeds especially pig keepers. It was found, as seen in Fig. 12, that 82.2% of households used part of their food inventory to make local brew and 1.3% used it for animal feeds. However, it should be noted that the responses were multiple as one respondent responded to several alternatives. Fig. 12 shows how the households utilized their crops after harvest.

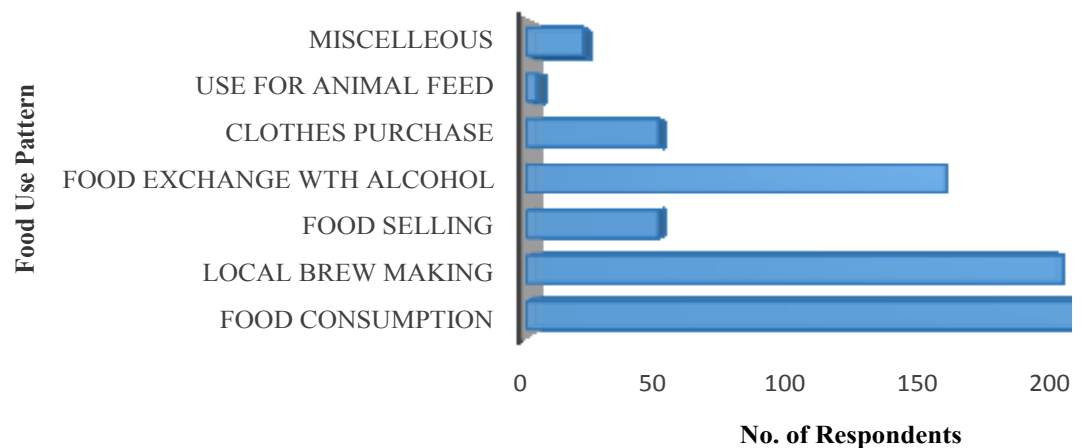


Figure 9: Pattern of food utilization in the study area.

Despite the fact that all the households surveyed used their food inventory for food consumption, still the number of them who used it for local brew making was high (82.2%). This pattern of food utilization was threatening the food security status in the study area.

4.4.4.6 Food utilization and dietary energy consumed in the study area

Based on estimates given by FAO (2004), households consuming less than 2 280 kCal per adult equivalent per day are considered to be food insecure. Dietary Energy Consumed (DEC) per capita per day and per adult equivalent per day were based on 30 days' data collected using a household questionnaire: In this case, households were food insecure if they had consumed less than 2 100 kCal per capita per day and less than 2 200 kCal per adult equivalent per day. All basic foods eaten in the study area made it possible to obtain DEC. Food security was determined using proxy and actual indicators. Proxy indicators included meals taken per day (24h-recall) or the amount of food taken per day

and meals taken per 30 days or the amount of food taken per 30 days. The actual indicator used was the amount of kCal consumed per adult equivalent per day in a household. In order to have reliable results and avoid loss of memory among households, representatives or heads of households were asked to recall and mention the amounts of all types of food eaten over a period of 30 days prior to the research.

Lukmanji's *et al.* (2008) provided the kCal contained per each edible part of a variety of food stuff per every edible 100 gm which were converted into kg through cross multiplication. After getting the amount of each food stuff consumed in a household per month each one was multiplied by its respective kCal content per kg to get the total kCal consumed per household per month. The total amount was divided by adult equivalent units. The adult equivalents were obtained considering sex and age of each household member using the calorific requirements constants by Collier *et al.* (1990) and then adjusted by using household Economic of Scale Constants by Deaton (1980, cited by Collier *et al.*, 1990) with average cost emanating from the fact that the household members share some items including cooking utensils hence diminishes with increasing number of household members. The adjusted adult equivalent units are the ones which were used as a denominator in division with total calories consumed by each household per month and divided by 30 days to get DEC per adult equivalent per day which was used to determine food security. Cognisant of the fact that if variables like purchasing power and dietary energy consumed expressed per capita they do not reflect good comparative figures consumed then they were expressed per adult equivalent following Collier *et al.* (1990) procedure in their study in Tanzania. In order to calculate adult equivalent units using the procedure, the sex and age of every household member must be identified, known, and recorded first as was done in this study. Then a two-step procedure was followed. In the first step, constants reflecting caloric requirements by age and sex were

added up for every household member to get all the household members in terms of adult equivalents. The constants are presented in Appendix 10. For example; if a household has seven members who are: a) female aged 54 years, b) female aged 48 years, c) male aged 19 years, d) male aged 16 years, e) female aged 14 years, and f) female aged 12 years g) female aged 10 years. These are equivalent to $0.88_{(\text{First Person})} + 0.88_{(\text{Second Person})} + 1.00_{(\text{Third Person})} + 1.20_{(\text{Fourth Person})} + 1.00_{(\text{Fifth Person})} + 0.88_{(\text{Sixth Person})} + 0.76_{(\text{seventh Person})} = 5.08$ unadjusted adult equivalent units.

However, Appendix 10 could not be used directly as a denominator for computing values per adult, because of economies of scale. Therefore, the second step involved adjusting the above adult equivalent units for economies of scale because larger households need fewer amounts of resources per person due to sharing some facilities. The adjustment was done by multiplying the adult equivalent units by average cost constants given in Appendix 11 in order to get adjusted adult equivalent units. The average cost constants diminish as the family size becomes larger and larger. Given the unadjusted adult equivalent of 5.08, this should be multiplied by 0.807 corresponding to family size of 5 approximated to no decimal point. Therefore, since 5.08 is approximately equal to 5 it was multiplied by 0.807, which is the average cost (Appendix 11) corresponding to seven adults living together, in order to adjust 5.08 for economies of scale. Therefore, the adjusted adult equivalent units are 4.09950, i.e. 5.08×0.807 . This should be the denominator for calculating values per adult equivalent in that household.

Such a procedure is followed for every household in a sample. Having calculated adult equivalent units, then dietary energy consumption was calculated by adding all the kilocalories from different food types consumed by household per month. It was then divided by 30 days recall in order to get the kCal consumed by individual household per

day. The dietary energy consumption per capita was calculated by considering all the foodstuffs which were consumed at the household level in both districts of the study including grains, cereals, tubers, meat, vegetables and fruits.

The caloric contents for each foodstuff in kg were added up to get the total Dietary Energy Consumed. Food intake per household was counted for 30 consecutive days in order to take into account at least all the types of foodstuff eaten. Therefore, the DEC per adult equivalent per day was obtained by dividing it by 30 days and then by adult equivalent units. DEC per capita per day was obtained by dividing it by 30 days and then divided by household size. There were two cut-off points of 2 100 kCal per capita per day and 2 200 kCal per adult equivalent per day that were used to categorize the households as food secure or insecure by transforming and recoding data from DEC per adult equivalent and DEC per capita as input variables into food secure and food insecure variables. Those DEC values falling below any of these two cut-off points were labelled food insecure and those which fell in and above the points were labelled food secure.

Food secure and food insecure households were obtained by segregating the households based on the Sukhatme's (1961) formula given in Chapter Two, and using two cut-off points of 2 200 kCal consumed per adult equivalent per day and 2 100 kCal per capita per day. Although the incidences of food insecure and food secure households based on kCal consumed per capita per day and kCal consumed per adult equivalent per day were different, the trend of food insecurity in the two districts were similar as they both fell below the cut-off points, Singida District being less food secure than Iramba District. Table 19 shows the distribution of households in terms of DEC and food insecurity.

Table 19: Dietary energy consumed (DEC) and food insecure households (n=240)

| Dietary energy consumed & Food insecure households | Singida District DEC | Iramba District DEC | Both Districts DEC |
|---|---------------------------------|--------------------------------|-------------------------------|
| DEC per capita (kCal.) | 1876.54 | 1985.72 | 1978.65 |
| DEC per adult equivalent (kCal.) | 2164.24 | 2185.63 | 2179.85 |
| Food insecure hh per capita (%) | 36.7 | 30.4 | 33.6 |
| Food insecure hh per adult equivalent (%) | 69.6 | 63.3 | 66.5 |

Table 19 shows that Singida District was more food insecure than Iramba District both in terms of DEC per capita and per adult equivalent as the former had less grains obtained per capita and per adult equivalent per year during year 2010/2011. It is also evident from the table that food insecure households per capita and per adult equivalent were more in Singida District than Iramba District.

4.4.4.7 Food utilization versus traditional norms, values and practices

It was observed that there were some norms, values, and practices which, apart from overall traditional institutions, were constraining food security in the study area and hence affected the status of food security as per objective two of this study. It was found that 82.5% of the households responded that there were traditions which inhibited the households' efforts towards food security and food self-sufficiency. Table 20 shows traditional norms, values, and practices that constrained or enhanced food security.

Table 20: Responses on food security friendly and unfriendly traditions (n=240)

| Tradition | Food security friendly | Food security unfriendly | Percent* |
|---|-------------------------------|---------------------------------|-----------------|
| Grains local brew making | | ✓ | 60.9 |
| Initiation ceremonies | | ✓ | 5.4 |
| Prolonged funeral ceremonies | | ✓ | 9.6 |
| Grains exchange with local brew | | ✓ | 50.0 |
| Exchanging livestock with grains | | ✓ | 3.4 |
| Informal groups of brew drinking | | ✓ | 41.7 |
| Exchanging one type of food with another type of food | | ✓ | 1.2 |
| Free giving of food to relatives | ✓ | | 50.0 |
| Payment in kind in lieu of labour | ✓ | | 25.0 |
| Collective labour | ✓ | | 25.0 |

4.4.4.8 Common Coping Strategies Resorted to by Households during Food

Shortage

Different households in the two study districts felt the situation of food insecurity at differing degrees and developed different strategies to counteract food shortage. Each household used any strategy, which was legal and feasible. Households from the two districts resorted to different strategies according to the entitlements they possessed including labour force though at low wages.

The findings indicated that 85.5% of all households in Singida District resorted to one or more of the coping strategies during 2010/11 agricultural season, whereas in Iramba District, there were 60.8% households that resorted to the same. Table 21 shows the number of households and strategies resorted. It was found that households had high access to their own labour compared to other resources. The least resorted strategy was temporary migration (0.2%) to other relief areas. The findings showed that other strategies included begging, food scavenging, rubbish combing, eating wild fruits,

hunting small games, seeking for food aid at the district council, child labour, taking-off a part of the family members to well-off relatives. Table 21 shows that households resorted to selling labour more than any other strategy in counteracting food shortage (61.3%) in both two districts.

Table 21: Coping strategies resorted to by households

| Coping strategy | Frequency | | Percentage | |
|-------------------------------------|-----------|--------|------------|--------|
| | Singida | Iramba | Singida | Iramba |
| Sold part of livestock | 24 | 48 | 10.0 | 20.0 |
| Borrowed food | 18 | 15 | 15.0 | 12.5 |
| Sold labour power | 50 | 75 | 60.0 | 62.5 |
| Sold part of land | 4 | 0 | 3.3 | 0.0 |
| Sold dom. assets | 3 | 2 | 2.5 | 1.7 |
| Borrowed cash | 4 | 6 | 3.3 | 5.0 |
| Temporary migration | 0 | 1 | 0.0 | 0.4 |
| Other strategies (<i>Specify</i>) | 7 | 11 | 5.8 | 9.2 |

Every coping strategy taken by a household had monetary value implication. The large part of the money received from any coping strategy was used to purchase food, though some households' heads used the money for alcohol abuse and gambling while their families were suffering from starvation. The average value of coping strategies was TZS 13 479 120.00 and selling of respondents' labour power had the highest value. Table 22 shows monetary value of coping strategies resorted to by households.

Table 22: Monetary value of coping strategies resorted to by households

| Coping strategy | n | Mean | SE | Std Dev | Min. | Max. | Sum TZS |
|------------------------|----------|---------------|---------------|----------------|-------------|------------------|-------------------|
| Livestock sold | 237 | 28 248 | 7549 | 116 229 | 0 | 1 000 000 | 6 695 000 |
| Food borrowed | 216 | 4874 | 1147. | 16 859 | 0 | 175 000. | 1 053 000 |
| Labour sold | 232 | 58 099 | 5804 | 8840 540 | 0 | 400 000 | 13 479 120 |
| Land sold | 240 | 833 | 58 800 | 910 960 | 0 | 100 000 | 200 000 |
| Domestic assets sold | 240 | 1041 | 1041. | 1 613 740 | 0 | 250 000 | 250 000 |
| Cash borrowed | 240 | 3941 | 1759 | 27 261 | 0 | 200000 | 200 012 |
| Temporary migration | 240 | 0 | 0 | 0 | 0 | 0.00 | 0. |
| Other strategies | 232 | 18 965 | 7507 | 114 354 | 0 | 1,250,000 | 440 000 |
| Total | | 93 097 | 16 130 | 246 741 | 0 | 1 925 000 | 21 677 120 |

4.4.5 Food security in terms of food stability

Stability referred to variations and the risk of shortfalls in income, food production, supplies and/or demand over time. It is sensible that food inflow and outflow to be dynamic, continuous and measurable in terms of food opening stock and closing stock. The average closing stocks for maize, millet and sorghum showed that 74.8% of the total households fell below the cut-off point of 270 kg per adult equivalent per year. In Singida District 82.5% of the households fell below the cut-off point whereas in Iramba District 72.5% fell below the cut-off point. It was also found that 20.6% of the households had their grains lasting for 12 months. In Singida District 17.4% of the households had their grains lasting for 12 months whereas, in Iramba District 22.7% of the households had their grains lasting for 12 months. The times taken by maize, millet and sorghum to last were 6 months, 2 months and 1 month respectively with the average of 8 months for all the three grains.

4.4.6 Extent of household food insecurity

Food insecurity in the two districts was obtained by using various methods including household self-appraisal where it was estimated in terms of percentage using respondents' own experience. The data obtained through descriptive analysis are presented in Table 23 and shows the percentage distribution of food secure and food insecure households.

Table 23 Food security levels based on various methods (%) (n=240)

| Method of food security determination | Food security status (%) | | | |
|---|--------------------------|-------------|-------------|-------------|
| | Food insecure | | Food secure | |
| | Singida (%) | Iramba (%) | Singida (%) | Iramba (%) |
| Households' self-appraisal | 62.4 | 57.9 | 37.6 | 42.1 |
| Number of meals eaten per day (Food secure \geq 3 meals) | 56.7 | 54.3 | 43.3 | 45.7 |
| Number of meals eaten in 30 days (Food secure \geq 90 meals) | 52.8 | 49.2 | 47.2 | 50.8 |
| Grains obtained per capita per year (Food secure \geq 200 kg) | 46.7 | 24.2 | 53.3 | 75.8 |
| Grains obtained per adult per year (Food secure \geq 270 kg) | 51.7 | 25.0 | 48.3 | 75.0 |
| DEC per capita per day based on 30 days' data (Food secure \geq 2,100 kCal) | 36.7 | 30.4 | 63.3 | 69.6 |
| DEC per adult per day based on 30 days' data (Food secure \geq 2,200 kCal) | 63.3 | 33.3 | 36.7 | 66.7 |
| All | 57.4 | 52.8 | 42.6 | 47.2 |

The results showed that Singida District was more food insecure than Iramba District as it had higher score of number food insecurity prone households. The data obtained through descriptive statistics displayed by SPSS frequency tables showed that there were more households in Singida District, which experienced very high food insecurity than in Iramba District. It is quite evident that Singida District was more prone to food insecurity than Iramba District. The results showed that Singida District was more food insecure than Iramba District as it had higher score of number food insecurity prone households. The data obtained through descriptive statistics displayed by SPSS frequency tables

showed that there were more households in Singida District, which experienced very high food insecurity than in Iramba district. It is quite evident that Singida District was more prone to food insecurity than Iramba District.

4.5 Linkages between Institutional Factors and Food Security Factors

4.5.1 Description of institutional factors and food security factors used

The study analysed the linkage between institutional factors (polices, rules, regulations by-laws, extension services, existing food norms and values, training programmes, organizations, credit support, land reform, input support system, marketing systems and infrastructure construction and rehabilitation) and food factors (acreage of land cultivated, acreage of land owned, agricultural production and storage systems, gender labour participation, varieties of food crops and animals kept, number of meals taken in a days, quantity of food eaten in 30 days, daily dietary energy consumption, amount of food produced per year, food import dependency ratio, main sources of income and coping strategies).

The respondents assessed the performance of various institutions in their areas based on the aforementioned scaled indicators so as to be able to compare correlations, associations and disparities results on food security based on these: Ranges; 0.0 – 20.0 (very low), 21.0 – 40.0 (low), 41.0 – 60.0 (moderate), and 61.0 – 80.0 (high), and 81.0 - 100.0 (very high). The respondents agreed that the institutional performance in terms of efficiency was high (73.3%) as well as in terms of effectiveness (rank 3.6 = 72.0%) indicating that the efficiency and effectiveness of institutions in delivering goods and services to the small farmers were not substantial enough to propel adequate impetus to raise food production and improve food security status in Singida Region.

4.5.2 Institutional factors and comparison of DEC per adult equivalent

As stated in the methodology chapter, food security was measured in terms of dietary energy consumption per adult equivalent using a number of institutional factors. Before using them, community members were asked whether the factors were relevant determinants of food security in their communities. In all the communities it was agreed that they were relevant determinants of food security. The scores on the 8 selected determinants indicators and comparison of the points across the institutional factors were as presented in Table 24.

Table 24: Differences in dietary energy consumed (DEC)[T-test]by selected institutional factors

| Institutional factors | n | Mean DECper adult equivalent (kCal) | F | Sig. (2-tailed) |
|---|-----|-------------------------------------|-----------|-----------------|
| Where there was institutional support | 154 | 2385.6647 | 14.575*** | 0.000 |
| Where there was no institutional support | 86 | 2000.3436 | | |
| Amount of credit provided to farmers in TZS >= 100,000 | 177 | 2196.3435 | 5.961*** | 0.000 |
| Amount of credit provided to farmers in TZS < 100,000 | 63 | 2003.4304 | | |
| Total value of input support in TZS >= 100000 | 71 | 2454.1426 | 12.321*** | 0.000 |
| Total value of input support in TZS < 100000 | 169 | 2004.2421 | | |
| Total value of infrastructure constructed in million TZS > = 360 | 179 | 2354.3606 | 11.984*** | 0.000 |
| Total value of infrastructure constructed in million TZS < 360 | 61 | 2007.3001 | | |
| Number of household members who received training > = 3 | 190 | 2296.5063 | 0.698 | 0.321 |
| Number of household members contacted by extension workers per year < 3 | 50 | 2175.4766 | 0.576 | 0.453 |
| Number of times household members contacted by extension workers in 2010/2011 > = 5 | 70 | 2299.7246 | | |
| Number of times household members contacted by extension workers in 2010/2011 >5 | 170 | 2187.7246 | | |
| Grains obtained per capita per year in Singida District | 120 | 252.3310 | 8.992** | 0.003 |
| Grains obtained per capita per year in Iramba District | 120 | 411.7978 | | |
| Grains obtained per adult equivalent per year in Singida District | 120 | 346.3485 | 8.162** | 0.005 |
| Grains obtained per adult equivalent per year in Iramba District | 120 | 564.1327 | | |

*p< 0.05, **p< 0.01, ***p < 0.001

The results in Table 23 show that the means in dietary energy consumed (DEC) per adult equivalent per day were significantly different on the bases of various institutional factors ($F = 14.575$, $p \leq 0.001$). The results showed that almost all the institutional factors analysed showed significant differences in food security between households where the institutional factors held differently. The findings mean that the households differed much in DEC per adult equivalent with respect to selected institutional factors. The differences were also significant between the households with total value of input support in TZS $\geq 100\,000$ than those with total value of input support in TZS $< 100\,000$ with $F = 12.321$ and $p = 0.001$. This might be due to the fact that inputs are used directly in the production process. The findings are contrary with those of Mphale *et al.* (2003) who found that distribution of inputs in Lesotho is done late, hence negatively affects crops yields to all households. A T-test tells about the probability that two sets of values come from different groups. Larger F-values translate into smaller p-values. So the larger the F-value is the more likely the difference is significant (Archilles, 2004). On the basis of these explanations and results, the first null hypothesis that grains produced per year and utilization of food in terms of dietary consumed per adult equivalent per day do not differ significantly among households having different institutional factors is rejected. These findings concur with arguments by Woldemeskel (1990) that institutional elements help increase food security. The results that showed that Dietary Energy Consumed (DEC) differed significantly among households with different institutional factors could mainly be due to low use of technology in production, skewed institutional support, difference in agricultural infrastructural development and inadequate training provided.

4.5.3 Correlation between some institutional factors and DEC per adult equivalent

Correlations coefficients and their level of significance (p-values) were computed to analyse the relationships between some institutional factors, some other factors and food

security in terms of dietary energy consumption in the surveyed area. According to Cohen and Holliday (1982), cited by Bryman and Cramer (1993), correlation coefficients (regardless of positive or negative signs) are interpreted as follows: below 0.19 is very low, 0.20 to 0.39 is low, 0.40 to 0.69 is modest, 0.70 to 0.89 is high, and 0.90 to 1.00 is very high. The interpretations of the results are based on the ranges of r-values. The results are shown in Table 25.

Table 25: Correlation between Dietary energy consumed (DEC) and some independent variables****

| Institutional Factors | Singida | | Iramba | | All | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|
| | r – value | p – value | r – value | p – value | r – value | p – value |
| Household size | -0.640*** | 0.000 | -0.264** | 0.004 | -0.733*** | 0.000 |
| Acreage with government regulations | 0.282*** | 0.000 | 0.206*** | 0.001 | 0.276*** | 0.000 |
| Value of agricultural inputs supplied to farmers | 0.069 | 0.456 | -0.187** | 0.003 | -0.195** | 0.002 |
| Number of household members received training | 0.667*** | 0.000 | 0.773*** | 0.000 | 0.732*** | 0.000 |
| Total acreage irrigated | 0.132 | 0.091 | 0.086 | 0.359 | 0.023 | 0.610 |
| Total acreage cultivated and planted | 0.026 | 0.775 | 0.189* | 0.035 | 0.026 | 0.688 |
| Amount of credit provided to farmers in TZS | -0.579** | 0.000 | -0.676*** | 0.001 | -0.091 | 0.159 |
| Total value of inputs used in production | 0.441** | 0.000 | 0.377** | 0.002 | 0.447*** | 0.000 |
| Total value of cash and animal crop sold | 0.062 | 0.499 | 0.084 | 0.361 | 0.528*** | 0.000 |
| Years of schooling of the heads of households | 0.076 | 0.407 | 0.006 | 0.945 | 0.004 | 0.946 |
| Land acres owned by households | 0.033 | 0.719 | 0.039 | 0.748 | 0.024 | 0.993 |
| Traditional practice constraining food security + | -0.018 | 0.782 | -0.091 | 0.323 | -0.489*** | 0.000 |
| Socio-economic status of households + | 0.069 | 0.379 | 0.023 | 0.276 | 0.133* | 0.030 |
| Rate of technology adoption+ | 0.657*** | 0.000 | 0.876*** | 0.000 | 0.654*** | 0.000 |

*p< 0.05, **p< 0.01, ***p < 0.001

+ = Spearman correlation used

**** = Each independent variable was correlated with the dependent variable (DEC per adult equivalent) sepa

As seen in Table 25, there was highly significant relationship between acreage with government regulations and food security with $r = 0.276$ and $p < 0.001$). Number of household members who had received training was significantly related to food security ($r = 0.732$, $p < 0.001$). There was also a highly significant relationship between total value of inputs used in production and DEC per adult equivalent with $r = 0.447$ and $p \leq 0.001$ and rate of technology adoption was also significantly related to food security with $r = 0.654$ and $p = 0.000$. The finding also corresponds to that of Feleke *et al.* (2005) and Kidane *et al.* (2005) who probed the household food security in rural households of Ethiopia found the positive significant linkage ($r = 0.687$, $p < 0.001$) between food security and technology adoption (adoption of high yield varieties of maize and fertilizer application) hence argued that technology adoption does increase household food security. This is a direct relationship provided the technology is used timely and appropriately.

Family size was statistically significant with a negative sign ($r = -0.733$, $p = 0.001$) suggesting an inverse relationship between family size and food security. These findings are also supported by Esturk and Oren (2014) whose study in Adana, Pakistan, found that increase in the number of household members increased the risk of food insecurity and poverty, especially those households with many children. The stance of this study is that large population size means more mouths to be fed in the households especially where the majority of the family members are young ones.

The majority of farm households in Singida Region are small-scale semi-subsistence producers with limited participation in non-agricultural activities. Because land and finance to purchase agricultural input are very limited, increasing family size, according to the literature, tends to exert more pressure on consumption than the labour it

contributes to production. Thus a negative correlation between household size and food security is expected (Paddy, 2003) as food requirements increase in relation to the number of persons in a household. The findings comply with those by Bashir *et al.* (2010) who found that large families having household members up to 9 were about half as food secure compared to families with 4 to 6 members. Similarly, in India, an increase of one member in the family size increases the probability of food insecurity by 49% (Sindhu *et al.*, 2008). These results comply with Malthus's theory on relationship between food resources and population.

However, it was expected that educational level of the household heads would have a statistically significant relationship with food security status of the households. However, the situation was contrary, most likely due to the fact that most household heads were standard seven leavers, other factors being kept constant.

4.5.4 Regression results of DEC per adult equivalent on selected institutional factors

Multiple linear regression was used to determine the impacts (effect, influence) of ratio level measured independent variables on the dependent variable, which was dietary energy consumed in terms of kCal consumed per adult equivalent per day, also measured at the ratio level. The regression was done since it is useful in finding the impact of independent variables on dependent ones. Table 26 shows the regression results.

Table 26: Regression of DEC per adult equivalent on some institutional variables

| Independent variables | Unstandardized Coefficients | | Standardized Coefficients Beta | T | Sig. | Collinearity Statistics | |
|---|-----------------------------|----------|--------------------------------|-------|-----------|-------------------------|-------|
| | n | B | Std. Error | | | Tolerance | VIF |
| (Constant) | | 3761.904 | 814.38 | 4.620 | 0.000 | | |
| Total acreage irrigated | 144 | 3.808 | 89.798 | 0.002 | 0.042 | 0.912 | 1.097 |
| Total food production with institutional support | 156 | 0.207 | 0.014 | 0.811 | 14.457*** | 0.420 | 2.383 |
| Number of households received training | 204 | 806.487 | 159.463 | 0.192 | 5.058*** | 0.913 | 1.095 |
| Amount of credit provided to farmers in TZS | 134 | -6.096 | 0.523 | 0.454 | -7.119*** | 0.911 | 1.059 |
| Total times farmers got extension officers advice | 111 | 2.412 | 12.242 | 0.007 | 0.197 | 0.931 | 1.074 |
| Total acreage cultivated | 240 | 70.533 | 6.305 | 0.441 | 10.250*** | 0.834 | 1.173 |
| Number of training sessions provided to households | 204 | 72.879 | 6.476 | 0.443 | 11.254*** | 0.851 | 1.175 |
| Total infrastructure value constructed in million TZS | 120 | 67.02 | 6.051 | 0.540 | 16.580*** | 0.882 | 1.751 |

R = 0.935, $R^2 = 0.874$, Adjusted $R^2 = 0.870$, Std. Error of the estimate = 432.327, T = 4.620 (p = 0.000).

Dependent Variable: Dietary energy consumed per adult equivalent per day

Negative and positive impacts are denoted by negative and positive signs, respectively, of standardized regression coefficients known as beta-weights whose symbol is β (Bryman and Cramer, 1993). The dependent variable was regressed on 8 independent variables which were included because they were thought to be able to account for more of the variation in the food security levels. The remainder of the variation would be due to independent variables not included in the model, incorrect model formulation and errors in the research (Mendenhall and Beaver, 1991). Before regression was done, the 8 independent variables and the dependent variable were checked for normality by computing their normal curves, which were then checked visually to find whether any of them was unevenly distributed. Checking for normality was done because linear regression requires that all the variables are normal. The correlation coefficient between the dependent variable and all the independent variables together, R, was 0.935, which was high implying that the independent variables collectively were highly related to the dependent variable. The adjusted coefficient of determination (R^2) that was 0.870 means that the independent variables included in the regression model explained 87.0% of the

variation in the dependent variable; the rest of the variation was due to other variables not included in the model and inherent errors in the model. The tolerance and VIF values of collinearity, which were greater than 0.1 and not more than 10 respectively, show that there was no multicollinearity. Tolerances below 0.1 imply multicollinearity (Landau and Everitt, 2004), and so do VIF values that are greater than 10 (Landau and Everitt, 2004).

Total acreage irrigated, total food production with institutional support, amount of credit provided to farmers in TZS, and total value of infrastructure constructed in million TZS were not normally distributed. Log_{10} (common logarithm) transformations was used to transform them to normal distributions because it has high conformity with normal curves. The other variables had normal distributions; hence they were not transformed. After the transformation, all the independent variables underwent correlation to also check multicollinearity, which is an undesirable condition whereby two or more pairs of variables have so much linear relationship between them that their correlation coefficient is 0.8 or above (Bryman and Cramer, 1993). Inclusion of both variables of such a pair reduces the quality of results. No such a pair was found among the independent variables. Singularity was also avoided as it is undesirable. It is a phenomenon whereby one independent variable is actually a combination of other independent variables, e.g. when both sub-scale scores and the total score of a scale are included (Pallant, 2007).

According to the results, the second null Hypothesis (H_0) that: amount of food produced with institutional support does not have significant effect on food security in terms of dietary energy consumed is rejected and the alternative Hypothesis (H_1) which implies that amount of food produced with institutional support have significant effect on food security in terms of dietary energy consumed is confirmed. This shows that institutional

support had significant effect on food security in the two districts. This implies that the institutional support helped farmers in improving food security.

There were five significant variables including total food production with institutional support with Beta = 0.811, and $p = 0.001$. This is an obvious case because a household which gets various kinds of support from different institutions possesses high capacity of growing food and doing other productive chores. These findings conform with that of Ahmad (2015) who found that several institutions in Bangladesh were involved with food security governance by involving various sectors and disciplines (ministries/department) charged with formulating and implementing food security policies; more specific policy issues were designed to foster education both at a higher level for research purposes and at a professional level for extension workers and easy access on land, water resources and credit facilities for small and marginal farmers.

Another significant variable was total number of adult household members who had received training (Beta = 0.192, $p = 0.000$) and total number of household members (Beta = -0.443, $p = 0.000$). This result is in agreement with those of de Muro and Burchi (2007) who found that food insecurity was highly correlated with educational deprivation in Bangladesh. Total acreage cultivated was positively and significantly related to the probability of the household being food secure since food production can be increased extensively through expansion of area under cultivation. This finding is consistent with results from research findings by Bogale (2007) in Ethiopia. Household size had significant negative impact on food security (Beta = -11.254, $p = 0.000$). This finding corresponds to findings by Sikwela (2008) who found in his study in Zimbabwe that the probability of being food secure diminishes with increase in household size. This is in line with Malthusian theory on population and food resources.

The amount of credit provided to farmers in TZS had negative impact on food security, which was significant ($T = -7.119$, $p = 0.001$). However, it was expected that credit impact would be positive; nevertheless, the situation was not so, more likely because the credit amounts offered were too little to cater for food production needs and sometimes drove the borrowers to consume the money instead of using it to produce food hence becoming indebted. The amount given ranged from TZS 50 000 to 500 000. USD 1 was equivalent to TZS 2 170.8 602 in October 6, 2015 12:28 pm (Currency Converter, 2015).

These findings are contrary to those by Babatunde (2007) who found that access to credit has positive impact on food security as credit is expected to serve as a consumption smoothing mechanism which gives households temporal relief against the effects of food insecurity. Pappoe (2011) also found that access to credit improves food security status of the farming households among biofuel producers in Central Region of Ghana.

The insignificant variables included: total acreage irrigated and number of times farmers got advice from extension officers per year in 2010/2011. This cropped up from the fact that land irrigated was very small compared to the number of households hence impact marginally on food production and food security. The findings are contrary with that of Lemba (2009) who found that irrigation had significant impacts on household food security, which was attributable to improved access to resources (mainly for production). Similar results were found for irrigation schemes in Malawi (Lewin, 2011). In Nepal, Tiwari *et al.* (2010) found significant effects of irrigation scheme on maize varietal intervention to improve productivity and food security. In terms of number of times farmers got advice from extension officers per year was few and in some cases none hence making the variable have insignificant effect on dietary energy consumed.

4.6 Irrigated farming and crop production per adult equivalent

In Singida Region irrigation is not widely practised. In Manyoni District there was an irrigation scheme whereas in Singida and Iramba Districts the schemes were defunct. Most irrigation activities were practised at small scale and owned by individual families. In Singida District ($n = 120$), 1.7% practised irrigation farming during the 2010/11 agricultural season. In Iramba District ($n = 120$) one-tenth (10.0%) practised irrigation farming during the 2010/11 agricultural season. The surface area irrigated was insignificantly related with amounts of crop products produced per adult equivalent ($r = 0.059, p = 0.361, \alpha = 0.05$) showing a very weak Pearsonian Moment Correlation Coefficient. In Iramba District surface area irrigated and amounts of crop products produced per adult equivalent were insignificantly related ($r = 0.145, p > 0.05, \alpha = 0.05$) whereas, in Singida District the value for r was also insignificantly related with amounts of crop products produced per adult equivalent ($r = 0.026, p > 0.05, \alpha = 0.05$).

There were various semi-permanent rivers located in Iramba District including; *Kyenkang'ombe, Kyungumbuli, Nkalanga, Nzalala, Msuwa, Mpumbuli, Mumpyula, Mzanga, Ndurumo, Jerumani, Kilonda, Ishoka, Mwajuma, Mnkwesi, Lukoko, Nkingi, Manonga, Nkonkilangi, Ntundu, Sibiti, Msaga Luzi and Wembere* whose water discharge capacity remained at 0.05 Cubic metres of water per second (CUMECS) during dry season (DALDO, 2011).

4.7 Gender labour participation in agricultural activities and DEC per adult equivalent

Household was a focal point in distribution of various activities among their members relative to age and sex in the study area. The most pronounced outdoor activities were cultivation, grazing, bricks laying, fishing and honey harvesting and salt farming. In both Singida and Iramba Districts average hours spent by men were 4.76 and those spent by

women were 5.28 hrs. In Singida District, mean hours spent by men in agriculture was 4.1 hours and significantly correlated ($p \leq 0.01$) with DEC per adult equivalent ($r = 0.240$, $p \leq 0.01$, $\alpha = 0.01$). The mean hours spent by women in agriculture was 5.7 hours and significantly correlated ($p \leq 0.001$) with DEC per adult equivalent ($r = 0.215$, $p = 0.000$, $\alpha = 0.01$). The mean hours spent by children in agriculture were insignificantly correlated with DEC per adult equivalent ($r = 0.077$, $p > 0.05$, $\alpha = 0.05$). In Iramba District the mean hours spent by men in agriculture was 6.9 hrs, and were significantly correlated ($p \leq 0.01$) with DEC per adult equivalent ($r = 0.277$, $p \leq 0.01$, $\alpha = 0.01$), the mean hours spent by women in agriculture was 6.7 hours and were also significantly correlated ($p \leq 0.01$) with DEC per adult equivalent ($r = 0.215$, $p \leq 0.01$, $\alpha = 0.01$). This shows that the mean hours spent by adult male and female were higher in Iramba District than Singida District and the gender labour participation gap was higher in Singida District than in Iramba District.

4.8 Contribution of Thesis

The study for this thesis dealt with institutional determinants of food security in Tanzania. However, different literatures surveyed didn't discuss crucial aspects of institutions which are traditional norms, values, expectations and preferences; attitudinal changes by providing knowledge and skills; linkage between gender and food security; and linkage between institutions and household food security in Tanzania. The gaps were addressed in data collection, and the findings included presenting, in Chapter Four, empirical information from the research, which is new information in addition to related literature that existed.

The gaps were also filled in by finding that institutional support is necessary for food security, agricultural loans and household food security loans help in improving food

security, large population sizes are a threat to food security and credit support impacts negatively on food if it is insufficient. The gaps were also filled in by determining the importance of entitlements in enhancing food security. Malthus's ideas differed from Boserup's in terms of population and food security. The researcher's stance is that human resource development in terms of education and training, knowledge and skills is crucial for food security and institutional building.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Institutions had different roles and functions in Singida Region specifically in the study area. The quality of services delivered by different institutions also differed substantially. The results of the institutions and food security quality appraisal showed that institutions performed well in delivering goods and services to its clients, including ensuring food security through enhancing household capacity to produce food and institutional building.

There were different institutions that were related to food security and provided support in the two districts. The institutions contributed substantially to food security through different ways, including training of some adult household members, provision of agricultural inputs and credit as well as construction of infrastructure. While many factors were pointed out by the respondents as institutional factors supporting improvement of agricultural production and food security, it was observed that the institutions were unevenly distributed and differed in terms of amounts of support. Therefore, from the findings, it is concluded that institutions are vital in enhancing food security.

It was learnt from the study that people in Singida and Iramba Districts experienced different levels of food insecurity as they consumed different levels of dietary energy. Singida District had higher levels of food insecurity than Iramba District in terms of grains obtained per capita per year, grains obtained per adult equivalent per year, dietary energy consumed per capita per day and dietary energy consumed per equivalent per day. In both districts the incidence of food insecurity was relatively high. Since food insecurity existed while there were institutions working to enhance food security, it

implies that if such institutions had not been there food insecurity would have been higher.

Basing on the findings of inferential analysis, the institutional factors analysed have significant effects on food security in terms of dietary energy consumed among households; there are significant differences in food security among households with various institutional factors; and there are significant correlations between various indicators of institutions and food security in terms of dietary energy consumed and grains obtained per adult equivalent per year. Therefore, it is concluded that institutions are helpful in increasing food security.

5.2 Recommendations

The recommendations presented in this section are derived from the conclusions specifying not only the levels at which strategies to raise agricultural crop production and improve food security should be addressed, but also the stakeholders who are urged to take a lead in undertaking the strategies. The stakeholders include International Agencies, Regional Co-operations, the Central Government, district councils, NGOs, other development partners, and households. Generally, institutions should strive to empower households with tools deemed necessary for improving food security at both community and household levels.

As it was found in the descriptive statistics in Section 4.2.1, institutions (national and local ones) should strive to increase both efficiency and effectiveness in raising both agricultural production and food security in Singida Region. Moreover, irrigation infrastructure and rural roads, which will help in minimising post-harvest losses, hence increase food inventory, should be created where they do yet exist. Agricultural extension

services should be provided adequately and in time; inputs through voucher system should reach the target beneficiaries at the set prices and avoid loopholes for those who would like to benefit on the shoulders of the poor farmers. This should be done through a thorough follow-up, monitoring and evaluation of the input support systems.

Since household food insecurity affects households rather than communities, food insecurity impacts negatively on agricultural development as it leads to decline in various agricultural factors including acreage and labour, while the government budget is not enough to do many activities to perform all agriculture-related activities and mitigate the adverse effects of food insecurity and malnutrition. International institutions should continue to help poor countries like Tanzania to build the internal capacities and strengthen local and international institutions; maintain food security, and get rid of hunger and malnutrition. Currently, cash crops are the biggest determinant of food security in Singida and Iramba districts; the Government, District Councils and other development partners are urged to create capacity and build sustainable institutions including for people to generate income through small and medium enterprises (SMEs) for bulk production of cash crops including sunflower, onions, simsim and finger millet, commercial fishing at Kitangiri and Magungumuka lakes as well as salt farming. The income will be used to buy food and other necessities.

As inferential analysis on linkages between technologies, agricultural development and food security, as explicated by Boserup Theory, showed a positive correlation it is the obligation of the Government, NGOs, and other development partners to join hands to support households with modern technologies. Furthermore, Tanzania should solicit and strengthen co-operation with the now expanded East African Countries to explore more

opportunities in terms of economic partnership agreements in order to facilitate agricultural development and food security.

5.3 Suggested Areas for Further Research

- a) Further research on linkages between institutions and food security is suggested using the fifth dimension of food security which is food safety. This suggestion is based on the findings of this research, which showed that the amounts of food produced and dietary energy consumed and grains obtained per adult equivalent per year differed significantly between households in Iramba District and those in Singida District without showing any food safety indicator. Food safety is a vital dimension as it deals with health and nutritional statuses of the population.

- b) Wild mushrooms of different varieties are abundantly found in Iramba and Singida Districts in alternating years. Thus, a thorough study should be done by research institutions like SUA to tame these varieties of products since they are highly valuable during food shortage as they are dual in consumption as a complete meal or as a vegetable.

- c) Irrigation farming seemed to be crucial in reduction of food poverty in the region as it accelerates field food production and horticultural farming which will increase household income and maintain food security. It is therefore necessary for the Members of the Parliament (MP) from Singida Region to request from the Government or donors agencies to carry out feasibility studies on water irrigation infrastructures. Such research will empirically show the role of irrigation for improving food security in Singida Region.

REFERENCES

- Adubi, A. A. (1992). An Empirical analysis of production risks and attitudes of small farmers in Oyo State, PhD thesis, University of Ibadan, Nigeria, 256pp.
- Ahmed, F. R. S. (2015). *Policy Support and Institutional Dimensions of Food Security*. Springer Link, NY, USA. 232pp.
- Akoroda, M. O. and Teri, J. M. (1999). Food security and crop diversification in SADC countries: The Role of Cassava and Sweet Potato: In: *Proceeding of the Scientific Workshop of the Southern African Root Crops Research Network (SARRNET)* August 1998, Lusaka, Zambia, 141-149pp.
- Archelles, D. (2004). The Math Forum [<http://mathforum.org/dr.math/>] site visited on 19/09/2015.
- Australian Government (2012). Measuring Socio-Economic Status, Staff Discussion Paper 2012-2013, AG. 24pp.
- AVRDC (2005). Vegetable Home Gardens [www.avrdc.org.] site visited on 20/10/2013.
- AVRDC (2011). *Kifurushi cha Mbegu Bora za Bustani kwa Afya Bora: Kwa Lishe Bora na Kipato* (Packet for improved horticultural seeds for good health and nutrition), The World Vegetable Centre, Duluti, Arusha, Tanzania 12pp.

- Babatunde, R. O. and Omotosho, O. A. and Sholotan O. S. (2007). Factors influencing food security status of rural farming households in Northern Central Nigeria. *Agric. J.* 2(3): 351 - 357.
- Baer, R. D. and Madrigal, L. (1993). Intra-household allocation of resources in larger and smaller Mexican households. *Social Science and Medicine* 36 (3): 305-310.
- Barrett, C. B. (2010). Measuring food insecurity. *The Science Journal of Peasant Studies* 327(2): 1-25.
- Barry, D. P. (2010). *Impact of Sociological Theories on the Institute of Family*. G. Allen and Unwin, London. 144 pp.
- Bartlett, J. E., II; Kotrlik, J. W. and Higgins, C. C. (2001). Organizational research: determining appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal* 19 (1): 43-50.
- BMI Calories (2014) BMR Calculator [<http://bmi.calories.com/contact.html>] site visited on 03/10/2015.
- Bne-Saad, M. (2000). Food security for the food-insecure: new challenges and renewed commitments. Centre for Development Studies, University College Dublin, Ireland. [<http://www.earthsummit2002.org/wcaucus/Caucus%20Position%20Papers/food%20security.pdf>] site visited on 20/11/2011.

- Boserup, E. (1965). *The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure*. G. Allen and Unwin, London. 124pp.
- Boserup, E. (1965). *The Conditions of Agricultural Growth*. Aldine Press, Chicago. 124pp.
- Boundless, S. (2014). *Malthus' Theory of Population Growth*.
[<https://www.boundless.com/sociology/textbooks/boundless-sociology-textbook/population-and-urbanization-17/population-growth-122/malthus-theory-of-population-growth-689-9631/>] site visited on 24/02/2015.
- Braun, W., Swaminathan, J., Sambasivan, M. R. and Mark, W. (2004). *Agriculture, Food Security, Nutrition and the Millennium Development Goals*. International Food Policy Research Institute, Washington D.C. 340pp.
- Brigham, A. M. (2004). Just hungry? Analysing the relationship between land concentration and food insecurity. Thesis for award of PhD Degree at Norwegian University of Science and Technology (NTNU), Trondheim, Norway, 221pp.
- Brown, L. R. and Kane, H. (1994). *Full House: Reassessing the Earth's Population Carrying Capacity*. The World watch Environmental Alert Series, W. W. Norton & Company, New York and London. 261pp.
- Bryman, A. (2004). *Social Research Methods*. Oxford University Press, Oxford. 592pp.
- Bryman, A. and Cramer, D. (1993). *Quantitative Data Analysis for Social Scientists*. Routledge, London. 290 pp.

- Cleveland, D. A. (1993). Is variety more than the spice of life? Diversity, stability and sustainable agriculture. *Culture and Agriculture*: 45-46.
- Cogill, B. (2003). *Anthropometric Indicators Measurement Guide*. Food and Nutrition Technical Assistance Project, Academy for Educational Development, Washington, D.C. 92pp.
- Collier, P., Radwan, S. and Wangwe, S. (1986). *Labour and Poverty in Rural Tanzania: Ujamaa and Rural Development in the United Republic of Tanzania*, Clarendon Press, Oxford. 89pp.
- Creswell, J. W. (2007). *Qualitative Inquiry and Research Design: Choosing among Five Approaches*. Thousand Oaks, CA. 414pp.
- Currency Converter (2015). Convert Dollars to Tanzania Shilling: Latest Exchange Rate [www.currency.me.uk/convert/usd/tzs] site visited on 06/10/2015.
- DALDO (2002). Annual Development Report. Planning Department, Singida. 34pp.
- Davies, A. J., Johnson, M. P. and Maggs, C. A. (1991). Ecosystem based management. *Marine Progress Series* 339:131.
- de January, P., Dans, A., Candido, C. L. and Brewer, M. (1989). *Institutional Analogy of Democratic Society*. Mendes University, Rio de Janeiro. 245pp.

- de Man, R. (2010). The Influence of the Interplay between National and International Institutions on food security [<http://www.wageningenuniversity.nl/uk/contact>] site visited on 18/04/2010.
- de Muro, P. and Burchi, P. (2007). *Education for Rural People and Food Security: A Cross Country Analysis*. NRM, Rome. 234pp.
- Dercon, S. and Krishnan, C. (1996). Income portfolios in rural Ethiopia and Tanzania: choices and constraints. *Journal of Development Studies* 32(6): 850–875.
- Diyamett, M. L. N. and Njau, L. S. (2009). Post-harvest handling, storage and protection of maize as a strategy of poverty reduction. Research Report Series. 1 (2): 49 - 77.
- Downey, B. (1995). When bigger is not better: parental resources and children's educational performance. *American Sociological Review* 60: 746-61.
- Dyson, T. (1996). *Population and Food: Global Trends and Future Prospects*. Routledge, London and New York. 231pp.
- Eide, W. B. (2005). From food security to the right to food." In: Eide, W. B. and Kracht, U. (2005). *Food and Human Rights in Development: Legal and Institutional Dimensions and Selected Topics* (Volume 1). Intersentia, Antwerpen, Oxford. pp. 67-98.
- Ellis, F. (1988). *Peasant Economics, Farm Household and Agrarian Development*. Cambridge University Press, Cambridge. 156pp.

Emmons L. (1986). Food procurement and the nutritional adequacy of diets in low-income families. *Journal of American Dietetic Association* 86 (12): 1684 - 1693.

ESRF (2008). *Assessment of Tanzania Development Vision (TDV)*. ESRF, Dar es Salaam. 52pp.

FAO (1983). *World Food Security: Re-Appraisal of the Concepts and Approaches*, Director General's Report, Rome. 46pp.

FAO (1996). *Rome Declaration on World Food Security and World Food Summit Plan of Action*. WFS13 – 17 November 1996, Rome. 143pp.

FAO (2001). *Food and Agricultural Organization, Committee on World Food Security* 28, May-June, 2001, Rome. 124pp.

FAO (2003). *Trade Reforms and Food Security: Conceptualizing the Linkages*, Rome, Italy. 234pp.

FAO (2007). [<http://www.fao.org/righttofood/>]. Site visited on 20/11/2012.

FAO and WFP (2010). *The State of Food Insecurity (SOFI) in the World: Addressing Food Insecurity in Protracted Crises*. UNFAO, Rome, Italy. 234pp.

FAO (2003). *Food and Agricultural Organization. Committee on World Food Insecurity in the World*, FAO, Rome. 212pp.

FAO (2010). *The State of Food Insecurity in the World: Addressing Food Insecurity in Protracted Crises*. Food and Agriculture Organization of the United Nations, Rome. Available online at [<http://www.fao.org/docrep/013/i1683e/i1683e.pdf>] accessed on 05/04/2015.

FAO, IFAD and WFP (2014). *The State of Food Insecurity in the World 2014: Strengthening the Enabling Environment for Food Security and Nutrition*. FAO, Rome. 57pp.

FAO, WHO and UNU (1985). *Energy and Protein Requirements*: Report of a joint FAO/WHO/UN ad hoc Expert Consultation. WHO Technical Report Series, No. 724, Geneva.

FAO (2003). *Food Energy - Methods of Analysis and Conversion Factors*. Report of a Technical Workshop. FAO Food and Nutrition Paper No. 77. Rome. 69pp.

Feleke, T. S., Kilmer, R. I.; and Gladwin, C. H. (2009). Determinants of food security in Southern Ethiopia at the household level. *International Association of Agricultural Economics Journal* 4: 3-33.

Floresta and CRS (2011). *Economic Context of Agriculture Production in Rural Areas*, Arusha, Tanzania. 134pp.

Foster, P. (1992). *The World Food Problem: Tackling the Causes of Undernutrition in the Third World*. Lynne Rienner Publishers, U.S.A. 230pp.

- Frankenberger, T. R. and McCaston, M. K. (1998). *From Food Security to Livelihood Security: The Evolution of Concepts*, CARE, USA. 234pp.
- Frankenberger, T. R. (1992). *Indicators and Data Collection: Methods for Assessing Household Food Security*. University Press, Florida 341pp.
- Godwin, W. (1793). *Enquiry Concerning Political Justice and its Influence on General Virtue of Happiness*. Yale University Press, NJ.481pp.
- Haapanen, L. (2010). Towards the theory of temporary competitive advantage in internationalization. *Advances in Applied Strategy* 12: 121-144.
- Hassan, R. M. and Babu, S. C. (1991). Measurement and determinants of rural poverty: household consumption patterns and food poverty in rural Sudan. *Food Policy* 16 (6): 451–460.
- Hayami, Y. (1969). Sources of agricultural productivity gap among selected countries. *American Journal of Agricultural Economics* 51(2): 564–575.
- Hoddinott, J. (1996). *Choosing Outcome Indicators of Household Food security*, 2 Technical Guide #72, IFPRI, Washington D.C.29pp.
- Hoddinott, J. (1999). *Operationalizing Household Food Security and Development Strategies*, Technical GuidelineNo.1.IFPRI, Washington DC. 67pp.

- Hodgson, G. M. (2006). What are Institutions? *Journal of Political Economic Issues* 1: 321 – 340.
- IDC (2009). *Iramba District Profile 2010*. District Agriculture and Livestock Development Office, Kiomboi, Iramba, Tanzania. 76pp.
- IDC (2010). *Annual District Development Plan*, District Planning Office, Kiomboi, Iramba, Tanzania. 60pp.
- Idriss, A., Sheet, I. and Romanos, I. (2012). *Food Security, the Moving Borders of Poverty, Free Market and Political Interventions*. University of Massachussets, MA. 78pp.
- IFAD (1997). *Human Energy Requirements: A Manual for Planners and Nutritionists*, Oxford University Press, Rome. 167pp.
- Jain, S. P. (Ed.) (2001). *Emerging Institutions for Decentralised Rural Development, Volume II*, NIRD, Hyderabad. 170pp.
- Kalirajan, K. P. and Shand, R. T. (1985). Types of education and agricultural productivity: a quantitative analysis of Tamil Nadu Rice Farming. *Journal of Development Studies* 21: 232-243.
- Kayunze, K. A., Mwageni, E. A. and Ashimogo, G. C. (2007). Entitlement to food and food insecurity in Rufiji District. *Tanzania Journal of Development Studies* 7(2): 29-47.

- Kayunze, K. A., Mwangeni, E. A. (2009). Do various methods of food security determination give the same results? Evidence from Rufiji District. *Tanzania Journal of Development Studies* 8(1): 30-36.
- Kidane, H. Z., Alemu, G. and. Kundhlande, G. (2005). Causes of household food security in Koredegaga peasant association, Oromiya Zone, Ethiopia. *Agrekon. Agr. Journal* 44(4): 543-560.
- Kothari, C. R. (2009). *Research Methodology: Methods and Techniques* (Second Edition). New Age International Limited Publishers, New Delhi. 418pp.
- Kumar, K. (1989). *Conducting Key Informant Interviews in Developing Countries A.I.D. Program Design and Evaluation Methodology*. Report No.13 AID, Washington D.C. 40pp.
- Landau, S. and Everitt, B. S. (2004). *Statistical Analyses Using SPSS*. Chapman & Hall/CRC Press LLC, Boca Raton, London. New York, & Washington, D.C. 337pp.
- Lemba, J. K. (2009). Intervention model for sustainable household food security in the Drylands of Kenya: A Case study of Makueni District. PhD thesis, Ghent University, Kenya. 179pp.
- Lewin, P. A. (2011). Three essays on food security, food assistance, and migration. PhD thesis, Oregon State University. 165pp.

- Lockheed, M. E., Jamison, D. T. and. Lau, I. J. (1980). Farmer education and farm efficiency: a survey. *Economic Development and Cultural Change* 29: 37–76.
- Lukmanji, Z., Hertzmark, H., Mlingi, N., Assey, V., Ndossi, G. and Fawzi, W. (2008). *Tanzania Food Composition Tables*, MUHAS, Dar es Salaam; TFNC, Dar es Salaam; HSPH, Boston, USA. 272pp.
- Maharjan, K. L. and Khatri-Chhetri, A. (2006). Household food security in rural areas of Nepal: Relationship between socio-economic characteristics and food security status: In: *Foster Paper Presented at the International Association of Agricultural Economics Conference*, 12-18 August 2006, Gold Coast, Australia. 25pp.
- Malthus, T. (1798). *An Essay on the Principle of Population, as it Affects the Future Improvement of Society*, J. Johnson, London, 134pp.
- Maxwell, D. G. and Frankenberger, T. R. (1992). *Household Food Security: Concepts, Indicators, Measurements: A Technical Review*. UNICEF and IFAD, New York and Rome. 429 pp.
- Maxwell, D. G. (1996). Measuring food insecurity: The frequency and severity of coping strategies, *Food Policy* 21:291-303.
- Maxwell, D. G., Vaitla, B. and Coates, J. (2013). How do Different Indicators of Household Food Security Compare? Empirical Evidence from Tigray, Ethiopia. *Publications from Feinstein International* 4 (6): 32 - 39

- Maxwell, J. A. (1996). *Qualitative Research Design: An Interactive Approach*, Thousand Oaks, CA, Sage, USA. 334pp.
- Maxwell, S. and Frankenberger, T. R. (1991). *Household Food Security: Concepts, Indicators, Measurements: A Technical Review*, UNICEF/IFAD, New York. 449pp.
- Maxwell, S. and Frankerberger, T. (1992). *Household Food Security: Concepts, Indicators, Measurements*, IFAD and UNICEF, Rome. 429pp.
- Mendenhall, W. and R. J. Beaver (1991). *Introduction to Probability and Statistics*. PWS- Kent Publishing Co., Boston. 106pp.
- Mkenda, A. F., Luvanda, E. G., Rutasitara, L. and Naho, A. (2004). *Poverty in Tanzania: Comparisons Across Administrative Regions*, An Interim Report 16pp.
- Msuya, E. E. and Isinika, A. C. (2001). Addressing food self-sufficiency in Tanzania: A balancing act of policy coordination, CAB International African Smallholders. *Food Crops, Markets and Policies*: 281-315.
- Muhammad, K. B., Steven, S. and Ram, P. (2012). Food Security and Its Determinants at the Crossroads in Punjab Working Paper 1206 June 2012, The University of Western Australia, Crawley, WA 6009, Australia.
- Mwaniki, A. (2003). *Achieving Food Security in Africa: Challenges and Issues*. U.S. Plant, Soil and Nutrition Laboratory, Cornell University 34pp.

Naiken, L. (2002). Methods for the measurement of food deprivation and under nutrition: Keynote Paper: FAO methodology for estimating the prevalence of under-nourishment. [<http://www.fao.org/DOCREP/005/Y4249Ey4249e04.htm>] site visited on 8/10/2007.

NBS (2002). *Household Budget Survey 2000/01*. President's Office, Dar es Salaam. 188pp.

NBS (2009). *Household Budget Survey 2007*. President's Office, Dar es Salaam. 94pp.

NBS, (2003). *2002 Population and Housing Census. General Report*. National Bureau of Statistics, Dar es Salaam. 203pp.

Netting, R.M. (1993). *Smallholders, Householders: Farm Families and the Ecology of Intensive, Sustainable Agriculture*. Stanford University Press, CA. 389pp.

Netting, R. M., Stone, G. D. and Stone, M. P. (1993). Agricultural expansion, intensification, and market participation among the Kofyar, Jos Plateau, Nigeria. In: Turner, B. L., Hyden, G. and. Kates, R. W. (Eds.) (1993). *Population Growth and Agricultural Change in Africa*. Gainesville, University Press, Florida. pp. 206-249.

Niehof, A. (2004). The significance of diversification for rural livelihood systems. *Food Policy* 29: 321-339.

- North, D. (1993). *Nobel de Economia, y la Historia Economica* (Nobel Economics and Economic History) 5(8): 89-93 ISSN 0121-117X, Washington University (Saint Louis) USA.
- North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University Press, Cambridge. 257pp.
- Nubé, M. (2005). Relationships between undernutrition prevalence among children and adult women at national and subnational levels. *European Journal of Clinical Nutrition* (2005). 59: 1112–1120.
- Paddy, F. (2003). Gender differentials in land ownership and their impact on household food security: A case study of Masaka District. PhD thesis. Uganda. Available on: [<http://www.troz.unihoenheim.dereasearch/Thesis/PhD/Paddy.pdf>] 138pp.
- Pallant, J. (2007). *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS for Windows* (3rd Ed). Open University Press, NY. 353pp.
- Patnaik, U. (1991). Food availability and famine: A longer view. *The Journal of Peasant Studies* 19 (1): 1-25.
- Pervez, G. and Kjell, G. (2005). *Research Methods on Business studies, A Practical Guide*. Prentice Hall, London. 252pp.
- Phillips, J. M. (1994). Farmer education and farmer efficiency: A Meta-analysis. *Economic Development and Cultural Change* 43: 1439–1465.

- Pottier, J. (1999). *Anthropology of Food: The Social Dynamics of Food Security*. Polity Press, Cambridge (UK) and Blackwell Publishers Ltd, Malden (USA). 230pp.
- Radimer, K. L., Olson, C. M. and Campbell, C. C. (1990). Development of indicators to assess hunger. *Journal of Nutrition* 120: 1544 - 1548.
- Radimer, K. L., Olson, C. M., Greene, J. C., Campbell, C. C. and Habicht, J. (1992). Understanding hunger and developing indicators to assess it in women and children. *Journal of Nutrition Education* 24 (1): 36 - 44.
- Reus-Smit (1999). *Moral Purposes of the State Culture, Social Identity and Institutional Rationality in International Relations*. Princeton University Press, NJ. 112pp.
- Riely, F., Mock, N., Cogill, B. Bailey, L. and Kenefick, E. (1995). *Food Security Indicators and Framework for Use in the Monitoring and Evaluation of Food Aid Programmes*. Oxford University Press, Oxford. 123pp.
- Rougoor, C. W., Ruud, G. T. , Huirne, B. M. and Renkema, J. A. (2007). How to define and study farmers' management capacity: Theory and use in agricultural economics. *Agricultural Economics Journal* 18: 261–272.
- SEEP Network (2015). *Rural Agriculture Finance and Food Security Practitioners Learning Program*. Floresta, Moshi, Tanzania. 34pp.
- Sen, A. (1981). *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford University Press, Oxford. 257pp.

- Shaikh, S. (2007). A Tafsir of Proxis, Gender, Marital Violence and Resistance in South African Muslim Community. In: *Violence against Women in Contemporary World Religions, Roots and Cure*, (Edited by Maguire, D. and Shaikh, S.). The Pilgrim Press, Ohio. pp. 66-69.
- Sharma, B.Y. (2013). *Basic Concepts of Food Security: Definitions, Dimensions and Integrated Phase Classification*. The University of Queensland, Bisbane, Australia. 423pp.
- Shiva, V. and Bedi, G. (2002). *Sustainable Agriculture and Food Security: The Impact of Globalization*. Research Foundation for Science, Technology and Ecology, New Delhi. 275pp.
- Sijm, J. (1997). *Food Security and Policy Interventions in Sub-Saharan Africa: Lessons from the Past Two Decades*. Thesis Publishers, Amsterdam. 229pp.
- Sikwela, M. M. (2008). Determinants of household food security in the semi-arid areas of Zimbabwe: A case study of irrigation and non-irrigation farmers in Lupane and Hwange Districts. Thesis for the degree of Master of Science in Agriculture. University of Fort Hare, Republic of South Africa. 180pp.
- Simion, J. L. (2014). *Population and Development in Poor Countries*. Princeton University Press, New Jersey, USA. 340pp.
- Stefanou, S. E. and Sexena, S. (1988). Education, experience and allocative efficiency: A dual approach. *American Journal of Agricultural Economics* 70: 338–345.

Steffen. P. (2010). *Food Security: Getting Down to the Basics, Technical Paper No.3*, USAID. 39pp.

Strauss, R. P., Conrad, R. F. and Banker, R. D. (1986). A Comparative application of data: An illustrative study of farm production: *Management Sciences* 32 (1): 213 - 231.

Sukhatme, P. V. (1961). The World's hunger and future needs in food supplies. *Journal of Royal Statistical Society* 124: 463-525.

Tanzania National Business Council (2009), *KILIMO KWANZA; Towards Tanzania Green Revolution*, TNBC, Dar es Salaam.120pp.

Teilbaum, M. S. (2003). Encyclopaedia Britannica: Population Biology and Anthropology [www.Britannica.com/topi/cp70323/history] site visited on 12/02/2015.

Tiwari, T. P., Ortiz-Ferrara, G., Gurung, D. B., Dhakal, R., Katuwal, R. B., Hamal, B.B., Gadal, N. and Virk, D. S. (2010). Rapid gains in food security from new maize varieties for complex hillside environments through farmer participation. *Food Security* 2: 317-325.

UN (2010). *The Millennium Development Goals Report*. United Nations Department of Economic and Social Affairs, NY. 80pp.

- URT (1992). *Comprehensive Food Security Programme, Volume II, Annexes*. Ministry of Agriculture, Government Printers, Dar es Salaam. 154pp.
- URT (1998). *National Forest Policy*. Ministry of Natural Resources and Tourism, Dar es Salaam. 49pp.
- URT (1999). *Poverty and Welfare Monitoring Indicators*. Vice-President's Office, Dar es Salaam. 75pp.
- URT (2000). *The National Micro finance Policy*. Ministry of Finance, Government Printer, Dar es Salaam. 62pp.
- URT (2004). *The National Empowerment Policy*. The Prime Minister's Office, Government printer, Dar es Salaam. 27pp.
- URT (2004). *Poverty Reduction Strategy: The Third Progress Report 2002/03*. Government Printer, Dar es Salaam. 116pp.
- URT (2005). *Summary of the National Strategy for Growth and Reduction of Poverty*. Government Printer, Dar es Salaam. 54pp.
- URT (2006). *SINGIDA REGION: Socio-economic Profile*. National Bureau of Statistics and Singida Regional Commissioner's Office, Dar es Salaam. 241pp.
- URT (2006). *Agricultural Sector Development Programme*. Government Printer, Dar es Salaam. 26pp.

URT (2007). *Poverty and Human Development Report 2007*. REPOA, Dar es Salaam. 162pp.

URT (2009). *Household Budget Survey 2007: Final Report*. Ministry of Finance and Economic Affairs, Dar es Salaam. 94pp.

URT (2009). *Millennium Development Goals Report: Mid-way Evaluation, 2000-2008*, Ministry of Finance and Economic Affairs, Dar es Salaam. 44pp.

URT (2009). *Millennium Development Goals Report: Empowerment, Eradication, Partnership: Midway Evaluation, 2000-2008*. Ministry of Finance and Economic Affairs, Dar es Salaam. 79pp.

URT (2009). *Poverty and Human Development: Report 2009*. Ministry of Finance and Economic Affairs, Dar es Salaam. 120pp.

URT (2009). *MKUKUTA Annual Implementation Report 2008/2009: Successes in the midst of Turbulence*. Ministry of Finance and Economic Affairs, Dar es Salaam. 124pp.

URT (2010). *National Strategy for Growth and Reduction of Poverty II, NSGRP II*, Ministry of Finance and Economic Affairs, Government Printer, Dar- Es-Salaam. 163pp.

URT (2011). *Tanzania Agriculture and Food Security Investment Plan (TAFSIP), 2011/12 – 2020/21*. Government Printers, Dar es Salaam. 75pp.

- URT (2011). *Tanzania Agriculture and Food Security Investment Plan 2011/12-2020/21: Working Paper No.4.A* Draft Document by CAADP and AU-NEPAD, Dar es Salaam. 75pp.
- URT (2012). *MKUKUTA: Annual Implementation Report, 2011/12. Accounting for Results*. Ministry of Finance and Economic Affairs, Dar es Salaam. 137pp.
- URT (2012). *National Agriculture Policy*. Ministry of Agriculture Food Security and Cooperatives, Government Printers, Dar es Salaam. 68pp.
- URT (2013). *2012 Population and Housing Census: Population Distribution by Administrative Areas*. Government Printers, Dar es Salaam. 244pp.
- URT (2007).[Tanzania] *National Sample Census of Agriculture 2002/2003Regional Report, Singida Region*, President's Office, Government Printer, Dar- Es-Salaam. 56pp.
- USAID (2007). *Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide*. FANTA, Washington D.C. 136pp.
- USDA (1999). *Food Safety and Antimicrobial Residues in Food Animals*. US Department of Health and Human Services, Washington DC. 87pp.
- USDA (2006). Food Security Measurement. [<http://www.fns.usda.gov/Measurement.ht>] downloaded on 24/10/2010.

- USDA (2014). Nutrients Database. [<http://www.ndb.nal.usda.gov/ndb/search/list>] downloaded on 14/04/2014.
- Vatn, A. (2005). *Institutions and the Environment*. Edward Elgar Publishing Limited, Cheltenham (UK) and Northampton, MA (USA). 481pp.
- Veblen, T. and Commons, J. (1970). *Early Institutionalists: Institutions and Organizations*. Sage Publications, Thousand Oaks, CA. 189pp.
- Wang, J., Wailes, E. J. and Cramer, G.L. (1996). A shadow-price frontier measurement of profit efficiency in Chinese agriculture. *American Journal of Agricultural Economics* 78: 146–156.
- Wanmali, S. and Islam, Y. (2002). Food security. In: *The Companion to Development Studies*. (Edited by Desai, V. and Pottier, R. B.), Arnold, London and Oxford University Press Inc., New York. pp. 159-165.
- Weinberger, K. and Lumpkin, J. (2005). *Horticulture for Poverty Alleviation. Working Paper No. 15*. Shanhua Publishers, Tainan, Taiwan. 48 pp.
- WFP (2006). *The United Republic of Tanzania: Comprehensive Food Security and Vulnerability Analysis (CFSVA)*. Vulnerability Analysis and Mapping Branch, Rome. 95pp.
- WFP (2009). *Facing up to the Challenge of Hunger*. FANTA, Rome. 60pp.

WFP (2009). Fighting Hunger World Wide, [file://E:\efp.html], site visited on 21/12/2009. pp. 10-12.

WFP (2012). Fighting Hunger World Wide: Food Security Analysis [file://E:\efp.html] site visited on 21/12/2009.

WFP and FAO (2010). *Food for Peace Security Framework for Burundi (FY 2014 – FY 2019)*, FANTA, Washington, DC. 213pp.

WFP and World Bank (2012). *Comprehensive Food Security and Vulnerability Analysis(CFSVA): Tanzania 2012, Fighting Hunger Worldwide*, FANTA, Rome. 76pp.

WHO (1995). *Physical status: The Use and Interpretation of Anthropometry. Report of a WHO Expert Committee*, Geneva. 324pp.

WHO (2003). *Global Strategy on Diet, Physical Activity and Health*. Red Cross Publishers, Geneva. 234pp.

WHO (2004). Expert consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *The Lancet American Journal of Biological Science* 92(4): 564–677.

WHO (2004). *Global Database on Mass Index*. Red Cross Publishers. Geneva. 56pp.

WHO (2011). *Community Empowerment*, Red Cross Publishers, Geneva. 234pp.

- WHO (2000) Obesity: preventing and managing the global epidemic. Report of a WHO Consultation. WHO Technical Report Series 894. Geneva, 343pp.
- Wilkinson, S. (2004). Focus Group Research. In D. Silverman (Ed.) *Qualitative Research: Theory, Method and Practice* (2nd Edition). Sage Publishers, London. pp. 177-199.
- Woldemeskel, G. (1990). Famine and the two faces of entitlement: A comment on Sen. *World Development* 18 (3): 491 - 495.
- World Bank (1986). *Poverty and Hunger: Issues and Options for Food Security in Developing Countries*. IBRD, Washington, DC. 69pp.
- World Bank (2000). *Agriculture in Tanzania since 1986: Followers or Leaders of Growth?* International Food Policy Research Institute, Washington. 286pp.
- World Bank (2001). *World Development Report 2000/01: Attacking poverty*. World Bank, Washington, DC. 335pp.
- World Bank (2003). *Sustainable Development in a Dynamic World: Transforming Institutional, Growth and Quality of Life*. Oxford University Press, London. 167pp.
- World Bank (2008). *Agriculture for Development: World Development Report*, IBRD, Washington D.C. 365pp.

Yang, D. T. (1997). Education in production: measuring labour quality and management.

American Journal of Agricultural Economics 79(3): 764–772.

Zalilah, M. Sharif, F. and Merlin, A. (2001). Assessment of Food Insecurity among Low

Income Households in Kuala Lumpur Using the Radimer/Cornell Food Insecurity

Instrument – A Validation Study. *Journal of Nutrition* 7(1&2): 15-32.

APPENDICES

Appendix 1: Distribution of Main Source of Household Income

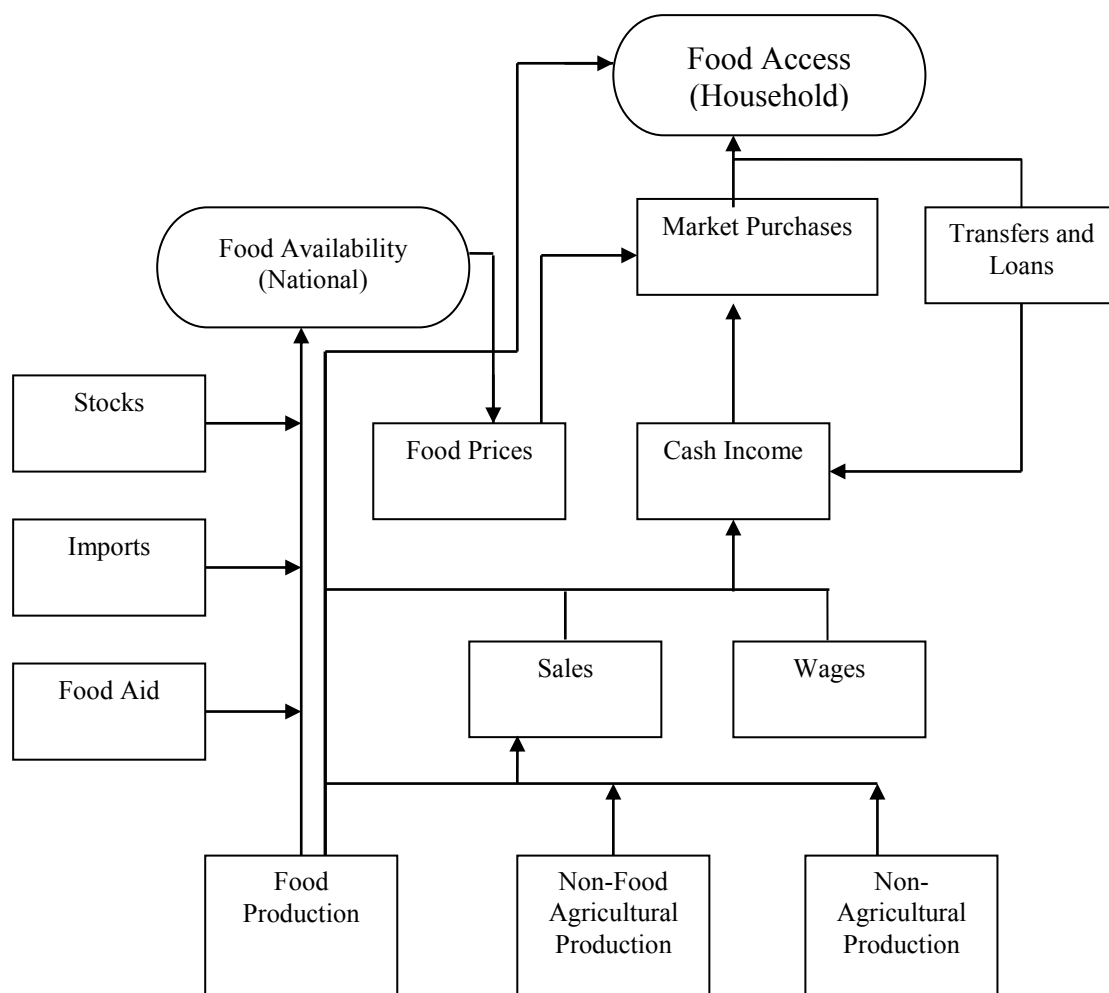
[illegible]

Appendix 2: Energy Content per 100 Grams of Edible Portions, Selected Foods

| Food | Kilocalories | Food | Kilocalories |
|----------------------------------|---------------------|-----------------------------------|---------------------|
| Cereal and grains | | Grain legumes | |
| Maize, Yellow immature on cob | 166 | Beans/peas, fresh, shelled | 104 |
| Maize, white whole kernel, dried | 345 | Beans, dried | 320 |
| Maize flour, 60-80% extraction | 334 | Chickpea, whole seeds, raw, dried | 327 |
| Maize meal | 341 | Cowpea, mature pods, dried | 318 |
| Millet, finger, flour | 315 | Mung bean, dried | 322 |
| Millet, bulrush, whole grain | 339 | Pigeon pea, dried | 309 |
| Rice milled | 333 | Nuts and seeds | |
| Sorghum, whole grain | 343 | Bambara groundnut, fresh | 346 |
| Sorghum flour | 337 | Cashew nut, dried | 560 |
| Wheat flour | 340 | Coconut, mature kernel, fresh | 392 |
| White bread | 240 | Groundnut, dry | 572 |
| Brown bread | 233 | Meat, poultry and eggs | |
| Starchy roots, tubers | | Beef, moderately fat | 234 |
| Cassava meal | 318 | Egg, hen | 140 |
| Plantain, ripe, raw | 128 | Goat, moderately fat | 171 |
| Sweet Potato, raw | 109 | Mutton, moderately fat | 257 |
| Taro/cocoyam | 94 | Poultry | 138 |
| Yam, fresh | 111 | Fish, dried | 255 |
| Yam, flour | 310 | Oils and fats | |
| Sugars | | Butter from cow's milk | 699 |
| Sugar | | Coconut oil | 900 |
| Milk and milk product | | Ghee, clarified butter | 884 |
| Milk, cow, whole | 79 | Lard/animal fats | 891 |
| Milk powder, cow, whole | 357 | Margarine | 747 |
| Milk, goat | 84 | Red palm oil | 892 |

Source: Lukmanji, Z., *et al.* (2008)

Appendix 3: Household Food Access model

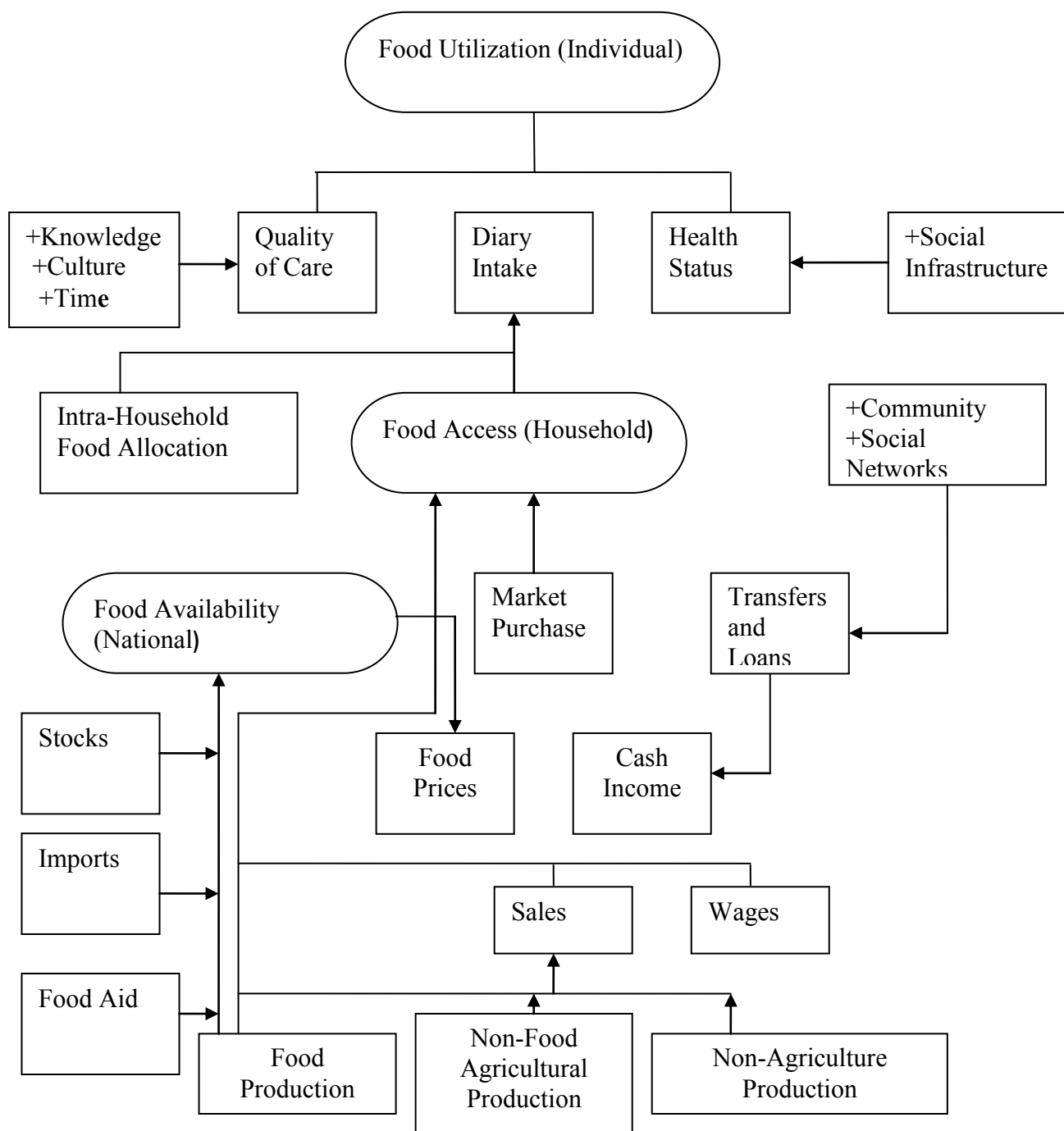


Source: Adapted from Riely, Mock Cogill, Bailey and Kenefick, 1999, cited by Steffen,

2010

Appendix 4: Food Utilization at the Individual level

Appendix 5: Food Utilization at individual level with associated parameters



Source: Adapted from Riely, Mock Cogill, Bailey and Kenefick, 1999, cited by Steffen,

Appendix 6: Recommended Daily Caloric Intakes

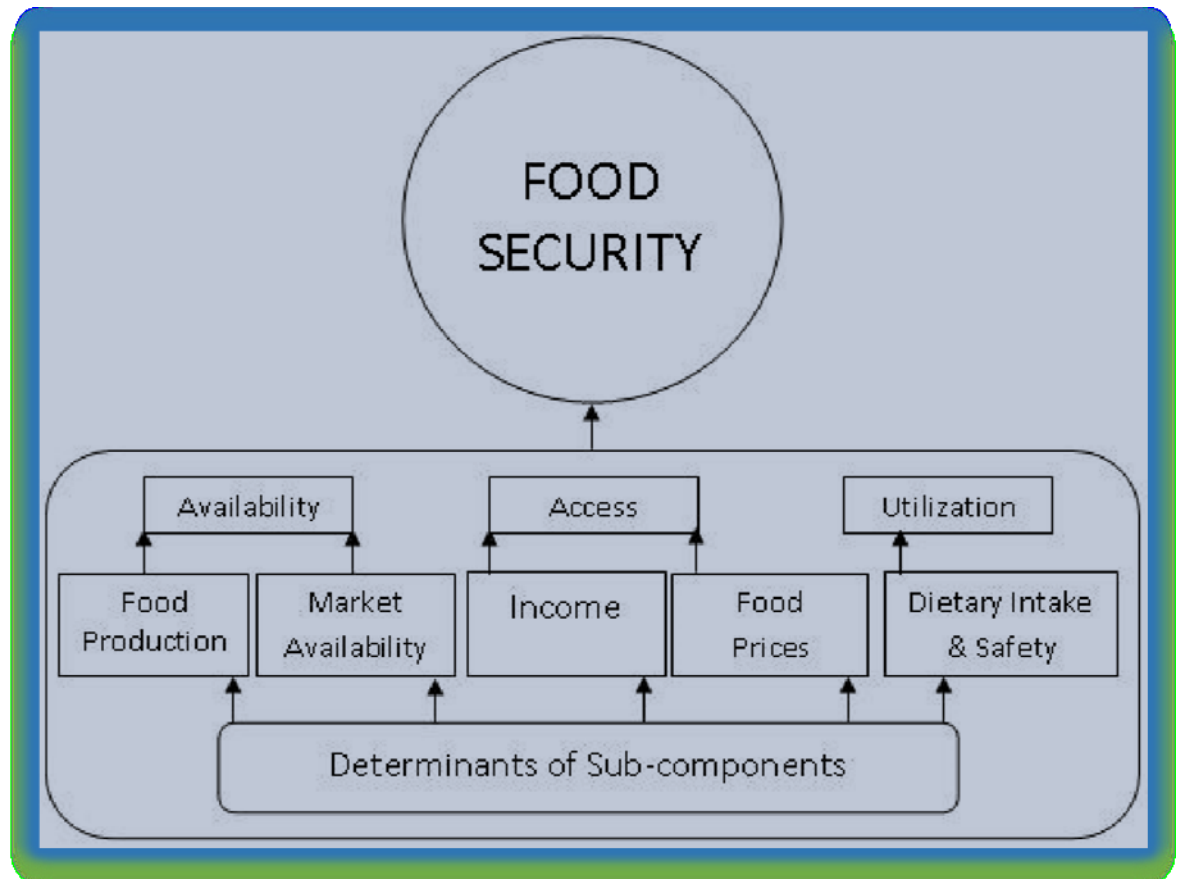
| Young Children | KCal/day | Food | Kilocalories |
|----------------|----------------|-------------------|----------------|
| <1 | 820 | Grain / legumes | |
| 1 -2 | 1150 | | |
| 2-3 | 1350 | | |
| 3-5 | 1550 | | |
| Older Children | Boys | Girls | |
| 5-7 | 1850 | 1750 | |
| 7-10 | 2100 | 1800 | |
| 10-12 | 2200 | 1950 | |
| 12-14 | 2400 | 2100 | |
| 14-16 | 2650 | 2150 | |
| 16-18 | 2850 | 2150 | |
| Men | Light Activity | Moderate Activity | Heavy Activity |
| 18-30 | 2600 | 3000 | 3550 |
| 30-60 | 2500 | 2900 | 3400 |
| >60 | 2100 | 2450 | 2850 |
| Women | Light Activity | Moderate Activity | Heavy Activity |
| 18-30 | 2000 | 2100 | 2350 |
| 30-60 | 2050 | 2150 | 2400 |
| >60 | 1850 | 1950 | 2150 |

Source: World Health Organization (1985)

Appendix 7: Nutrition Contents of Selected Vegetables in mg

| Vegetable | Edible Part | Wt | Prot | Fibre | Vit C | Vit E | Ca | Fe | Zn | *Oxalate | P | H ₂ O |
|---------------------|---------------|-------|-------|-------|-------|-------|-----|------|------|----------|-----|------------------|
| Tomato | Fruit | 4.10 | 0.89 | 0.44 | 19 | 0.7 | 8 | 0.54 | 0.15 | 3.23 | 64 | 26 |
| Amaranth | tender leaves | 14.4 | 5.21 | 1.78 | 81 | 2.21 | 264 | 2.66 | 2.93 | 899 | 272 | 284 |
| African eggplant | Fruit | 9.10 | 0.97 | 1.53 | 8 | 0.30 | 12 | 0.59 | 0.18 | 383 | 83 | 11 |
| Ethiopian mustard | tender leaves | 11.3 | 3.37 | 1.48 | 183 | 1.80 | 153 | 1.39 | 0.72 | 849 | 260 | 13 |
| Jute mallow | Seedlings | 14.3 | 5.13 | 1.59 | 92 | 280 | 213 | 289 | 0.77 | 508 | 115 | 87 |
| Moringe oleifera | Seedlings | 11.4 | 3.95 | 1.09 | 240 | - | 34 | 2.55 | 0.00 | 1 663 | 314 | 12 |
| African night shade | Seedlings | 11.0 | 4.69 | 1.08 | 132 | 2.10 | 206 | 3.89 | 0.93 | 683 | 156 | 60 |
| Okra | tender fruits | 8.10 | 1.71 | 0.76 | 26 | 0.40 | 112 | 0.60 | 0.41 | 835 | 120 | 167 |
| Pumpkin | tender leaves | 8.30 | 2.21 | 0.84 | 9.00 | - | 9 | 0.73 | 0.28 | 913 | 79 | 17 |
| Spider plant | tender leaves | 10.30 | 4.36 | 1.06 | 103 | 0.60 | 170 | 2.21 | 0.88 | 1 439 | 273 | 80 |
| Vegetable cowpea | tender leaves | 14.60 | 4.83 | 2.02 | 104 | 0.50 | 218 | 2.56 | 0.72 | 1 796 | 575 | 295 |
| Vegetable soyabeans | tender pods | 26.70 | 10.83 | 1.12 | 38 | - | 36 | 4.04 | 1.48 | 565 | 208 | 4 |

Source: AVRDC (2011), cited by FAO (2003), WHO (2003) nutrition standard

Appendix 8: Rural Household Food Security Model

Source: Muhammad, K. B., Steven, S. and Ram, P. (2012)

Appendix 9: Sources of Risk to Household Food Security

| Sources of Entitlement | Types of Risk | | | | |
|--|--|--|---|---|--|
| | Natural | State | Market | Community | Other |
| Productive capital (land, machinery, tools, animals, farm buildings, trees, wells, etc.) | Drought contamination (for example, of water supplies) | Land or other asset redistribution/confiscation | Changes in costs of maintenance | Appropriation and loss of access to common property resources | Loss of land as a result of conflict |
| Nonproductive capital (jewellery, dwellings, Granaries,) | Pests Animal disease | Compulsory procurement Villagization, Wealth tax | Price shocks, Rapid inflation | Breakdown of sharing mechanisms | Loss of assets as a result of war |
| Human capital (labour power, education, health) | Disease epidemics (For example AIDS) Morbidity | Declining public health expenditures | Unemployment Falling real wages | Breakdown of labour reciprocity | Produced labour; Consumption Mobility Restrictions |
| Income-crops, livestock, non-farm and non-agri activity) | Pests, Drought and other climatic events | Subsidies on inputs Tax increases | Commodity price falls Food price shocks | | Marketing channels disrupted by war embargoes |
| Claims (loans, gifts, social contracts, social security) | | | Rises in interest rates Changes in borrowing capacity | Loan recall Breakdown of reciprocity | Communities disintegrated/displaced by war |

Source: WFP and World Bank, (2012)

Appendix 10: Adult Equivalence: Index of Calorific Requirements by Age and Gender for East Africa

| Age group | Gender | |
|-----------|--------|--------|
| | Male | Female |
| 0 – 2 | 0.40 | 0.40 |
| 3 – 4 | 0.48 | 0.48 |
| 5 – 6 | 0.56 | 0.56 |
| 7 – 8 | 0.64 | 0.64 |
| 9 – 10 | 0.76 | 0.76 |
| 11 – 12 | 0.80 | 0.88 |
| 13 – 14 | 1.00 | 1.00 |
| 15 – 18 | 1.20 | 1.00 |
| 19 – 59 | 1.00 | 0.88 |
| 60+ | 0.88 | 0.72 |

Source: Collier *et al.* (1990)

Appendix 11: Household Economics of Scale Constants

| Household size (Number of adults) | Marginal cost | Average cost |
|--|----------------------|---------------------|
| 1 | 1.000 | 1.000 |
| 2 | 0.892 | 0.946 |
| 3 | 0.798 | 0.897 |
| 4 | 0.713 | 0.851 |
| 5 | 0.632 | 0.807 |
| 6 | 0.632 | 0.778 |
| 7 | 0.632 | 0.757 |
| 8 | 0.632 | 0.741 |
| 9 | 0.632 | 0.729 |
| 10+ | 0.632 | 0.719 |

Source: Deaton (1980), cited by Collier *et al.* (1990)

Appendix 12: Definitions of Food Security and Insecurity, 1975 – 1991

1. “Availability at all times of adequate world supplies of basic food-stuffs to sustain a steady expansion of food consumption ... and to offset fluctuations in production and prices” (UN, 1975)
2. “A condition in which the probability of a country’s citizens falling below a minimal level of food consumption is low” (Reutlinger and Knapp, 1980)
3. “The ability to meet target levels of consumption on a yearly basis” (Siamwalla and Valdes, 1980)
4. “Everyone has enough to eat at any time – enough for life, health and growth of the young, and for productive effort” (Kracht, 1981)
5. “The certain ability to finance needed imports to meet immediate targets for consumption levels” (Valdes and Konandreas, 1981)
6. “Freedom from food deprivation for all of the world’s people all of the time” (Reutlinger, 1982)
7. “Ensuring that all people at all times have both physical and economic access to the basic food they need” (FAO, 1983)
8. “The stabilization of access, or of proportionate shortfalls in access, to calories by a population” (Heald and Lipton, 1984)
9. “A basket of food, nutritionally adequate, culturally acceptable, procured in keeping with human dignity and enduring over time” (Oshaug 1985 in Eide, *et al.*, 1985)
10. “Access by all people at all times to enough food for an active and healthy life” (Reutlinger, 1985)
11. “Access by all people at all times to enough food for an active, healthy life” (World Bank, 1986)
12. “Always having enough to eat” (Zipperer, 1987)
13. “An assured supply and distribution of food for all social groups and individuals adequate in quality and quantity to meet their nutritional needs” (Barraclough and Utting, 1987)
14. “Both physical and economic access to food for all citizens over both the short and the long run” (Falcon, *et al.*, 1987)
15. “A country and people are food secure when their food system operate efficiently in such a way as to remove the fear that there will not be enough to eat” (Maxwell, 1988)
16. “Adequate food available to all people on a regular basis” (UN World Food Council, 1988)
17. “Adequate access to enough food to supply the energy needed for all family members to live healthy, active and productive lives” (Sahn, 1989)
18. “Consumption of less than 80% of WHO average required daily caloric intake” (Reardon and Matlon, 1989)
19. “The ability to satisfy adequately food consumption needs for a normal and healthy life at all times” (Sarris, 1989)
20. “Access to adequate food by and for households over time” (Eide, 1990)
21. “Food insecurity exists when members of a household have an inadequate diet for part or all of the year or face the possibility of an inadequate diet in the future” (Philips and Taylor, 1990)
22. “The ability ... to assure, on a long term basis, that the food system provides the total population access to a timely, reliable and nutritionally adequate supply of food” (Staatz, 1990)
23. “The absence of hunger and malnutrition” (Kennes, 1990)

24. “The inability to purchase sufficient quantities of food from existing supplies” (Mellor, 1990)
25. “The self-perceived ability of household members to provision themselves with adequate food through whatever means” (Gillespie and Mason, 1991)
26. “(Low) risk of on-going lack of access by people to the food they need to lead healthy lives” (Von Braun, 1991)
27. “Availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices”(World Food Summit, 1974)
28. “Access of all people at all times to enough food for an active, healthy life” (World Bank report, 1986).
29. “Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”. (World Food Summit, 1996)
30. “Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (The State of Food Insecurity 2001).

Appendix 13: Household Questionnaire on Institutional Determinants for Food Security in Singida Region

A: HOUSEHOLD QUESTIONNAIRE

1.0 Respondents Identification

1.1 Day/Month/Year of Interview

| | | | | | | | |
|--|--|--|--|--|--|--|--|
| | | | | | | | |
|--|--|--|--|--|--|--|--|

1.2 Questionnaire No.

| | | |
|--|--|--|
| | | |
|--|--|--|

1.3 Interviewer Name

1.4 Location

1.4.1 Village

1.4.2 Ward

1.4.3 Division

1.4.4 District

1.4.5 Region

2.0 Household Information

2.1 Basic Information on the respondents

2.1.1 Household Code

2.1.2 Name of Respondent

2.1.3 Name of household head.....

2.1.4 Sex of household head.....

1 = Male

2 = Female

2.1.5 Household's head age (years)

2.1.6 Marital Status of the head of the household

1 = Married....

a) Number of Wives.....

b) Number of Children.....

2 = Not Ever Married

3 = Widowed

4 = Divorced

5 = Separated

6 = Deserted

2.1.7 Members of household who are resident in the household, their sex, marital status and occupation

| ID | Name | Age | Sex | Marital Status | Relationship | Education | Main Occupation of household head |
|----|------|-----|----------------|----------------|--|-----------|--|
| | | | 1 = M 2 = F | | 1 = Head 2 = None 3 = Husband 4 = Child 5 = Relative 6 = Non Relative | | 1 = Farmer 2 = Off-farm activities 3 = Civil Servant 4 = Others |
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |

2.1.8 Total Resident members.....

2.1.9. Members of the household permanently or often away

| ID | Name | Age(Year) | Sex | Send Home | Money | Estimated Last Year (TZSs) | Amount |
|----|------|-----------|------------------------|-------------------|-------|----------------------------|--------|
| | | | 1 = Male 2 = Female | 1 = Yes 2 = No | | | |
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |

2.1.10 Total Family members permanently, or often away

2.1.11 Total remittances in the past year period from 2010 to 2011 TZSs.....

3.0 Crops and Livestock Production

3.1 Crops Production

3.1.1 Crops grown by the household in 2010/2011

| Crop grown | Area Cultivated in areas | Inputs | Input Amounts in TZSs | Yield in Kg | Source of Inputs |
|----------------|--------------------------|----------------|-----------------------|-------------|------------------|
| | | 1 = seeds | | | 1=own |
| | | 2 = fertilizer | | | 2=purchase |
| | | 3 = Pesticides | | | 3=government |
| | | 4 =weedkillers | | | 4=input lenders |
| | | 5 = Manure | | | 5=given |
| Millet | | | | | |
| Sorghum | | | | | |
| Maize | | | | | |
| Rice | | | | | |
| Sweet Potatoes | | | | | |
| Groundnuts | | | | | |
| Peanuts | | | | | |
| Beans | | | | | |
| Sun flower | | | | | |
| Tomatoes | | | | | |
| Bananas | | | | | |
| Vegetables | | | | | |
| Tubers | | | | | |
| Carrot | | | | | |
| Okra | | | | | |
| Mangoes | | | | | |

Note: Given Implies input from Friends and relatives

3.2 Livestock Production

3.2.1 Livestock products produced by household during 2009/2010

| Product | Type of animal kept | No. of animal Kept | Yield in Litres/Kg | Input Amount | Source of Input |
|------------|---------------------|--------------------|--------------------|--------------|----------------------|
| | | | | | 1 = own |
| | | | | | 2 = Bought |
| | | | | | 3 = Institu. Support |
| | | | | | 4 = NGOs |
| | | | | | 5 = Given |
| Beef | | | | | |
| Mutton | | | | | |
| Pork | | | | | |
| Eggs | | | | | |
| Hides/Skin | | | | | |
| Others | | | | | |

Note: Given Implies Inputs from Friend and Relatives

4.0 Main Sources of Cash Income of the Household

4.1 What is your average monthly income in TZS?

- i) 0 – 20 000
- ii) 21 000 – 40 000
- iii) 41 000 – 60 000
- iv) 61 000 and above

4.2 Household's main sources of income:

| Source of Cash Income | Dependency | Cash Value | Percentage of the Total Income |
|---|---------------|------------|--------------------------------|
| | 1 = Very High | | |
| | 2 = High | | |
| | 3 = Moderate | | |
| | 4=Low | | |
| | 5 =Very Low | | |
| Sale of Food Crops | | | |
| Sale of Livestock products | | | |
| Sale of Cash Crops | | | |
| Sale of Charcoal | | | |
| Sale of Timber/poles | | | |
| Sale of firewood | | | |
| Sale of wild products (Honey, medicinal plants) | | | |
| Wages and Salaries in cash | | | |
| Selling of local brew | | | |
| Other casual cash earnings | | | |
| Business Income | | | |
| Cash Remittances | | | |
| Fishing | | | |

5.0 Availability and Quality of Inputs for Agricultural Production at the Household Level**6.0 Mode and Methods of Production Used by the Household**

| Type of product | Mode of Production | Technology Used | Output Level |
|---------------------|--------------------------|-----------------|---------------|
| | 1 = Shifting cultivation | 1 = Traditional | 1 = Very High |
| | 2 = Crop rotation | 2 = Modern | 2 = High |
| | 3 = Harrowing | 3 = others | 3 = Low |
| | 4 = Mono cropping | | 4 = Very Low |
| | 5 = Mixed cropping | | |
| | 6 = Intercropping | | |
| | 7=Fodder cropping | | |
| | 8=Zero grazing | | |
| | 9=Free range grazing | | |
| | 10 = Others | | |
| Food crop | | | |
| Cash Crop | | | |
| Animal Husbandry | | | |
| Horticultural Crops | | | |
| Forest Crops | | | |
| Vegetables | | | |

7.0 Household Consumption Pattern**7.1 Have your household ever experienced food shortage?**

- i) Yes ii) No

7.2 If yes, to what extent is your household prone to food insecurity?

- i) Very high
 ii) High
 iii) Moderate
 iv) Low
 v) Very low

7.3 Please, estimate food insecurity in your household in percentage.

- i) 0 – 20
 ii) 21 – 40
 iii) 41 – 60
 iv) 61 – 80
 v) 81 - 100

7.1 Household dietary diversity: This is the Sum of the number and amount of different food consumed by an individual over the past one day, one week, and one month.

| S/N | Item | Frequency and amount food taken | | | | | |
|-----|----------------------|---------------------------------|----------------|-----------------|----------------|--------------|----------------|
| | | One day before | | Last seven days | | Last 30 days | |
| | | Times | Amount (kg) | Times | Amount (kg) | Times | Amount (kg) |
| | Cereals | | | | | | |
| | Millet | | | | | | |
| | Sorghum | | | | | | |
| | Rice | | | | | | |
| | Maize | | | | | | |
| | Bread | | | | | | |
| | Tubers | | | | | | |
| | Sweet potatoes | | | | | | |
| | Groundnuts | | | | | | |
| | Vegetables | | | | | | |
| | Tomatoes | | | | | | |
| | Onions | | | | | | |
| | Beans | | | | | | |
| | Carrots | | | | | | |
| | Fruits | | | | | | |
| | Bananas | | | | | | |
| | Mangoes | | | | | | |
| | Lemons | | | | | | |
| | Pineapple | | | | | | |
| | Guavas | | | | | | |
| | Meat | | | | | | |
| | Beef | | | | | | |
| | Chicken | | | | | | |
| | Mutton | | | | | | |
| | Goat | | | | | | |
| | Pork | | | | | | |
| | Fish | | | | | | |
| | Dried | | | | | | |
| | Smoked | | | | | | |
| | Fresh | | | | | | |
| | Milk Products | | | | | | |
| | Cow milk | | | | | | |
| | Goats milk | | | | | | |
| | Other Milk | | | | | | |
| | Other Items | | | | | | |
| | Butter | | | | | | |
| | Tea | | | | | | |
| | Salt | | | | | | |
| | Coffee | | | | | | |

7.2 Household Food Balance Sheet: This is composed of the food utilization structure in terms of food opening and closing balance, food produced, consumed, etc.

| Food type | Food b/d (kg) | Food prod (kg) | Food inflow (kg) | Food outflow (kg) | Domestic consumption | | | | | Food b/f (kg) |
|-----------|---------------|----------------|------------------|-------------------|----------------------|-----------|-----------|------------|------------|---------------|
| | | | | | Feeded (kg) | Seed (kg) | Food (kg) | Waste (kg) | Total (kg) | |
| Maize | | | | | | | | | | |
| Sorghum | | | | | | | | | | |
| Millet | | | | | | | | | | |
| Rice | | | | | | | | | | |
| Tubers | | | | | | | | | | |
| Potatoes | | | | | | | | | | |
| Nuts | | | | | | | | | | |
| Onions | | | | | | | | | | |
| Beans | | | | | | | | | | |
| Bananas | | | | | | | | | | |

8.0 Household coping strategies: This is based on how household adopt to the presence or threat of food shortages. This is guided by questions developed in the nutrition literature (Ridimer, Olson and Campbell (1990), Maxwell and Frankenberger (1992) and Maxwell (1996)

8.1 Did you worry that your household would not have enough food? 1.Yes 2.No

8.2 Has the household consumed less preferred foods?

1. Nev 2. Rarely (once) 3. From the time to time (2 or 3 times) 4. Often (5 or times more)

8.3 Have you reduced the quality of food served to men in this household?

1. Never 2. Rarely (once) 3. From the time to time (2 or 3 times). 4. Often (5 or times more)

8.4 Have you reduced your own consumption of food?

1. Never 2. Rarely (once) 3. From the time to time (2 or 3 times) 4. Often (5 or times more)

8.5 Have you reduced the quantity of food served to children in this household?

1. Never 2. Rarely (once) 3. From the time to time (2 or 3 times) 4. Often (5 or times more)

8.6 Have members of this household skipped meal?

1. Never 2. Rarely (once) 3. From the time to time (2 or 3 times) 4. Often (5 times or more)

8.7 Have members of this household skipped meal for a whole day?

1. Never 2. Rarely (once) 3. From the time to time (2 or 3 times) 4. Often (5 or times or more)

9.0 Household Awareness on Food Security

9.1 Are you aware of food security?

1 = Yes 2 = No

9.2 If yes, what specific issues are addressed by food security initiatives, mention.

.....

9.3 What do you always do to ensure food security in your household?

.....

9.4 Has your household ever experienced food insecurity in 2010\2011?

i) Yes ii) No

9.5 If yes, to what extent is your household prone to food insecurity?

1 = very high 2 = high 3 = low 4 = moderate 5 = very low

9.6 Please, can you estimate the food incidence in your household in percentage?

- i) 0.0 – 20.0
- ii) 21.0 – 40.0
- iii) 41.0 – 60.0
- iv) 61.0 – 80.0
- v) 81.0 – 100.0

9.7 What do you think are the main causes of food insecurity in your area?

.....

9.8 What do you think are the probable impact on your household when it is food insecure? Mention

.....

10.0 Agricultural Development and Food Security Support Institutions

10.1 Are there any institutions dealing with agricultural development and food security in your area?

1 = Yes 2 = No

10.2 If Yes, what type of institutions are they?

1 = Governmental 2 = Non-Governmental Organisations
3 = Community Based Organisations 4 = Civil Society Organisations 5 = Others

10.3 What are these institutions? Mention them.

.....
.....

10.4 Has any member of your household received any training organized by any institution concerning crop/animal production, management, processing, preservation, storage, utilization and marketing?

1 = Yes 2 = No

10.5 If Yes, in what are and what type of training?

Production

Management

Processing

Preservation

Storage

Utilization

Marketing

Others (Specify).....

10.6 If Yes, did the training meet your expectation?

1 = Yes 2 = No

10.7 To What extent are you utilizing knowledge and skills in your production process?

1 = Very Poor

2 = Poor

3 = Moderate

4 = Effective

5 = Very Effective

10.8 Did you receive any facility or service from any institution in relation to agricultural production?

1 = Yes 2 = No

10.9 If Yes Mention

| Service Provider | Target Product | Type of Support | Condition if Any | Value of TZS | Support in |
|------------------|----------------|-----------------|------------------|--------------|------------|
|------------------|----------------|-----------------|------------------|--------------|------------|

Codes for Type of Support

- 1= Capital (Physical)
- 2= Meteorological Information
- 3= Farm Inputs
- 4=Extension Services
- 5= Preservatives
- 6= Storage
- 7= Financial Support
- 8= Production Techniques
- 9 = Land Acquisition
- 10 = Others (Specify)

10.10 Which Services do not exist but are needed in the area?

.....

.....

10.11 What was the frequency for each support provided in your household for 2010/2011? .
.....times

10.12 In your opinion how do you rate the institutional support regarding agricultural development and food security?

- 1=Very high
- 2=High
- 3=Moderate
- 4 = Low
- 5 =Very low

10.11 What is the value of each institutional support in monetary terms in your village for the period of 2009/2010? TZS.....

11.0 Policy Related Issues

11.1 Are you aware of any government policy related to agricultural development?

- 1 = Yes
- 2 = No

11.2 If Yes, State the policy and its constraints, if any?

.....

.....

11.3 If the government was to come up with new policy on agricultural development and food security, bearing in mind, KILIMO KWANZA, what would you suggest to be included?

- 1 = Production Technology
- 2 = Provision of knowledge, skills and attitudes changes
- 3 = Agriculture Extension services Intensification
- 4 = Credit policy reform
- 5 = Land Reform
- 6 = Village Community Banks
- 7 = Availability of Agricultural inputs in time
- 8 = Subsidies to agricultural inputs

11.4 In your opinion, what are the major constraints towards food security in Singida region?

.....

.....

11.5 What do you think can be done to mitigate the problem of food insecurity in your area?

.....
.....

THANK YOU FOR YOUR CORDIAL COOPERATION!

**Appendix 14: Guiding Questions for Focus Group Discussions on Institutional
Determinants of Food Security in Singida Region**

- Q1.** Do you have any food shortage in your area?
- Q2.** What is the extent of food shortage in your area?
- Q3.** What do you think is the main cause of food shortage in your area?
- Q4.** Are there institutions dealing with food security in your district?
- Q5.** What are they and allocated where in the district?
- Q6.** What agricultural input support services do they provide to small scale farmers?
- Q7.** What do you think are the inadequacies in providing these services?
- Q8.** What specifically do they do in addressing the above problem?
- Q9.** In the past four weeks:
- Q10.** Did you worry that your household would not have enough food?
- Q11.** Were you or any household member not able to eat the kinds of foods you preferred because of lack of resources?
- Q12.** Did you or any household member have to eat a limited variety of foods due to a lack of resources?
- Q13.** Did you or any household member have to eat some foods that you really did not want to eat because of lack of resources to obtain other types of food?
- Q14.** Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
- Q15.** Did you or any household member have to eat fewer meals in a day because there was not enough food?
- Q16.** Was there ever no food to eat of any kind in your household because of lack of resources to get food?
- Q17.** Did you or any household member go to sleep at night hungry because there was not enough food?
- Q18.** Did you or any household member go a whole day and night without eating anything because there was not enough food?

**Appendix 15: A checklist of items of discussion with key informants for Research on
Institutions Determinants of Food security in Singida Region**

1. How food security is normally measured and reported by the Ministry of Agriculture at district level?
2. What is the status of food security in Iramba/Singida Rural district based on the above ways in which food security is normally measured?
3. According to the 2007 Household Budget Survey, 17% of all people on Mainland Tanzania fall below the national food poverty line. What are the corresponding figures for Iramba/Singida Rural district?
3. Which NGOs deal with agricultural in the district and what are they doing where?
4. What elements of the current agricultural policy are given priority in improving agriculture for higher food security and income generation in the district?
5. What rules and regulations are being implemented to improve food security in the district?
6. What by-laws have been formulated to improve agriculture and food security in councils of the district?
7. What social capital aspects are in Iramba/Singida Rural district, and how do they constrain/enhance food security?
8. What traditional practices constrain/enhance food security in Iramba/Singida Rural?
9. In what ways are cooperatives enhancing and/or con straining food security in Iramba/Singida Rural district?

Appendix 16: Nutritional value of common mushroom per 100g

| | |
|---|-----------------|
| Kingdom: Fungi, Phylum: Basidiomycota, Class: Agaricomycetes | |
| Family: Agaricaceae, Genus: Agaricus, Species: Agaricus Bisporus | |
| Agaricus bisporus, white raw | |
| Nutritional value per 100g (3.5oz) | |
| Energy | 93 kJ (22 kCal) |
| Carbohydrates | 3.26 g |
| - Sugars | 1.98 g |
| - Dietary fiber | 1 g |
| Fat | 0.34 g |
| Protein | 3.09 g |
| Water | 92.45 g |
| Thiamine (vit. B ₁) | 0.081 mg (7%) |
| Riboflavin (vit. B ₂) | 0.402 mg (34%) |
| Niacin (vit. B ₃) | 3.607 mg (24%) |
| Pantothenic acid (B ₅) | 1.497 mg (30%) |
| Vitamin B ₆ | 0.104 mg (8%) |
| Folate (vit. B ₉) | 17 µg (4%) |
| Vitamin B ₁₂ | 0.04 µg (2%) |
| Vitamin C | 2.1 mg (3%) |
| Vitamin D | 0.2 µg (1%) |
| Iron | 0.5 mg (4%) |
| Magnesium | 9 mg (3%) |
| Phosphorus | 86 mg (12%) |
| Potassium | 318 mg (7%) |
| Sodium | 3 mg (0%) |
| Zinc | 0.52 mg (5%) |
| Source: USDA, (2014). | |

