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ROLE OF INSTITUTIONS IN HOUSEHOLD FOOD SECURITY IN TANZANIA: A CASE OF SINGIDA REGION

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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 study 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) identify institutions dealing with food security and their key functions, (ii) determine food security at the household level, and (iii) 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 Kilocalories (kCal). Data were collected among 240 households between November 2018 and July 2019, 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 District 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 regressions, 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.

Key words: *Institutions, food security, poverty severity index, dietary energy consumed*

1.0 Introduction

1.1 Background to the problem

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.

In addition to this, The World Food 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).

It has been noted that, 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 institutional factors (Pottier, 1999). Furthermore, in Tanzania, there are various institutions and organizations that deal with agricultural development and hence fostering food security. Likewise, in Singida Region, institutions have a potential role to play pertinent to food security implying that they have a vital function in fostering agricultural production as well as food security status.

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, 2016). The proportions were based on the cut-off point of 2200 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 hold. 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.

2.0 Methodology

2.1 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 1.0for 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), and hence giving justification for selecting Singida Region as a case study.

2.2 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. This design was considered to be useful because of time limit and resources that were available for the research hence fulfil the objectives of the study.

2.3. The Sample and Sampling Procedures

The population for the research was all households in the two districts. 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:

$$n = \frac{Z.\ N.\ \sigma^2_p}{(N-1)\ e^2+Z^2\ \sigma^2_p}$$

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

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

= 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 3000 and 3500 per village. The sampling units were households.

2.4 Instruments for Data Collection

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.

2.5 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.

2.6 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.

Inferential analyses involved testing the two null hypotheses. 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 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:

$Yi = a_0 + b_1x_1 + b_2x_2 + b_3b_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7b_7 + b_8x_8 + b_9x_9 + b_{10}x_{10} + e$

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

a_0 = A constant

$b_1 \ldots b_8$ =Coefficients of regression

$x_1 \ldots x_8$ = 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

3.0 FINDINGS AND DISCUSSIONS

3.1 Socio-Economic and Demographic Characteristics of the Households Surveyed

3.1.1 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 1). Three-quarters (75%) of all heads of household who were married were male (Table 1), which shows that the households surveyed were culturally male dominated.

Table 1: 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**

Source: Field data (2019)

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. 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.

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).

3.1.2 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. Table 2 shows the distribution of respondents by level of education.

Table 2: Distribution of respondents by level of education (n = 240)

Education Level	f	%
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.

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).

3.2 Availability and operations of Institutions in the Study Area

3.2.1 International Organisations/Institutions

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.

ii) WB

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.

3.2.2 National institutions

i) The Central government Institutions

(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, 2018). Table 3 shows budget allocation for the two districts in the year 2014/15 – 2018/19 for ASDP & DADPs.

Table 3: Budget allocation for DADPs and ASDPs for 2014/15-2018/19

Year	Singida (Mil. TZS)	Iramba (Mil. TZS)
2014/15	520	616
2015/16	720	984
2016/17	243	362
2017/18	314	445
2018/19	234	304

Source: DALDOs Offices (2018)

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 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 km^2, out of which 95.5 km^2 or 0.19% is covered by water bodies of Lake Eyasi, Kitangiri, Singidani, Kindai and Balengida. The remaining 49 342.5 km^2 is a dry land area, out of which 24 671.2 km^2 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 km^2 suitable for agriculture, only 13 340.5 km^2 are suitable for irrigation whereby 5362.1 km^2 are classified as high potential, 4547.4 km^2 as medium potential; and 3331 km^2 as low potential. Furthermore, only 31 km^2 have been provided with improved irrigation infrastructure as of May 2010.

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 District Councils

It was found that 91.9% of the total respondents in the two districts 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.

(b) Village Councils

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:

(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.

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 also some 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) 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 2017/18 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.

(ii) 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.

3.3.4 Institutional Support in the study area

3.3.4.1 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 2017/2018.

3.3.4.2 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).

3.3.4.3 Institutional support in credit provision to household members

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%).

3.4 Food Security Status at Household Level in the Study Area

3.4.1 Grains per Capita 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..

3.4.2 Dietary Energy Consumed (DEC) in the Study Area

Based on estimates given by FAO (2004), households consuming less than 2280 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: Table 4 shows the distribution of households in terms of DEC and food insecurity.

Table 4: Dietary Energy Consumed (DEC) and food insecure households

Dietary energy consumed & Food insecure households	Singida District		Iramba District		Both Districts	
	n	DEC	n	DEC	n	DEC
DEC per capita (kCal.)	120	1876.54	120	1985.72	240	1978.65
DEC per adult equivalent (kCal.)	120	2164.24	120	2185.63	240	2179.85
Food insecure hh per capita (%)	120	36.7	120	30.4	240	33.6
Food insecure hh per adult equivalent (%)	120	69.6	120	63.3	240	66.5

Table 4 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.

3.5 Linkages between Institutional Factors and Food Security Factors

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).

3.6 Institutional factors and comparison of DEC per adult equivalent

Food security was measured in terms of dietary energy consumption per adult equivalent using a number of institutional factors. 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 5.

Table 5: 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		
Number of times household members contacted by extension workers in 2010/2011 > = 5	70	2299.7246	0.576	0.453
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 Distric	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 5 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 >= 100000 than those with total value of input support in TZS < 100000 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.

3.7 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 6 shows the regression results.

Table 6: Regression of DEC per adult equivalent on some institutional variables

Independent variables	**Unstandardized Coefficients**			**Standardized Coefficients**	**T**	**Sig.**	**Collinearity Statistics**	
	n	B	Std. Error	Beta			Tolerance	VIF
(Constant)		3761.904	814.38		4.620	0.000		
Total acreage irrigated	144	3.808	89.798	0.002	0.042	0.966	0.912	1.097
Total food production with institutional support	156	0.207	0.014	0.811	14.457***	0.000	0.420	2.383
Number of households received training	204	806.487	159.463	0.192	5.058***	0.000	0.913	1.095
Amount of credit provided to farmers in TZS	134	-6.096	0.523	0.454	-7.119***	0.000	0.911	1.059

Total times farmers got extension officers advice	111	2.412	12.242	0.007	0.197	0.844	0.931	1.074
Total acreage cultivated	240	70.533	6.305	0.441	10.250***	0.000	0.834	1.173
Number of training sessions provided to households	204	72.879	6.476	0.443	11.254***	0.000	0.851	1.175
Total infrastructure value constructed in million TZS	120	67.02	6.051	0.540	16.580***	0.000	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

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.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 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.

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.

4.2 Recommendations

Institutions (international, 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 doyet 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.

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 and therefore making families more food secure.

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