DEVELOPMENT IN EAST AFRICA

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Environment and Economy

edited by Jerzy Gilarowski

Development in East Africa

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Jerzy Gilarowski

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INTRODUCTION

I should start this introduction with an explanation – what does East Africa mean? Which countries belong to it? There is no simple answer to this question because different sources give different answers. For example, in The United Nations Statistics Division scheme of geographic regions, East Africa encompasses 20 countries, from Egypt in the North, to Mozambique in the South, and State-islands located in the Western part of Indian Ocean[1]. Encyclopedia Britannica defines Eastern Africa as two traditionally recognized regions: East Africa, made up of only Kenya, Tanzania, and Uganda; and Horn of Africa, made up of Somalia, Djibouti, Eritrea, and Ethiopia[2]. In this book, however, East Africa is identified, with some small exceptions, as East African Community (EAC). EAC consists at present of 6 countries, but until 2007, its members were only Kenya, Tanzania and Uganda. In 2007 Rwanda and Burundi joined, and in 2016 South Sudan. The next member will be, probably, Somalia, which applied for entry to the organization in 2012.

East African Community is the fastest-growing region in Sub-Saharan Africa. Within the last decade, its average GDP reached nearly 6%. The leaders are Kenya and Tanzania, with GDP per capita: 3.4 and 3.1 thousand dollars respectively. However, it is still

[1] United Nations Statistics Division-Standard Country and Area Codes Classifications (M49), un.org.

[2] https://www.britannica.com/place/eastern-Africa.

a poor region, because Human Development Index is still low. The most developed country of the region, Kenya, occupies 146th position, and the least developed, Burundi, 184th position, out of 188 states of the World, which have been taken under consideration.

In comparison with other regional economic communities, like Economic Community of Central African States, Economic Community of West African States, or Southern African Development Community, East Africa Community grows faster in terms of economy. Does it mean that EAC, including Tanzania, which occupies a large part of this paper, really develops fast? The chapters of this book try to answer this question.

According to Cambridge Dictionary, development is the process in which someone or something grows or changes and becomes more advanced[3]. In this meaning development encompasses everything, for example: nature (including living and non-living things), people (their culture, traditions, relations, attitudes, economy, and science), but also area, events, and all processes, which develop something new. If we concentrate on this last meaning, we may say that development can be understood as: advancement, evolution, expansion, improvement, increase, progress, advance, enlargement, and many other terms. Development may be material and non-material. The first encompasses, for example, biological growth of living organisms, appearance of new buildings, diversification and modernization of national economy or increase of Gross Domestic Product. Non-material might be as: mental, psychological, personal, cultural, linguistic development; development of geophysical sciences; or increase of intolerance.

In common use there is the term "sustainable development", which appears in this paper many times. Sustainable development is development that meets the needs of the present without compro-

[3] https://dictionary.cambridge.org/dictionary/english/development.

mising the ability of future generations to meet their own needs[4]. This concept is based on three pillars: economic development, social development and environmental protection for future generations. The term or concept is catchy, based on the premise that we should develop on the basis of today's resources, but in such a way that they do not run out for our, even very distant, descendants. But on the other hand it is deeply criticized. How can we use non-renewable resources without their depletion? It is not possible, because they are non-renewable. The amount of coal, petrol or natural gas is still decreasing with extraction. Even renewable resources, when overexploited, might become irretrievably lost. Also climate change may contribute and contributes to it significantly. Overexploitation and climate change are factors, which are acting in concert. More details about this problem are exposed in this paper by Richard R. Mwaipungu and Lola Y. Selle in chapter 9.

Due to the fact that development can be understood in different ways, as it has been explained above, the book "Development in East Africa" consists of three volumes with the same title but different subtitles. They are as follow: Vol. 1. Environment and economy, Vol. 2. Politics, security, and conflicts management, Vol. 3. Cultural Shift: Developments, Biographies, (Im) materialities. All of them are the aftermath of the 1st International Conference on "Development in East Africa: Conditioning, Aspects & Effects", which took place from 2nd to 4th October, 2017, at Mkwawa University College of Education in Iringa/Tanzania.

Again, taking under consideration the complexity of the term development, this volume has been divided into 3 parts:

– Part I. Coping strategies towards food insecurity,
– Part II. Food production and storage,

[4] World Commission on Environment and Development, Our Common Future (1987).

– Part III. Natural resources, investment and development.

First part deals with the problem of insufficient food production, which does not cover the needs of different local communities. This situation can be understood as food insecurity, which results mostly from overexploitation of arable land, decreasing fertility of soil, climate change and population growth. Authors of the first 5 chapters present strategies, used by farmers, to cope food insecurity. Those strategies can be divided into two groups: in-farm, and off-farm activities. In-farms strategies encompass activities, which are connected with agriculture/food production, and have been exposed by Emiliana A. Assenga and Kim A. Kayunze in the paper: "Vulnerability to and coping strategies against food insecurity in Chamwino District, Tanzania", and by Helena Myeya and Danielson R. Kisanga in: "Challenges encountered by smallholder farmers in adapting to adverse effects of climate change in semi-arid areas of Central Tanzania". According to their findings, the mostly used strategies are: growing drought tolerant crop varieties, practicing intercropping, shifting the planting to earlier/later dates, increase of farm sizes, reducing meal amounts, eating less preferred foods, and food storage. In both papers authors pointed out that off-farm activities also play a certain role, which has been elaborated in details in my paper together with Evarist Fundisha: "Role of off-farm livelihood diversification in the mitigation of food insecurity in Rombo District, Tanzania"; and in the paper of J. Msinde, J.K. Urassa, I. Nathan: "Off-farm employment response to Idiosyncratic Shocks to crop income in Kilombero Valley, Tanzania". The authors of both papers agree that the most effective off-farm strategy to alleviate effects of food insecurity is off-farm employment, which may take different forms like entrepreneurship, casual labour and formal employment. However, they pointed further two different, but significant issues. Evarist Fundisha and Jerzy Gilarowski, through their research, noted that education and the availability of small loans play a basic role

in finding additional job in off-farm activities. We wrote, as the recommendation for the local governments, that "Women, singles, elders, youths and individuals with primary and non-formal education should be empowered through training and capital to raise their participation in off-farm livelihood activities that are profit-making". In turn, J. Msinde, J.K. Urassa, and I. Nathan emphasize that off-farm activities are shaped by seasonality. These activities take place mostly during the post-harvest season when farming activities are much less intense. Seasonal work outside agriculture, especially in the dead season, plays an essential risk management role and cushions against crop income shocks. The prices of crops are the lowest at the beginning of post-harvest season, but many peasants are forced to sell their harvest in that time, because the money from the sale of last year harvest is mostly gone. Having an additional job one may store the harvest, or at least a part of it until the peak price season.

Part two consists of three chapters, which present gleams and shadows of food production in Tanzania and development of agriculture. Asnath Alberto Malekela and Agnes M.S. Nyomora in their paper "Dynamics of food production and their distribution in urban areas. A case of Dar es Salaam city, Tanzania", underline that urban and peri-urban agriculture around Dar es Salaam should be given special attention by city planners. Due to urban sprawl, agricultural land in, and around Dar es Salaam, decreased of about 22% within last 35 years, but it is still the main supplier of fresh vegetables and fruits. The producers are mostly outsiders, migrants from inland of Tanzania, who cultivate "no one's land" and rented plots. Despite many challenges those people supply 47% of food products for the market of Dar es Salaam.

Emilia K. Bamwenda and Gratian R. Bamwenda in their paper: "Identifying agro-value adding sectors that may catalyze accelerated rural industry development in Tanzania" present their vision

of modernization of Tanzanian agriculture by identification of sectors and products, which can be value added, and by pointing out the concrete activities which should be done. According to them, the three sectors that may provide an impulse for rural industry development are: i) edible oil, ii) grain, cassava, and pulses-based processed food products, and iii) milk and dairy products. They point out that the raw materials from these sub-sectors, should be further processed and value added. The new products are highly demanded not only country wide, but also in African and global markets.

The modernization of Tanzanian agriculture, together with the yield increase, must be combined with the improvement of storage. In Tanzania, the lack of efficient storage technologies is a major factor leading to high postharvest losses. For example, Tanzanian farmers lose up to 40% of their grains. However, this problem might be solved at a relatively low cost by introducing to the market hermetic bags made of polyethylene, in which common pests cannot survive. More about that is presented by Elieza Paul Milonga in chapter five: "Customized hermetic bag (CHB) for safe grain storage in Tanzania".

Third part of the book begins with the article of Konrad Czernichowski titled: "The investment environment in the East African Community". The author presents the foreign direct investment (FDI) in the East African Community and characterizes the investment environment in Tanzania, Kenya, Uganda, Rwanda, Burundi and South Sudan. The main obstacles for doing business in East Africa are corruption, high tax rates, insufficient access to financing and un-stable political situation, especially in South Sudan and Burundi. Taking under consideration different reports such as: *Doing Business* (by the World Bank), *Index of Economic Freedom* (by the Heritage Foundation), *Freedom in World Country Ratings* (by Freedom House), *Global Competitiveness Index* (by World Economic

Forum), *Fragile States Index* (by Fund for Peace) and *Ibrahim Index* (by Mo Ibrahim Foundation), the author calculated an index of the investment climate in these countries. According to him, the most favorable investment situation is in Rwanda and Tanzania, whereas the worst in Sudan and Burundi.

The paper of Richard R. Mwaipungu and Lola Y. Selle: "Challenges in management and deployment of East African region natural capital for sustainable economic development of its citizen. Tanzania case study", looks at the challenges which affect the management and deployment of East African natural capital for sustainable economic development of its citizens. Among those challenges are: lack of visionary leadership, capacity and know-how, and furthermore, corruption, self-enrichment and nepotism. The paper takes Tanzania as a mirror through which one can see how lack of knowledgeable society undermines creation of environmentally sustainable society. Moreover, the paper recommends awakening of Tanzanian citizens through education so as to be the vigilant keeper of their natural capital.

The next two articles show the way of country development through tourism. According to the Tanzania Ministry of Tourism and Natural Resources, tourism generates around USD 2 billion, which constitutes 25% of Tanzania's foreign exchange earnings, and represents 17% of Tanzania's GDP[5]. In my article: "TAZARA and tourism development in the Southern Circuit", I present a concrete tourism product, which in my opinion may contribute significantly to the development of Southern Highlands region. Tourism is developing mostly in the so-called the Northern Circuit (Kilimanjaro, Serengeti, Ngorongoro) and in the coast, but other areas of the country are somehow neglected in this matter. If the

[5] http://www.tanzaniainvest.com/tourism/tanzania-tourism-sector-report [21.11.2017].

governmental plans of the revitalization of the Tanzania-Zambia Railway (TAZARA) take place, tourism industry will profit enormously, because the railway goes through, or in a near distance to many tourist attractions, such as game reserves, national parks, nature reserves, forests, lakes, rivers – generally – beautiful and unique landscapes. Due to those attractions, and according to the different likings of tourists, the tour operators may prepare and implement various tourists thematic programs. The common feature of all of them is that they might involve local communities and a huge portion of benefit might go to them.

Chakupewa Joseph and Evaristo Haule in their paper sketch several factors that have stopped the growth of tourism in the Southern Circuit: poor infrastructure, poor marketing of the tourist attractions, lack of entrepreneurial skill to run the tourism sector, poor government support as well as failure to diversify the tourism sector beyond wildlife so as to attract more entrepreneurs in the sector. However,they emphasise that the Southern Circuit holds a great future for growth of tourism industry which may catalyse the growth of entrepreneurship. The attempts to improve entrepreneurship through tourism industry should be made possible by undertaking training to the entrepreneurs, improve infrastructure and emphasis on diversifying the tourism industry to include cultural tourism which will attract more entrepreneurs in the sector.

The book ends with the article of J.L. Gudaga, S.J. Kabote, A.K.P.R. Tarimo, and D.B. Mosha: "Groundwater situation in Tanzania. Experiences from Mbarali District in Mbeya Region". In 2006 Human Development Report announced that over one-third (38%) of Tanzanian population does not have any access to improved water and only 47% have access to improved sanitation. The situation has not improved much since then. The lack of sufficient access to water is one of the reasons for the economic underdevelopment of the country. For many areas in Tanzania,

like in Mbarali, the only available water source is groundwater. The authors recommend that different water stakeholders, including local government, should put more effort in addressing the challenges that exist between groundwater availability and the groundwater users. They emphasise the importance of the effective water management by different institutions. Knowing the status of groundwater governance will help to determine the sustainability of the invisible groundwater resource. The authors also recommend that groundwater users should continue protecting its sources in order to make them sustainable.

The opinions, ideas, analyses, and even concrete proposals, which have been exposed in this book, encompass only a narrow fragment of very complex issues regarding development of this region of Africa. The authors of particular chapters presented their own points of view. Apart from some substantive corrections I did not interfere with forms of their papers. In order to get acquainted with the contemporary problems of broadly understood development in the countries of East Africa, I strongly encourage readers to familiarize themselves with the content of the second and third volumes of this book.

Jerzy Gilarowski

PART I

COPING STRATEGIES TOWARDS FOOD INSECURITY

Chapter 1.

EMILIANA A. ASSENGA
KIM A. KAYUNZE

VULNERABILITY TO AND COPING STRATEGIES AGAINST FOOD INSECURITY IN CHAMWINO DISTRICT, TANZANIA

ABSTRACT

Vulnerability to food insecurity persists in Chamwino District in spite of presence of various strategies to fight against it. The research on which this paper is based aimed at determining vulnerability to and coping strategies against food insecurity in the district. Specifically, the paper assesses the extent of vulnerability to food insecurity, determines coping strategies against vulnerability to food insecurity, analyses determinants of vulnerability to food insecurity and compares vulnerability to food insecurity among households with different coping strategies. A cross-sectional research design was used to collect data from 400 households which were randomly selected. A household food insecurity access scale was used to measure vulnerability to food insecurity. Using multiple linear regression total annual household income per adult equivalent, non-farm income generating activities, reducing meal size and food stored significantly influenced ($p \leq 0.05$) surveyed households' vulnerability to food insecurity. Most households relied on less preferred foods as a food insecurity coping strategy. Households were vulnerable to food insecurity with 75% of households experiencing mildly to severe vulner-

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ability to food insecurity. One-way ANOVA showed that vulnerability to food insecurity differed significantly ($p \leq 0.001$) among households with different coping strategies. The paper concludes that coping strategies used against vulnerability to food insecurity had short-term effects, and vulnerability to food insecurity differed significantly based on coping strategies. Improving non-farm income generating activities, total household income and increasing food stored in the household can help more reduce vulnerability to food insecurity than any other factors can do. Accordingly, these factors should be given high importance, among others.

Key words: Food insecurity, vulnerability, coping strategies, Chamwino, Tanzania.

Introduction

Food security has been defined as a state "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 healthy life[1]. Four dimensions are essential for a household to be food secure: food availability, access, utilization and stability. Maxwell[2], Moser[3] and Tawodzera[4] introduced vulnerability to food insecurity to be another dimension. The terms vulnerability and food insecurity are often used interchangeably[5].

[1] FAO, *The state of food insecurity in the world*, [http://www.fao.org/3/a_i4030.e.pdf] site visited on 20/7/2015.

[2] D.G. Maxwell, *Measuring food security: The frequency and severity of coping strategies*, 1995, [ageconsearch.umn.edu.bitstream/42669/2/dp08.pdf] site visited on 12/9/2015.

[3] C. Moser, *The asset vulnerability framework: Reassessing urban poverty reduction strategies*, „World Development", 26(1998), no. 1, pp. 1–19.

[4] G. Tawodzera, *Vulnerability in crisis: Urban households food insecurity in Epworth, Harare, Zimbabwe*, „Food Security", 3(2011), pp. 503–520.

[5] C.R. Lovendal, M. Knowles, *Tomorrow's hunger. A framework for analyzing vulnerability to food insecurity*, Agricultural and Development Economics Division, FAO 2005, ESA Working Paper, no. 05–07; S. Hendricks, *The food security*

However, they are different things. In order to differentiate them, Lovendal and Knowles[6] pointed out that food insecurity is a phenomenon whose severity fluctuates, whereas vulnerability is propensity to fall, or stay below a food security threshold in the future. Vulnerability refers to the *ex ante* probability of falling or remaining below a specific threshold, while food insecurity is a current or *ex post* measure relative to the threshold[7]. In this paper, vulnerability to food insecurity is defined as people's propensity to fall or stay below a predetermined food security threshold. Because vulnerability is linked to uncertainty of events, everyone is vulnerable to food insecurity, but some more so than others. Vulnerability can be thought of as a continuum[8]. The higher the probability of becoming food insecure, the more vulnerable one is. Being food insecure today does not necessarily imply vulnerability. Chronically food insecure people live below the food security threshold today. Potentially, food insecure people are 'living on the edge'. Although they are not food insecure today, they face a high probability of becoming so[9].

Household food insecurity has been classified as either chronic or transitory[10]. Chronic food insecurity signifies persistent food crisis

continuum: a novel tool for understanding food insecurity as a range of experiences, „Food Security", 7(2015), pp. 609–619.

[6] C.R. Lovendal, M. Knowles, *Tomorrow's hunger. A framework for analyzing vulnerability to food insecurity*, Agricultural and Development Economics Division, FAO 2005, ESA Working Paper, no. 05–07.

[7] C.R. Lovendal, M. Knowles, *Tomorrow's hunger. A framework for analyzing vulnerability to food insecurity*, Agricultural and Development Economics Division, FAO 2005, ESA Working Paper, no. 05–07; R.O. Babatunde, O.A. Omotesho, E.O. Olorusanya and G.M. Owotoki, *Determinants of vulnerability to food insecurity: A gender based analysis of farming household in Nigeria*, „Indian Journal of Agricultural Economics", 63(2008), no. 1, pp. 117–125.

[8] Ibidem.

[9] Ibidem.

[10] S. Maxwell, T.R. Frankenberger, *Household Food Security: Concepts, Indicators and Measurements: A Technical Review*, New York and Rome 1992, pp. 277.

caused by continual inability of households to acquire needed food either through market purchases or through own production[11]. On the other hand, transitory food insecurity is a temporary decline in a household's food access to needed food due to instability in prices, production or income. It signifies a short time inadequacy in households' food access, which obligates the vulnerable households to cope in order to bridge their food consumption gaps[12]. People cope actively using either *ex ante* coping strategies (for example, building up stores, making savings, nurturing social networks, building up livestock herds, diversifying crops and incomes sources)[13] or *ex post* coping strategies (for example, seeking off farm employment, migrating, removing children from schools, having fewer meals, selling livestock, reducing consumption of non-food items, sending a family member to town to look for work, gathering wild foods)[14]. Whether chronic or transitory, food crisis remains a great concern in developing countries[15] since it impacts negatively on many other indicators of wellbeing[16]. Roughly, 795 million people in the world were chronically undernourished

[11] A. Khatri-Chatri, K.L. Maharja, *Food security and coping strategies in rural areas of Nepal. A case study of Dailekh District in Mid-West Development Region*, „Journal of International Development Cooperatives", 12(2006), no 2, pp. 25–45.

[12] H.O. Edeh, K. Gyimah-Brempong, *Determinants of change and household response to food insecurity: Empirical evidence from Nigeria*, „African Journal of Agricultural Research", 10(2015), no. 5, pp. 423–433.

[13] J. Swift, *Why are rural people vulnerable to famine?*, „IDS Bulletin", 20(1989), no. 2, pp. 8–15.

[14] S. Devereux, *Goats before ploughs: Dilemmas of household response sequencing during food shortages*, „IDS Bulletin", 20(1993), no. 4, pp. 52–59.

[15] T.T.H. Nhat, *Tracking household food insecurity: The experience of Vietnam*, „Asian Journal of Agriculture and Development", 5(2009), no. 2, pp. 42–56; H.O. Edeh, K. Gyimah-Brempong, *Determinants of change*..., op. cit.

[16] D.H. Mende, Kayunze K.A., M. Mwatawala, *Food security incidences based on monetary and caloric poverty lines in Mbeya and Makete Districts, Tanzania*, „Developing Countries Studies", 4(2014), no. 26, pp. 20–27.

in 2014–16[17]. Of these, 15.7% were inhabitants of Southern Asia while 23.2% were inhabitants of Sub-Saharan Africa. Whilst no comparative estimate exists on the number of vulnerable people, several studies related to income or consumption poverty point out that the number of vulnerable people is much larger[18]. In Tanzania, statistics show that, in 2007, about 15% of households were food insecure and 15% were highly vulnerable to food insecurity[19]. In 2011/12, 9.7% of the people were food insecure[20]. Food insecurity and vulnerability are prevalent in Tanzania but vary regionally. The central band of Tanzania shows the highest proportion of households that are food insecure. In 2007, WFP[21] reported that in regions such as Dodoma, Singida and Tabora 45–55% of the households were food insecure. In 2010, WFP[22] reported that Dodoma Region, particularly Chamwino District, was vulnerable to food insecurity with 33.8% of households having borderline consumption. Although the district is vulnerable to food insecurity, there is little empirical information on the extent of vulnerability to food insecurity among households in Chamwino District.

Several studies in Tanzania on food security[23] have focused mainly on various indicators of food security such as dietary energy

[17] FAO, *The state of food insecurity in the world*, op. cit.

[18] C.R. Lovendal, M. Knowles, *Tomorrow's hunger*..., op. cit.

[19] WFP, *Comprehensive Food Security and Vulnerability Analysis*, 2007, [http://docum ents.wfp.org/stellent/groups/public/documents/ena/wfp085651.pdf] site visited on 21/8/2013.

[20] National Bureau of Statistics, Ministry of Finance, *Household Budget Survey Main Report 2011/12*, Dar es Salaam 2014, pp. 201.

[21] WFP, *Comprehensive Food Security and Vulnerability Analysis*, 2007, op. cit.

[22] WFP, *Comprehensive Food Security and Vulnerability Analysis*, 2010, [http://documents.wfp.org/stellent/groups/public/documents/ena/wfp227079. pdf] site visited on 21/8/2013.

[23] For example: K.A. Kayunze, E.A. Mwageni, N.S.Y.S. Mdoe, *Do various methods of food security determination gives similar results? Evidence from Rufiji District, Tanzania*, „Eastern and Southern Africa Journal of Agricultural Economics and

consumption, monetary value of food consumed and number of meals. A major shortcoming to these indicators is non-inclusion of the vulnerability aspect of food security, which Maxwell[24] notes is the most important element of food security. WFP[25] pointed out that although substantial amount of data has been collected in Tanzania, some gaps have been identified in terms of understanding household food security and vulnerability. Data available do not identify the degree of vulnerability to food insecurity that these households are subject to, with quantitative data at the household level[26]. Further, a good understanding of the factors that determine vulnerability to food insecurity in the near future is important to reduce food insecurity over time. There is inadequate information on the factors responsible for vulnerability food insecurity in Chamwino District. The problem of food insecurity has big diversity and multiple dimensions, which range from the global, regional, country, local, household to individual level. Household level causes of vulnerability to food insecurity and coping strategies may be different among different people and areas[27]. Studies that examine

Development", 6(2009), pp. 125–145; M.M. Msaki, M.I. Mwenda, I.J. Regnard, *Cereal bank as a necessary rural livelihood institute in arid land, Makoja village, Dodoma-Tanzania*, „Asian Economic and Financial Review", 3(2013), no. 2, pp. 259–269; A.M. Ngongi, J.K. Urassa, *Farm households' food production and households food security status: A case of Kahama District, Tanzania*, „Tanzania Journal of Agricultural Sciences", 11(2014), no. 2, pp. 40–58; D.H. Mende, K.A. Kayunze, M. Mwatawala, *Food security incidences*..., op. cit.

[24] D.G. Maxwell, *Measuring food insecurity: The frequency and severity of coping strategies*, „Food Policy", 21(1996), no. 3, pp. 291–203.

[25] WFP, *Comprehensive Food Security and Vulnerability Analysis*, 2007, op. cit.

[26] Ibidem; C. Fenton, J. Hatfield, L. McIntyre, *A qualitative pilot study of food insecurity among maasai women in Tanzania*, „Pan African Journal", 12(2012), no. 81, pp. 1–8.

[27] A. Mitiku, W. Legesse, *The determinants of rural households' vulnerability to food insecurity in Jimma Zone, South Western Ethiopia*, „Journal of Biological and Chemical Research", 31(2014), no. 1, pp. 62–72.

vulnerability to and coping strategies against food insecurity employed by these households in Tanzania are inconclusive. Therefore, the evidence available is critically scanty. This called for an urgent need to investigate vulnerability to and coping strategies against food insecurity employed by households in Chamwino District, Tanzania, with the specific objectives to: (1) assess the extent of households' vulnerability to food insecurity; (2) determine coping strategies against vulnerability to food insecurity; (3) analyze determinants of vulnerability to food insecurity; and (4) compare vulnerability to food insecurity among households with different types of coping strategies. Moreover, the following hypotheses were tested: (a) household size does not have a significant impact on vulnerability to food insecurity, and (b) there is no significant influence of coping strategies on vulnerability to food insecurity.

2. Methodology

2.1. Description of the study area

The study was conducted in Chamwino District. The district was selected since it had a history of chronic food insecurity. Chronic food insecurity leads to chronic malnutrition which is reflected by stunting. Stunting reflects failure to receive adequate nutr tion over a long period of time[28]. In Chamwino District, 34.9% of children under five had low height for age (stunting); 1.1% had low weight for height (wasting) and 21.9% had low weight-for-age (underweight) which is reflected both in chronic and acute malnutrition in 2007[29].

[28] National Bureau of Statistics, *Tanzania Demographic and Health Survey 2010*, [https://dhsprogram.com/ pubs/pdf/FR243/FR243%5B24June2011%5D.pdf] site visited on 10/06/2017.

[29] PMO-RALG, *Chamwino District core welfare indicators questionnaire survey on poverty, welfare and services in Chamwino District Council*, 2007, [https://

The problem of malnutrition in Chamwino District is also reported by Mbwana [et al.][30] who found that 41% of children under age of five were stunted in the district in 2017. This level of stunting in the district is higher than that reported at the national and Dodoma Region levels in 2015 which were 34% and 37% respectively. Chamwino District is among the districts of Dodoma Region. This region has recurrent higher levels of stunting in Tanzania. According to URT[31], Dodoma Region was among the four regions of Tanzania which had stunting levels that exceeded 50%. These were Dodoma (56%), Lindi (54%), Iringa (52%) and Rukwa (50%). According to URT[32], nationally, 42% of children under age of five were stunted in Tanzania. According to URT[33], Dodoma Region was among 9 regions considered to have "very high," chronic malnutrition (stunting) exceeding 40% threshold. These region included Iringa, Njombe, Kagera, Dodoma, Ruvuma, Rukwa, Kigoma, Katavi and Geita. Chamwino District had chronic food insecurity for the previous five years (2009–14)[34]. In 2012 the district was among food insecure districts in Tanzania[35]. The district was purposively selected also due to history of receiving food aid. The need for food aid from the

www.edi-global.com/docs/cwiq/CWIQ%202007%20CHAMWINO%20DC.pdf] site visited on 10/6/2017.

[30] H.A. Mbwana, J. Kinabo, C. Lambert, H.K. Biesalski, *Factor influencing stunting among children in rural Tanzania: Agro-climatic zone perspective*, 2017, [http://www.tropentag.de/2016/abstracts/posters/237.pdf] site visited on 10/06/2017.

[31] National Bureau of Statistics, *Tanzania Demographic and Health Survey 2010*, op. cit.

[32] Ibidem.

[33] *Tanzania Demographic Health Survey and Malaria Indicator Survey 2015/16*, 2016 [https://dhsprogram.com/pubs/pdf/FR321/FR321.pdf] site visited on 10/6/2017.

[34] Personal communication with DAICO of Chamwino District, 2014.

[35] Prime Minister's Office and Ministry of Agriculture Food Security and Cooperative, *Comprehensive Food Security and Nutrition Assessment Report*, 2012, Dar Es Salaam, pp. 44.

government has been increasing since 2009–14. Generally, food aid in tonnes for the above period was 93.8 (2009/10), 25 (2010/11), 53.8 (2011/12), 69 (2012/13) and 10 (2013/14). The study was narrowed down to three wards and six villages. These were Fufu Ward (Fufu and Suli Villages), Idifu Ward (Idifu and Miganga Villages) and Membe Ward (Membe and Mlimwa Villages).

2.2. Research design, sampling procedures and sample size

Estimation of vulnerability to food insecurity at the household level is normally done with panel data of sufficient length and richness[36]. However, such data are rare, especially in poor, developing economies. Instead, the best one can usually hope for cross-sectional household surveys with detailed data on household characteristics, consumption expenditures and in some cases income[37]. A cross-sectional research design was used because it is the best method in estimation of vulnerability at the household level[38], and data were collected at one point in time without repetition from the representative population sample[39]. The sampling unit for this study was a household since food scarcity is ultimately experienced at the household level[40]. Chamwino District was selected purposively because of its history of chronic food insecurity. Additionally, the district has a higher stunting level for children of under-five age compared to national and regional levels in 2017. In 2010, Dodoma Region was among the four regions of Tanzania with higher stunting

[36] S. Chaudhuri, J. Jalan, A. Suryahadi, *Assessing household vulnerability to poverty from cross-sectional data: A methodology and estimate from Indonesia*, 2002, [http://www.academiccommon.colombia.edu/.../econ_0102_52.pdf] site visited on 12/9/2013.

[37] Ibidem.

[38] Ibidem.

[39] K.D. Bailey, *Methods of Social Science Research (Fourth Edition)*, New York 1998, pp. 587.

[40] D.G. Maxwell, *Measuring food security...*, op. cit.

levels for under-five age[41]. Three wards were purposively selected due to their history of receiving food aid from the government[42] (Appendix 2), while six villages were selected purposively. These included Fufu Ward (Fufu and Suli Villages) and Idifu Ward (Idifu and Miganga Villages) where chronic food insecurity was relatively high and Membe Ward (Membe and Mlimwa Villages) where chronic food insecurity was relatively low. The respondents were selected randomly from the sampling frame which was established from the village register by listing all households headed by male and female heads with children aged 7 to 17 years old. The sample size was 400 households. The formula for sample size determination by Cochran[43] was used to determine the sample size as indicated in Appendix 1. In addition, 13 key informants were purposively selected based on their positions and being considered to have much knowledge and experience about food security in the research villages.

2.3. Data collection

Primary data were collected using a questionnaire administered to household heads. Key informant interviews were held with people who were considered to have in-depth understanding and knowledge on food security in the district. Key informants included one District Agricultural Irrigation and Cooperatives Officer (DAICO), six village and ward extension officers, three village government leaders and three Ward Executive Officers (WEO). Twelve focus group discussions (FGD) were conducted in the 6 villages (2 FGD per village) with 8 to 10 villagers. The FGD participants were a mixture of old and young

[41] National Bureau of Statistics, *Tanzania Demographic and Health Survey*, 2010, op. cit.

[42] *Personal communication with DAICO of Chamwino District*, 2014.

[43] Cited by J.E. Bartlett, J.W. Kotrlik, C.C. Higgins, *Organizational research: Determining appropriate sample size in survey research*, „Information Technology, Learning, and Performance Journal", 19(2001), no. 1, pp. 43–50.

farmers, the youth and women, and villagers doing various activities. In the study, secondary information was collected through reviewing literature on the state of food insecurity in Tanzania and reports on the trend of food aid from Chamwino District Office. Information on household food security was collected using a questionnaire which included a nine-item household food insecurity access scale (HFIAS) (Appendix 3). The scale was used to assess whether households had experienced problems in accessing food during the reference period of 30 days prior to the survey date. A person responsible for meal preparation was interviewed to provide information on the modifications a household made in the diet or food consumption patterns due to limited resources to acquire food.

2.4. Determination of Household Food Insecurity Access

The household food insecurity access scale (HFIAS) developed by the USAID was used to measure vulnerability to food insecurity in terms of scores on Household Food Insecurity Access Scale (HFIAS) (Appendix 3). There are two sub-questions to the questionnaire; the first group of questions are called the nine occurrence questions, and there are two response options available to the respondent: 'yes' or 'no' (where no = 0 and yes =1). The second group of questions refers to the nine frequency of occurrence questions; these questions are asked with the intention of making a follow-up to the occurrence questions and to establish whether the condition (vulnerability to food insecurity) ever occurred. Next to the 'no' response option there is a skip code, meaning the interviewer can skip the related frequency-of-occurrence follow-up question if the respondent answers 'no' to the occurrence question[44]. The HFIAS score was calculated

[44] J. Coates, A. Swindale, P. Bilinsky, *Household Food Insecurity Access Scale. (HFIAS) for measurement of food access: Indicator guide*, 2007, [http://www.fao.org/fil] site visited on 20/10/2013.

using the answers based on the nine frequency-of-occurrence questions. The scale takes the lowest score of 0 and the highest score of 27; the higher the score the higher the probability of a household being vulnerable to food insecurity[45]. The households were ranked into four categories of vulnerability to food insecurity using HFIAS scores by modifying FAO[46] basis of classification. Based on scores on the household food insecurity access scale, households were ranked into four levels of vulnerability to food insecurity as follows: not vulnerable to food insecurity (a score of less or equal to ten), mildly vulnerable to food insecurity (a score of between eleven and sixteen), moderately vulnerable to food insecurity (a score of between seventeen and twenty two) and severely vulnerable to food insecurity (a score of between twenty three and twenty seven).

2.5. Data processing and analysis

Qualitative and quantitative methods were employed to analyze the data. Qualitative data were analyzed by being summarized by their themes, and comparing and contrasting arguments given by different interviewees. Quantitative data were analysed using IBM SPSS Statistics Version 20 Software and Microsoft Excel software. Data were analysed by computing descriptive statistics to determine frequencies, percentages, statistical means, and standard deviations of individual variables. Besides, inferential analysis was done to test the two hypotheses of the research. These hypotheses were tested using multiple linear regression analysis to determine

[45] F. Ndobo, T.J. Sekhampu, *Determinants of vulnerability to food insecurity in a South African Township: A gender analysis*, „Mediterranean Journal of Social Sciences", 4(2013), no. 14, pp. 311–317.

[46] FAO, *Report on use of the Household Food Insecurity Access Scale and Household Dietary Diversity score in two survey rounds in Monica and Sofala Provinces, Mozambique*, 2008, [www.foodsec.org/../user../eufao../dietary_Diversity_ paper.pdf] site visited on 15/9/2013.

whether household size does not have a significant impact on vulnerability to food insecurity, and that there is no significant influence of coping strategies on vulnerability to food insecurity.

Principal Component Analysis (PCA) was performed before regression analysis. Factor loading through rotated component matrix, scree plotting and component plotting in rotated space were employed. According to De Vaus[47] (2002), variables (coping strategies) with loading factors above 0.3 were considered in the regression analysis. Reducing size of a meal, migrating to other areas for casual labour and receiving money remittance from relatives were selected based on rotated component matrix method, which had loading factor values above 0.3 (Appendix 4). Other coping strategies were not selected for the regression following the accepted concept of PCA as the loading factors were below 0.3.

Multiple linear regression was used to address specific objective 3. Definitions of variables used in the multiple linear regressions are indicated in Appendix 5. The multiple linear regression results are indicated in Table 3. Before running the model, the 12 independent variables and the dependent variable were checked for normality by computing their normal curves, which were then checked visually to find whether they had normal distributions[48]. Checking normality was done because linear regression requires that all the variables to be used to have normal distributions[49]. Any variable that does not have a normal distribution should be transformed into a normal distribution. Distance from the market place, age of household head, land size cultivated, and total annual household incomes per adult equivalent were found not to

[47] D. de Vaus, *Analyzing Social Science Data*, London 2002.

[48] O. Jason, E. Waters, *Four assumptions of multiple linear regression that researchers should always test*, 2002, [http:pareonline.net/getvn.asp?n=2&v8] site visited on 18/2/2016.

[49] Ibidem.

have normal distributions. They were transformed by computing their log ten values to make them normal distribution. The other variables had normal distributions; they were not transformed. After transformation, all the independent variables underwent correlation to check multicollinearity. Multicollinearity exists if any pair of variables has a correlation coefficient (r-value) of 0.8 and above[50]. None of the pairs of the variables had an r-value of 0.8 and above. This shows that there was no multicollinearity. Multicollinearity is an undesirable condition whereby two or more pairs of variables have so much linear relationship that inclusion of both variables reduces the quality of results[51].

Moreover, multicollinearity was checked by computing variance inflation factors (VIFs) and tolerances of independent variables during regression analysis. The VIF of an explanatory variable measures the inflation of the variance of the variable's regression coefficient relative to a regression where all the explanatory variables are independent. The VIFs are inversely related to tolerances with larger values indicating involvement in more severe relationships. The rule of thumb is that VIFs above 10 or tolerances below 0.1 are seen as a cause of concern[52]. The tolerance values of collinearity which were greater than 0.1 and the VIF values of collinearity which were less than 10 show that there was no multicollinearity (Table 3). Multiple linear regression was used to determine the impact of independent variables on vulnerability to food insecurity which was measured using household food insecurity access scale scores. The multiple linear regression model was specified as follows:

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[50] A. Bryman and D. Cramer, *Quantitative Data Analysis for Social Scientists*, London 192.

[51] J. Pallant, *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS for Windows: Third Edition*, New York 2007.

[52] S. Landau, B. Everitt, *A hand book of Statistical Analyses Using SPSS*, New York 2004.

$$\gamma = a + \beta_1 \times_1 + \beta_2 \times_2 + \beta_3 \times_3 + .. + \beta_{12} \times_{12} + e$$

Where:

Y = vulnerability to food insecurity as measured using Household Food Insecurity Access Scale scores (continuous variable). According to Ndobo and Sekhampu (2013) the higher the score the higher the probability of a household being vulnerable to food insecurity.

a = Constant or Intercept of the equation

$b_1 ... b_9$ = Regression coefficients,

e = Error term representing a proportion of the variance in the dependent variable that was unexplained by the regression equation.

X_1 = Total annual household income per adult equivalent, X_2 =Land size cultivated (measured in hectares), X_3 = Distance to the nearest market place (measured in kilometres), X_4 =Age of household head (measured in years), X_5 = Household size (number of members), X_6 = Sex of household head (1 = Male 0 = Female), X_7 = Non-farm Income Generating Activities (IGAs) (1 = Yes, 0 = No), X_8 = Food stored in the household (measured in kilograms), X_9 =Livestock ownership (1 = Yes, 0 = No), X_{10} = Migrated to other areas for casual labour(1 = Yes, 0 = No), X_{11}=Money remittances from relatives (1 = Yes 0 = No), X_{12} = Reduction of meal size (1 = Yes 0 = No).

In this paper, the sex of a household head was captured by a dummy variable. The plausible explanation is that, in regression analysis, the dependent variable or regressand, is frequently influenced not only by ratio scale variables (e.g. income, output, prices, costs, height, temperature) but also by variables that are essentially qualitative, or nominal scale, in nature, such as sex, race, colour, religion, nationality, geographical region, political upheavals, and party affiliation[53]. A Qualitative variable such as sex seems to influence the regressand and clearly should be included among the explanatory variables, or the regressors[54],

[53] D. Gujarati, *Basics Econometrics. Fourth Edition*, New York 2004.

[54] Ibidem.

since such a variable usually indicates the presence or absence of a "quality" or an attribute. One way of quantifying such attributes is by constructing artificial variables that take on values of 1 or 0, 1 indicating the presence (or possession) of that attribute and 0 indicating the absence of that attribute[55]. In this paper, 1 indicates that a person is a male and 0 indicates a female[56]. Variables that assume such 0 and 1 values are called dummy variables[57]. It was decided to assign a value of 1 for a male headed household and 0 for a female headed household due to the fact that in Africa most households are headed by male. The male category was included in the model, while the female category, which was omitted, is a reference category[58].

The extent of household vulnerability to food insecurity was measured using HFIAS scores. HFIAS has been used by various researchers in measuring vulnerability to food insecurity, for example, Ndobo and Sekhampu[59], Grobler[60] and Kimani-Murage [et al.][61]. The HFIAS scale was tested for reliability using Cronbach's alpha, which is the most common measure of scale reliability[62].

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[55] Ibidem.

[56] Ibidem.

[57] Ibidem.

[58] E. Uriel, *Multiple regression analysis with qualitative information*, 2013, [http://www.uv.es/uriel/5%20Multiple%20regression%20analysis%20with%20qualitative%20information.pdf] site visited on 09/6/2017.

[59] F. Ndobo, T.J. Sekhampu, *Determinants of vulnerability*..., op. cit.

[60] W.C. Grobler, *Self reported vulnerability to food insecurity in South African Low income Neighbourhood. Proceedings of Global Business Research Conference Kathmandu, Nepal, 7–8 November*, 2013.

[61] E.W. Kimani-Murage, L. Shofield, F. Wekesah, S. Mohamed, B. Mberu, R. Ettarh, T. Egondi, C. Kyobutungi, A. Ezeh, *Vulnerability to food insecurity in urban slums: Experiences from Nairobi, Kenya*, „Journal of Urban Healthy: Bulletin of the New York Academy of Medicine", 91(2014), no. 6, pp. 1098–1113.

[62] J. Pallant, *SPSS Survival Manual*..., op. cit.; A. Field, *Discovering Statistics using SPSS. (Third Edition)*, London 2009.

Multiple linear regression was used to analyse the determinants of vulnerability to food insecurity for objective 3.One-Way ANOVA was used to compare vulnerability to food insecurity in households with different coping strategies. In comparing vulnerability to food insecurity in households with different coping strategies, the grouping variable was coping strategies.

2.6. Total Annual Household Income per Adult Equivalent (AE) calculation

Net monetary values of all products produced and services provided by all household members over the previous 12 months were added up from the following household sources of income: products and services, salaries, wages, rentals, remittances and receipt in kind[63]. These were the households' sources of income which were used in this paper. The amount of money obtained from those sources was divided by adjusted adult equivalent (AE) units of relevant households. According to Deaton[64], to get better estimates of income, the survey must collect detailed data on all transactions, purchases of inputs, sales of output, and assets transactions, and do so for the whole range of economic activities for wage earners as well as for the self-employed[65].

$$\text{Per AE income per person} = \frac{\text{(Total income during one year in household)}}{\text{(Adult equivalent units at home)}^{66}}$$

[63] A. Deaton, *The Analysis of Household Surveys. A Microeconomic Approach to Development Policy*, Baltimore 1997.

[64] Ibidem.

[65] Ibidem.

[66] S. Rahim, D. Saeed, G.A. Rasool, G. Saeed, *Factors influencing household food security status*, „Food and Nutrition Science", 2011, no. 2, pp. 31–34.

3. Results and discussions

3.1. Extent of vulnerability to food insecurity

For the analysis of the extent of household vulnerability to food insecurity, the household food insecurity access-scale (HFIAS), developed by USAID, was used. Before using the scale, it was tested for reliability, and it exhibited a good internal consistency (Cronbach's Alpha was 0.765) (Appendix 6). A value of 0.7 to 0.8 is acceptable for Cronbach's Alpha[67]. HFIAS has previously been tested for reliability in Iringa District in Tanzania and had a good internal consistency i.e. Cronbach's Alpha was 0.90[68]. In measuring vulnerability to food insecurity, the higher the HFIAS score the higher the probability of a household being vulnerable to food insecurity[69]. In this paper, the average HFIAS score was 12.61, with female headed households recording a higher score of 13.24 compared to 12.44 for male headed households. Further analysis indicated that vulnerability to food insecurity was more prevalent among female headed households whereby 23% were not vulnerable to food insecurity, compared to male headed households whereby 25.5% who were not vulnerable to food security (Figure 1).

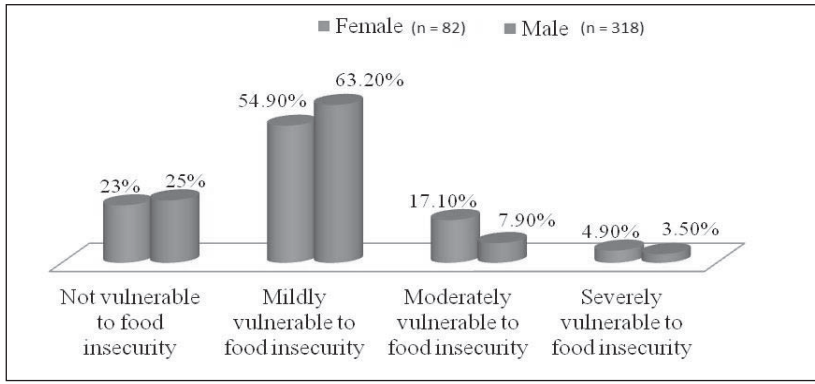
Fig. 1 provides a comparison of vulnerability to food insecurity levels among male and female headed households. The figure indicates an increased concentration of female headed households (4.9%) in the severely vulnerable to food insecurity group. Overall, these results suggest that determinants of vulnerability to food insecurity may vary with household headship, but a further analysis is needed. The extent of vulnerability to food insecurity can also be presented

[67] A. Field, *Discovering Statistics using SPSS*..., op. cit.

[68] D. Knueppel, M. Demment, L. Kaiser, *Validation of Household Food insecurity Access Scale in Tanzania*, „Public Health Nutrition", 13(2009), no. 3, pp. 360–367.

[69] F. Ndobo, T.J. Sekhampu, *Determinants of vulnerability*..., op. cit.

Figure 1. A comparison of vulnerability to food insecurity levels and household headship



by ranking the scores of each household from not vulnerable to food insecurity to severely vulnerable to food insecurity[70]. HFIAS score was used to categorize households into four categories of not vulnerable to food insecurity, mildly vulnerable to food insecurity, moderately vulnerable to food insecurity and severely vulnerable to food insecurity. The study portrayed the experience of food insecurity in Chamwino District, illustrating vulnerability to food insecurity that households experience in their daily life. The study results in Table 1 show that vulnerability to food insecurity was very high, with 75% experiencing mild to severe vulnerability to food insecurity. This implies that many households were vulnerable to food insecurity. The probable cause of many households being vulnerable to food insecurity is the fact that after ranking the households into four levels of vulnerability, the three levels (i.e. mild, moderate and severe) were combined. The study shows that, during "normal times", vulnerability to food insecurity is very high in Chamwino District. The situation could be worse during lean season.

[70] Ibidem.

Table 1. Extent of vulnerability to food insecurity (n = 400)

Food security status	Frequency	Percent
Not vulnerable to food insecurity	100	25.0
Mildly vulnerable to food insecurity	246	61.4
Moderately vulnerable to food insecurity	39	9.8
Severely vulnerable to food insecurity	15	3.8
Total	**400**	**100.0**

3.2. Coping Strategies against vulnerability to food insecurity

This paper used food insecurity coping strategies which were identified during focus group discussions in the study area. The coping strategies used in Chamwino District ar**e** similar to those which have been reported by Swift[71] and Devereux[72]. The food insecurity coping strategies adopted by farming households in the study area to mitigate effects of food insecurity are presented in Table 2. The results show that the most widely used strategies by the households in the study area were eating less preferred food, skipping meals, selling labour and reducing sizes of meals consumed. This implies that when households are faced with food shortage, the immediate strategy they adopt is to eat less preferred and less expensive food. These results are supported by those by Ngidi and Hendricks[73] who found that relying on less preferred food was the most common strategy. As the food insecurity continues, other strategies which are more severe are used such as skipping meals and reducing the quantity of food consumed. Other strategies adopted by households, though with difficulties, included receiving money remittance from relatives and selling livestock. This was also supported by results of

[71] J. Swift, *Why are rural people vulnerable to famine?*, op. cit.

[72] S. Devereux, *Goats before ploughs*..., op. cit.

[73] M.S. Ngidi, S.C. Hendriks, *Coping with food insecurity in rural South Africa. The case of Jozini, Kwa Zulu-Natal*, „Mediterranean Journal of Social Sciences", 5(2014), no. 25, pp. 278–289.

focus group discussions. During focus group discussions, the discussants reported that they sold livestock between October and March.

One would expect that selling livestock could guarantee households buying enough grains for consumption. However, during focus group discussions it was pointed out that a few (5%) of the surveyed households owned livestock in the surveyed villages. It was further noted that the owners of large herds of cattle (*tajiri ng'ombe*) lend oxen to those who do not have cattle, based on social trust so that they take care of them by grazing and in turn they use the oxen for ploughing their farms. Those who have been given oxen are not allowed to sell them even in difficult times. The least preferred food insecurity coping strategies were borrowing cash to buy food and food loan (*songoleda*). During focus discussions it was reported that people sought food loan (*songoleda*) between February and March. However, people in the study area do not prefer borrowing food because it is associated with negative consequences when paying back the food loan. One FGD participant at Fufu village reported the following:

> "We do not prefer songoleda because if you borrow one bucket of grain (bulrush millet or maize or sorghum or paddy) when you harvest next season you have to pay back two buckets. This is because your grain (maize or bulrush millet or paddy) is newly harvested" (FGD participant at Fufu village, 18th September 2014).

The above findings on food loan were in agreement with those reported by Ngongi and Urassa[74] who found that borrowers who took food loan had to repay the grain (maize/paddy) loan with interest, usually after the next harvest in Kahama District in Tanzania. Additionally, the above authors noted that one bag of maize would attract three bags after harvesting and two bags of paddy would attract five bags.

[74] A.M. Ngongi, J.K. Urassa, *Farm households' food production*..., op. cit.

Table 2. Coping strategies against vulnerability to food insecurity (n = 400)

Coping strategy	Responses	
	n	%
Reducing sizes of meals consumed	190	47.5
Skipping meals	299	74.5
Selling livestock	154	38.8
Eating inferior/less preferred food	361	90.3
Selling labour	275	68.8
Food loan	7	1.8
Petty business	88	22.0
Reduce expenditure on non food	3	0.8
Food remittances from relatives	54	13.5
Borrow cash to buy food	6	1.50
Money remittances from relatives	107	26.75
Migrated to other areas for casual labour	97	24.25
Picking and processing wild fruits	18	4.75

During focus group discussions they reported that the study area is endowed with wild fruits; hence one would have expected households to resort to searching for such fruits when they had food shortage. However, it was one of the least practiced strategies by the farmers.

3.3. Determinants of vulnerability to food insecurity

Multiple linear regression (MLR) was used to determine impacts of some factors on vulnerability to food insecurity at the household level. The coefficient of determination, R2, was 0.538 implying that the predictor variables explained 53.8% of the variation in the variance of the dependent variable that was vulnerability to food insecurity in terms of HFIAS scores[75]. Using a linear regression analysis for determining influence of some factors on vulnerability to food insecurity, only total annual household income per adult

[75] D. Gujarati, *Basics Econometrics*..., op. cit.; A. Field, *Discovering Statistics using SPSS*..., op. cit.

equivalent, non-farm income generating activities (IGAs), amount of food stored in the household and reducing size of the meals were found to be significant (Table 3). The β-values tell us about the relationship between vulnerability to food insecurity for each predictor. If the value is positive there is a positive relationship between the predictor and vulnerability to food insecurity, whereas a negative coefficient represents a negative relationship[76].

Table 3. Determinants of vulnerability to food insecurity

Predictor variables	Un-standardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	3.019	0.220		13.720	0.000		
Total annual household income per AE	–0.097	0.027	–0.157***	–3.663	0.000	0.817	1.224
Land size cultivated (hectare)	–0.054	0.043	–0.057	–1.267	0.206	0.742	1.347
Distance to the nearest market place (km)	0.050	0.032	0.065	1.599	0.111	0.912	1.096
Age of household head	0.154	0.099	0.062	1.547	0.123	0.925	1.082
Household size	0.005	0.007	0.031	0.706	0.481	0.769	1.300
Sex of household head (Male=1, Female=0)	0.005	0.027	0.008	0.184	0.854	0.872	1.146
Non-farm income generating activities (Yes=1, No=0)	–0.094	0.022	–0.174***	–4.348	0.000	0.934	1.071
Amount of food stored (kg)	–0.144	0.011	–0.535***	–12.990	0.000	0.882	1.134
Livestock ownership (Yes=1, No=0)	–0.016	0.024	–0.030	–0.686	0.493	0.775	1.290
Migrated to other areas for casual labour (Yes = 1, No = 0)	0.040	0.033	0.069	1.203	0.203	0.458	2.182
Money remittance from relatives (Yes=1, No=0)	–0.024	0.031	–0.042	–0.771	0.441	0.497	2.011
Reduce size of meal (Yes=1, No=0)	0.179	0.021	0.338***	8.378	0.000	0.918	1.090

Dependent variable: HFIAS scores: R = 0.734; R^2 = 0.538; adjusted R^2 = 0.520; F statistics = 30.036; ***significant at 0.1%, **significant 1%, *significant at 5%

[76] Ibidem.

Non-farm income generating activities showed negative significant influence ($\beta = -0.174$; $p \leq 0.001$) on vulnerability to food insecurity. Holding other predictors constant, households which were doing non-farm income generating activities were found to be less vulnerable to food insecurity by 0.174 HFIAS scores compared to households which were not doing non-farm income generating activities. This implies that the higher the household involvement in non-farm income generating activities the less the household vulnerability to food insecurity. These results are in conformity with the findings of Babatunde [et al.][77] and Mitiku and Legesse[78] who found that vulnerability to food insecurity decreased with household involvement in non-farm income generating activities.

Amount of food stored (kg) in the household showed negative significant influence ($\beta = -0.535$; $p \leq 0.001$) on vulnerability to food insecurity. An increase of 1 kg of food stored in a household with all other predictor variables held constant caused a decrease in vulnerability to food insecurity by 0.535 HFIAS scores. This implies that the higher the food stored in the household the lesser the vulnerability to food insecurity. This is due to the fact that households will not worry that they would not have enough food. In Malawi, Javdani[79] pointed out that hunger season ensued once maize stored was finished. Food stored in the household is a major determinant of food security[80]. Kimani-

[77] R.O. Babatunde, O.A. Omotesho, E.O. Olorusanya and G.M. Owotoki, *Determinants of vulnerability to food insecurity*..., op. cit.

[78] A. Mitiku, W. Legesse, *The determinants of rural households' vulnerability*..., op. cit.

[79] M. Javdani, *Malawi's agricultural input subsidy: study of Green Revolution style strategy for food security*, „International Journal of Agricultural Sustainability", 10(2012), no. 20, pp. 150–163.

[80] K. Nyikahadzoi, B. Zamasiya, G.A. Muchinako, C. Dziro, *Enhancing social support system for improving food security among the elderly headed household in communal areas of Zimbabwe*, „Journal of Food Research", 2(2011), no. 3, pp. 46–54.

Murage [et al.][81] reported that vulnerability to food insecurity in Kenya was exacerbated by the fact they had no food stock of food in their homes.

Total annual household income per adult equivalent showed negative significant influence ($\beta = -0.157$; $p \leq 0.001$) on vulnerability to food insecurity. An increase of TZS 1 with all other predictor variables held constant caused a decrease in vulnerability to food insecurity by 0.157 HFIAS scores. This implies that the higher the household income the lesser the vulnerability to food insecurity. These findings are in agreement with those reported by Ndobo and Sekhampu[82], Babatunde [et al.][83], Mannaf and Uddin[84] who found that household income decreased the vulnerability to being food insecure in South Africa.

Consumption-related coping strategies e.g. reducing size of meals showed positive significant influence ($\beta = 0.338$; $p \leq 0.001$) on vulnerability to food insecurity. Holding other predictors constant, households which were reducing size of meals were found to have increased vulnerability to food insecurity by 0.338 HFIAS scores compared to households which were not reducing size of meals. This implies that households that already worry most about food insecurity status of households tend to use consumption-related coping strategies e.g. reducing the size of the meals. Reducing size of the meal was included in the model as one of determinants of vulnerability to food insecurity because, in vulnerability to food

[81] E.W. Kimani-Murage, L. Shofield, F. Wekesah, S. Mohamed, B. Mberu, R. Ettarh, T. Egondi, C. Kyobutungi, A. Ezeh, *Vulnerability to food insecurity in urban slums*..., op. cit.

[82] F. Ndobo, T.J. Sekhampu, *Determinants of vulnerability*..., op. cit.

[83] R.O. Babatunde, O.A. Omotesho, E.O. Olorusanya and G.M. Owotoki, *Determinants of vulnerability to food insecurity*..., op. cit.

[84] M. Mannaf, M. Uddin, *Socioeconomic factors influencing food security status of maize growing households in selected areas of Borga District*, „Bangladesh Journal of Agricultural Economics", 35(2012), no. 1–2, pp. 177–187.

insecurity, households start using simple coping strategies like eating less preferred food, eating fewer food varieties, etc.

As vulnerability to food insecurity increases, they start using severe coping strategies such as reducing the size of the meal[85]. Other findings based on multiple linear regression are as seen in Table 3. On the basis of the results, which show that household size had positive impact ($\beta = 0.031$) on vulnerability to food insecurity with a p-value of 0.481, the null hypothesis that household size does not have a significant impact on vulnerability to food insecurity is not rejected because the p-value is greater than 0.05. This means that household size had no significant influence on vulnerability to food insecurity. This result is in conformity with Matunga[86] who reported that food secure households had average household size of 5.86 compared to 5.52 for food insecure households in Chamwino District. On the basis of the results in Table 3, the null hypothesis that there is no significant influence of coping strategies on vulnerability to food insecurity is rejected. Coping strategies have significant influence on vulnerability to food insecurity. For example, reducing size of meals had positive significant influence (β=0.338; $p \leq 0.001$) on vulnerability to food insecurity.

3.4. Comparison of vulnerability to food insecurity among households with different coping strategies

The overall HFIAS scores were compared across 15 food insecurity coping strategies using One-Way ANOVA to find whether there were significant differences in mean scores across the food insecurity coping strategies (Table 4).

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[85] J. Coates, A. Swindale, P. Bilinsky, *Household Food Insecurity Access Scale*..., op. cit.

[86] B.N. Matunga, *Causes of Food insecurity and Copping Strategies in Tanzania. A Case of Smallholder Farmers in Chamwino District. Dissertation for Award of MA Degree at Sokoine University of Agriculture*, Morogoro 2008.

The comparison results are presented in Table 4 and show that vulnerability to food insecurity differed significantly ($p \leq 0.001$) among households based on the 15 coping strategies analyzed, meaning that households using different food insecurity coping strategies differ greatly in vulnerability to food insecurity.

Table 4. Comparison of household coping strategies and vulnerability to food insecurity

Coping strategies	n	Mean HFIAS scores	Between and within groups	Sum of squares	df	Mean square	F	Sig.
Reduce size	21	16.66	Between groups	664.844	12	55.40	4.66	0.000
Skipping meals	107	13.22	Within groups	4139.04	348	11.89		
Selling livestock	25	11.44						
Eating inferior food	56	12.60						
Selling labour	20	13.80						
Food loan	7	17.28						
Petty business	49	11.40						
Reduce expenditure	2	14.00						
Food remittance	25	12.40						
Borrow cash	5	12.40						
Money remittance from relatives	20	11.85						
Migrated for casual labour	12	12.17						
Process wild fruits	12	12.92						
Total	361	12.88		4803.88	360			

4. Conclusions and recommendations

On the extent of vulnerability to food insecurity, it is concluded that many households were vulnerable to food insecurity. Female headed households were more vulnerable to food insecurity com-

pared to male headed households. It is recommended that specific programmes providing access to income earning possibilities would be needed to ensure reduction of food insecurity. Enhancing income generation and food production capacity among female headed households is important to improve food security.

Based on coping strategies against vulnerability to food insecurity, it is concluded that most of the households relied on less preferred foods. The coping strategies adopted by the households are severe and can only be used to avert the impact of food insecurity on a temporary basis. Therefore, there is the need to increase food stored in the household as well as non-farm income generating activities.

The major determinants of households' vulnerability to food insecurity were identified to be total annual household income per adult equivalent, non-farm income generating activities, food stored in the household and use of consumption-related coping strategies i.e. reducing the size of the meal. It was also noted that non-farm income generating activities, total annual household income per adult equivalent and food stored in the household were more important factors in reducing vulnerability to food insecurity. Reducing the size of the meal was a more important factor in increasing vulnerability to food insecurity. On the basis of these findings, it is concluded that improving households' non-farm income generating activities and increasing food stored in the household can help in reducing vulnerability to food insecurity more than any other factor can do. Accordingly, in order to reduce the risks of households falling in to vulnerability to food insecurity in the future, non-farm income generating activities and increasing food stored in the household should be given high importance, among other factors.

Based on vulnerability to food insecurity among households with different types of coping strategies, it is concluded that house-

holds used different coping strategies based on vulnerability to food insecurity. It is recommended that households should engage in various non-farm activities which are sustainable in order to increase household income and therefore increase food security at the household level.

REFERENCES

Babatunde R.O., Omotesho O.A., Olorusanya E.O. and Owotoki G.M., *Determinants of vulnerability to food insecurity: A gender based analysis of farming household in Nigeria*, „Indian Journal of Agricultural Economics", 63(2008), no. 1, pp. 117–125.

Bailey K.D., *Methods of Social Science Research (Fourth Edition)*, New York 1998.

Bartlett J.E., Kotrlik J.W., Higgins C.C., *Organizational research: Determining appropriate sample size in survey research*, „Information Technology, Learning, and Performance Journal", 19(2001), no. 1, pp. 43–50.

Bryman A. and Cramer D., *Quantitative Data Analysis for Social Scientists*, London 192.

Chaudhuri S., Jalan J., Suryahadi A., *Assessing household vulnerability to poverty from cross-sectional data: A methodology and estimate from Indonesia*, 2002, [http://www.academiccommon.colombia.edu/.../econ_0102_52.pdf] site visited on 12/9/2013.

Coates J., Swindale A., Bilinsky P., *Household Food Insecurity Access Scale. (HFIAS) for measurement of food access: Indicator guide*, 2007, [http://www.fao. org/fil] site visited on 20/10/2013.

De Vaus D., *Analyzing Social Science Data*, London 2002.

Deaton A., *The Analysis of Household Surveys. A Microeconomic Approach to Development Policy*, Baltimore 1997.

Devereux S., *Goats before ploughs: Dilemmas of household response sequencing during food shortages*, „IDS Bulletin", 20(1993), no 4, pp. 52–59.

Edeh H.O., Gyimah-Brempong K., *Determinants of change and household response to food insecurity: Empirical evidence from Nigeria*, „African Journal of Agricultural Research", 10(2015), no. 5, pp. 423–433.

FAO, *Report on use of the Household Food Insecurity Access Scale and Household Dietary Diversity score in two survey rounds in Monica and Sofala Provinces, Mozambique*, 2008, [www.foodsec.org/../user../eufao../dietary_Diversity_ paper.pdf] site visited on 15/9/2013.

FAO, *The state of food insecurity in the world*, [http://www.fao.org/3/a_i4030.e.pdf] site visited on 20/7/2015.

Fenton C., Hatfield J., McIntyre L., *A qualitative pilot study of food insecurity among maasai women in Tanzania*, „Pan African Journal", 12(2012), no. 81, pp. 1–8.

Field A., *Discovering Statistics using SPSS (Third Edition)*, London 2009.

Grobler W.C., *Self reported vulnerability to food insecurity in South African Low income Neighbourhood. Proceedings of Global Business Research Conference Kathmandu, Nepal, 7–8 November, 2013*.

Gujarati D., *Basics Econometrics. Fourth Edition*, New York 2004.

Hendricks S., *The food security continuum: a novel tool for understanding food insecurity as a range of experiences*, „Food Security", 7(2015), pp. 609–619.

Jason O., Waters E., *Four assumptions of multiple linear regression that researchers should always test*, 2002, [http:pareonline.net/getvn.asp?n=2&v8] site visited on 18/2/2016.

Javdani M., *Malawi's agricultural input subsidy: study of Green Revolution style strategy for food security*, „International Journal of Agricultural Sustainability", 10(2012), no 20, pp. 150–163.

Kayunze K.A., Mwageni E.A., Mdoe N.S.Y.S., *Do various methods of food security determination gives similar results? Evidence from Rufiji District, Tanzania*, „Eastern and Southern Africa Journal of Agricultural Economics and Development", 6(2009), pp. 125–145.

Khatri-Chatri A., Maharja, K.L., *Food security and coping strategies in rural areas of Nepal. A case study of Dailekh District in Mid-West Development Region*, „Journal of International Development Cooperatives", 12(2006), no. 2, pp. 25–45.

Kimani-Murage E.W., Shofield L., Wekesah F., Mohamed S., Mberu B., Ettarh R., Egondi T., Kyobutungi C., Ezeh A., *Vulnerability to food insecurity in urban slums: Experiences from Nairobi, Kenya*, „Journal of Urban Healthy: Bulletin of the New York Academy of Medicine", 91(2014), no 6, pp. 1098–1113.

Knueppel D., Demment M., Kaiser L., *Validation of Household Food insecurity Access Scale in Tanzania*, „Public Health Nutrition", 13(2009), no. 3, pp. 360–367.

Landau S., Everitt B., *A hand book of Statistical Analyses Using SPSS*, New York 2004,.

Lovendal C.R., Knowles M., *Tomorrow's hunger. A framework for analyzing vulnerability to food insecurity*, „Agricultural and Development Economics Division", FAO 2005, ESA Working Paper no. 05–07.

Mannaf M., Uddin M., *Socioeconomic factors influencing food security status of maize growing households in selected areas of Borga District*, „Bangladesh Journal of Agricultural Economics", 35(2012), no. 1–2, pp. 177–187.

Matunga B.N., *Causes of Food insecurity and Copping Strategies in Tanzania. A Case of Smallholder Farmers in Chamwino District. Dissertation for Award of MA Degree at Sokoine University of Agriculture*, Morogoro 2008.

Maxwell D.G., *Measuring food insecurity: The frequency and severity of coping strategies*, „Food Policy", 21(1996), no. 3, pp. 291–203.

Maxwell D.G., *Measuring food security: The frequency and severity of coping strategies*, 1995, [ageconsearch.umn.edu.bitstream/42669/2/dp08.pdf] site visited on 12/9/2015.

Maxwell S., Frankenberger T.R., *Household Food Security: Concepts, Indicators and Measurements: A Technical Review*, New York and Rome 1992.

Mbwana H.A., Kinabo J., Lambert C., Biesalski H.K., *Factor influencing stunting among children in rural Tanzania: Agro-climatic zone perspective*, 2017, [http://www.tropentag.de/2016/abstracts/posters/237.pdf] site visited on 10/06/2017.

Mende D.H., Kayunze K.A., Mwatawala M., *Food security incidences based on monetary and caloric poverty lines in Mbeya and Makete Districts, Tanzania*, „Developing Countries Studies", 4(2014), no.26, pp. 20–27.

Mitiku A., Legesse W., *The determinants of rural households' vulnerability to food insecurity in Jimma Zone, South Western Ethiopia*, „Journal of Biological and Chemical Research", 31(2014), no. 1, pp. 62–72.

Moser C., *The asset vulnerability framework: Reassessing urban poverty reduction strategies*, „World Development", 26(1998), no. 1, pp. 1–19.

Msaki M.M., Mwenda M.I., Regnard I.J., *Cereal bank as a necessary rural livelihood institute in arid land, Makoja village, Dodoma-Tanzania*, „Asian Economic and Financial Review", 3(2013), no. 2, pp. 259–269.

National Bureau of Statistics, *Tanzania Demographic and Health Survey 2010*, [https://dhsprogram.com/ pubs/pdf/FR243/FR243%5B24 June2011%5D.pdf] site visited on 10/6/2017.

National Bureau of Statistics, Ministry of Finance, *Household Budget Survey Main Report 2011/12*, Dar es Salaam 2014.

Ndobo F., Sekhampu T.J., *Determinants of vulnerability to food insecurity in a South African Township: A gender analysis*, „Mediterranean Journal of Social Sciences", 4(2013), no. 14, pp. 311–317.

Ngidi M.S., Hendriks S.C., *Coping with food insecurity in rural South Africa. The case of Jozini, Kwa Zulu-Natal*, „Mediterranean Journal of Social Sciences", 5(2014), no. 25, pp. 278–289.

Ngongi A.M., Urassa J.K., *Farm households' food production and households food security status: A case of Kahama District, Tanzania*, „Tanzania Journal of Agricultural Sciences", 11(2014), no. 2, pp. 40–58.

Nhat T.T.H., *Tracking household food insecurity: The experience of Vietnam*, „Asian Journal of Agriculture and Development", 5(2009), no. 2, pp. 42–56.

Nyikahadzoi K., Zamasiya B., Muchinako G.A., Dziro C., *Enhancing social support system for improving food security among the elderly headed household in communal areas of Zimbabwe*, „Journal of Food Research", 2(2011), no 3, pp. 46–54.

Pallant J., *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS for Windows: Third Edition*, New York 2007.

PMO-RALG, *Chamwino District core welfare indicators questionnaire survey on poverty, welfare and services in Chamwino District Council*, 2007, [https://www.edi-global.com/docs/cwiq/CWIQ%202007%20CHAMWINO%20DC.pdf] site visited on 10/6/2017.

Prime Minister's Office and Ministry of Agriculture Food Security and Cooperative, *Comprehensive Food Security and Nutrition Assessment Report*, Dar Es Salaam 2012.

Rahim S., Saeed D., Rasool G.A., Saeed G., *Factors influencing household food security status*, „Food and Nutrition Science", 2011, no. 2, pp. 31–34.

Swift J., *Why are rural people vulnerable to famine?*, „IDS Bulletin", 20(1989), no. 2, pp. 8–15.

Tanzania Demographic Health Survey and Malaria Indicator Survey 2015/16, 2016. [https://dhsprogram.com/pubs/pdf/FR321/FR321.pdf] site visited on 10/6/2017.

Tawodzera G., *Vulnerability in crisis: Urban households food insecurity in Epworth, Harare, Zimbabwe*, „Food Security", 3(2011), pp. 503–520.

Uriel E., *Multiple regression analysis with qualitative information*, 2013, [http://www.uv.es/uriel/5%20Multiple%20regression%20analysis%20with%20qualitative%20information.pdf] site visited on 09/6/2017.

WFP, *Comprehensive Food Security and Vulnerability Analysis*, 2007, [http://docum ents.wfp.org/stellent/groups/public/documents/ena/wfp085651.pdf] site visited on 21/8/2013.

WFP, *Comprehensive Food Security and Vulnerability Analysis*, 2010, [http://documents.wfp.org/stellent/groups/public/documents/ena/wfp227079. pdf] site visited on 21/8/2013.

Chapter 2.

EVARIST FUNDISHA
JERZY GILAROWSKI

ROLE OF OFF-FARM LIVELIHOOD DIVERSIFICATION IN THE MITIGATION OF FOOD INSECURITY IN ROMBO DISTRICT, TANZANIA

ABSTRACT

This study was conducted to examine the role of off-farm livelihood diversification in the mitigation of food insecurity in Rombo District, Tanzania. Data were collected by using questionnaires and field observations and analysed with a Statistical Package of Social Science Software. Results show that the study community was rich in off-farm livelihood activities which enabled to withstand effects of the shortage of food and other hardships. The off-farming activities can broadly be categorised according to the decreasing popularity as entrepreneurship, casual labour and formal employment. Off-farm livelihood diversifications were found to be influenced by the characteristics of heads of household creating a differentiated ability to mitigate the effects of food insecurity.

Key words: Food insecurity and its mitigation, head of household, off-farm livelihood diversification.

1. Introduction

Most of the poor people do not choose to heap all their eggs in one basket as trade-offs exist between security and in-

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come[1]. This signifies the importance of livelihood diversification. Livelihood diversification is defined as the process in which rural families construct a diverse portfolio of activities and social support capabilities in order to survive and to improve their standards of living[2]. Off-farm diversification is among livelihood diversification which involves all activities undertaken beyond the farm with the purpose of garnering livelihood earnings. While some individuals may diversify their livelihood activities by hunting, fishing and gathering wild food plants that help them to reduce risks associated within sufficient harvest of agricultural produce, others supplement their subsistence base by selling surplus crops, handicrafts, wage labour, and forest products, commonly in areas with market access[3]. Similarly, some villagers in areas characterised by agricultural failure engaged in brick-making, charcoal-burning, fishing and labouring depending on the geographical locations and seasons[4]. A study in Swaziland shows that people diversified their livelihoods by making and selling clothes as an adaptive strategy to crop failure that resulted from climate change[5].

Off-farm diversification may be undertaken irrespective of the degradation of the natural environment, soil depletion,

[1] T.B. Below, K.D. Mutabazi, D. Kirschke, C. Franke, S. Sieber, R. Siebert, K. Tscherning, *Can Farmers' Adaptation to Climate Change be Explained by Socio-economic Household-level Variables?*, „Global Environmental Change", 22(2012), no. 1, pp. 223–235.

[2] F. Ellis, *The Determinants of Rural Livelihood Diversification in Developing Countries*, „Journal of Agricultural Economics", 51(2000), no. 2, pp. 289–302.

[3] J. Salick, A. Byg, *Indigenous People and Climate Change*, Oxford 2007.

[4] C. Shemsanga, A.N. Omambia, Y. Gu, *The Cost of Climate Change in Tanzania: Impacts and Adaptations*, „Journal of American Science", 6(2010), no. 3.

[5] L.C. Stringer, J.C. Dyer, M.S. Reed, A.J. Dougill, C. Twyman, D. Mkwambisi, *Adaptation to Climate Change, Drought and Desertification: Local Insights to Enhance Policy in Southern Africa*, „Environmental Science and Policy", 12(2009), pp. 748–765.

population growth or fluctuations of prices of crops. It is pointed out that some households depend on off-farm income to cover costly inputs for intensified agriculture[6]. Diversification toward off-farm activities is hindered by few job opportunities and high illiteracy level of farmers in Northern Burkina Faso[7]. Gender also influences diversification of economic activities such that charcoal-burning and brick-making, as well as high-intensity casual labour became full-time activities for men while women were involved in petty trade and handicraft because they were tied up with family chores[8]. In this regard, family chores limited the women's mobility. Diversification, which involves the collection of firewood and charcoal-burning are not ecologically sustainable as they contribute to deforestation[9].

The community in Rombo District has in long time been depending on agriculture for survival. The district used to receive reliable rainfall to support rain-fed agriculture and pasture for zero-grazed animals. But due to climate change and variability, the area is no longer receiving enough rainfall.Some authors point that the rainfall decreased significantly from 1974 to 2004[10]. There

[6] J.Z. McDowell, J.J. Hess, *Accessing adaptation: Multiple Stressors on Livelihoods in the Bolivian Highlands under a Changing Climate*, „Global Environmental Change", 22(2012), pp. 342–352.

[7] B. Barbier, H. Yacouba, H. Karambiri, Zoromĕ M., Somĕ B., *Human Vulnerability to Climate Variability in the Sahel: Farmers' Adaptation Strategies in Northern Burkina Faso*, „Environmental Management", 43(2009), pp. 790–803.

[8] S.H. Eriksen, K. Brown, P.M. Kelly, *The Dynamics of Vulnerability: Locating Coping Strategies in Kenya and Tanzania*, „The Geographical Journal", 171(2005), no. 4, pp. 287–305.

[9] A.I. Ayeni, *Adaptation Opportunities, Barriers and Strategies in Developing Countries: Focus On Drought Management in Nigeria. Drought and Desertification Department, Federal Ministry of Environment*, Abuja 2002.

[10] H.E. Meena, P. O'Keefe, *Sustainable Livelihoods in the Context of Vulnerability and Adaptation to Climate Change Impacts in Tanzania: A Case Study of Kilimanjaro Region. The Netherlands Climate Association Program*, Netherlands 2007.

is recurrent drought in the lower parts of the district which is creeping upwards[11] with expectations to impact more on agricultural activities. Consequently, the communities have to diversify livelihood activities beyond farming to withstand the effects of changing environment. Studies to examine the role of off-farm livelihood diversification in the connection to food insecurity in Rombo District are not substantially available. Therefore, the study intended to examine this problem.

2. Methodology

This study was conducted in Rombo District, which is a part of Kilimanjaro Region (Fig. 1).

Climate of Rombo District varies from semi-arid, tropical to subalpine with bimodal average annual rainfall that varies from 400 to 2,000 mm, from the lowlands to the highlands[12]. The short rainy season occurs in November and December while the long one occurs from March to May[13]. The average annual temperature varies from 15°C to 30°C and there was a rise of 1°C in the annual mean temperature from 1974 to 2004[14]. This could be the cause of the observed glacier retreats on the summit of Mount Kilimanjaro[15].

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[11] B. Mongula, *Food Security, Appropriate Technology and Micro-Industry: The Case of Drought Areas of Rombo District in Tanzania*, Dar es Salaam 2000.

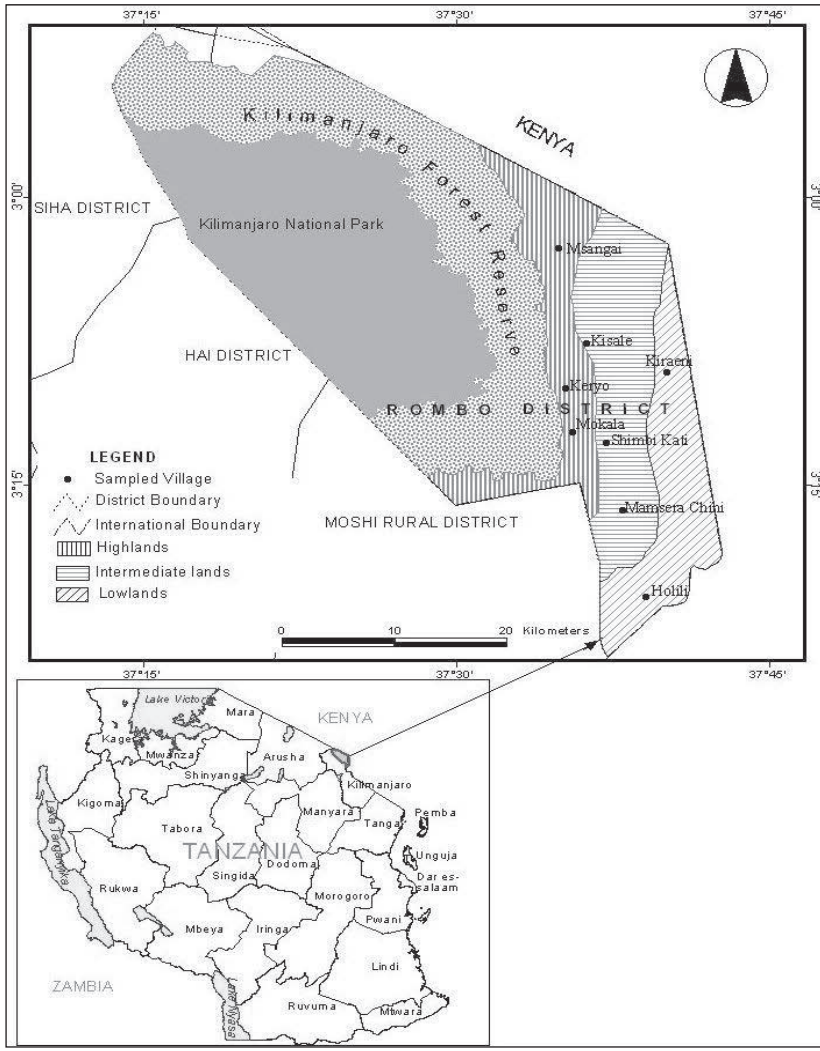
[12] H.E. Meena, P.O'Keefe, *Sustainable Livelihoods in the Context of Vulnerability and Adaptation*..., op. cit.

[13] B. Mongula, *Food Security, Appropriate Technology and Micro-Industry*..., op. cit.

[14] H.E. Meena, P. O'Keefe, *Sustainable Livelihoods in the Context of Vulnerability and Adaptation*..., op. cit.

[15] United Republic of Tanzania, *National Adaptation Programme of Action (NAPA) for Tanzania. Division of Environment*, 2007, [http/:unfccc.int/ resource/ doc/ napatza01.pdf.], retrieved on 28th May 2010.

Figure 1. Study area



The dominant economic activity is subsistence agriculture involving cultivation of rain-fed crops and zero-grazing animals. The main crops cultivated are coffee, banana, maize and beans.

Others are cassava, millet, sorghum, sweet potatoes, sunflower, yams, fruits and vegetables. Coffee and banana are the main cash crops. Animal kept in the area include cattle, goats, sheep, pigs and poultry. Petty trades such as selling of household items in small shops and local brews in traditional bars and clubs, and micro-industries such as carpentry and bicycle repairs are also practised to sustain individuals' livelihood. Few individuals earn income from wage employment.

The study used questionnaires and field observations to collect data. Questionnaires were directly administered to 611 respondents who were obtained through random sampling in eight villages in three agro-ecological zones (Figure 1). Out of 611 respondents, 369 (60.4%) have diversified their livelihood earning activities beyond crop production and livestock-keeping. Our study focussed only on respondents who were undertaking off-farm activities. Field observations were also used to gather none verbal information. Quantitative data were analysed with a Statistical Package of Social Science Software and presented in percentages, frequency tables and narrations.

3. Results

3.1. Characteristics of respondents

The findings show that out of 369 heads of household, 86.4% were males and 13.6% were females. 84.0% of respondents attained primary education and 89.2% were married.

3.2. Off-farm activities

All heads of household have diversified their livelihood earning activities beyond crop production and livestock-keeping. The off-farming activities can broadly be categorised into entrepreneurship, casual labour and formal employment.

Table 1. Heads of household involved in off-farm activities

Characteristics of Heads of Household	Responses on Involvement in Off-farm Activities (%)		
	Entrepreneurship	Causal labour	Formal employment
Location (AEZ)			
Highland (N=127)	63	22.8	14.2
Intermediate (N=166)	62.7	32.5	4.8
Lowland (N=76)	62	18	20
Sex			
Male (N=319)	61.8	27.2	11
Female (N=50)	64	22	14
Cadre			
Youths; 15–34 (n=53)	74.4	24.6	1
Adults; 35–64 (n=297)	57.7	27.9	14.4
Elders 65+ (n=19)	89.5	10.5	0
Education			
Primary (n=310)	62.9	28.1	9
Post Primary (n=41)	65.5	4.7	29.8
No Formal(n=18)	55.6	44.4	0
Marital Status			
Married (n=329)	62.9	24.3	12.8
Singles (n=40)	58.9	41.1	0
Total (N=369)	**64.7**	**25.2**	**10.1**

Source: Field Data

Entrepreneurship activities include the involvement in the preparation and sale of local brews, retail sale of clothing, shoes, agricultural produce and building materials. Others are carpentry, masonry, tailoring and vending of water and fodder. There are also good numbers of heads of household involved in transporting passengers using motorcycles, popularly known as *boda boda*. Casual labour involves transporting local brews from where they are prepared to local brew sale points and clubs, construction of houses, brick-making, and stone crushing. Formal employment opportunities mentioned include teaching in primary and secondary

schools; health care employment in dispensaries, pharmacies and hospitals; security guard jobs in schools and co-operative unions; cooking in schools; and driving jobs to convey cargo and passengers.

Table 1 shows that females are more frequently employed in formal sectors than males. Respondents with post-primary education are more involved in entrepreneurship, and they are more frequently formally employed than respondents with only primary education. They are more resilient to the effects of food insecurity. This is because formal employment and entrepreneurship is less affected than informal employment. Elders are more represented in the entrepreneurship but not engaged in formal employment.

Furthermore, Table 1 shows that the participation of females in the entrepreneurship slightly outweighs that of males by 2.2 percent. This women's domination in entrepreneurship, particularly in petty businesses, was confirmed during field observation (see Plate 1 [a], [b], [c] and [d] below).

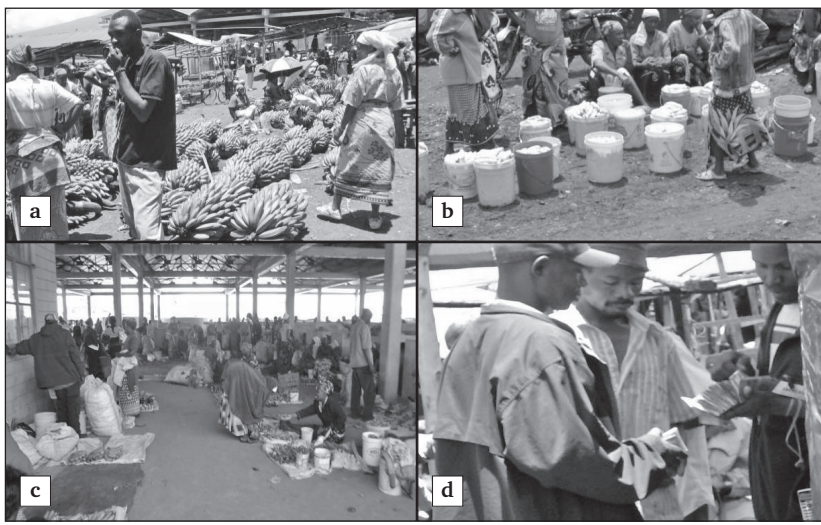


Plate 1. Petty trade at Usseri (a and b) and Tarakea (c and d) markets
(**Source**: Authors' picture)

However, most of commodities the women sold have a short shelf life, which limits storage and transportation. Such commodities include bananas, potatoes, vegetables and fruits. This indicates that the commodities traded by females are subjected to uncertainty that makes women less resilient to the effects of food insecurity than their male counterparts. It is also worth to note further that none of those living in single life mentioned to engage in formal employment (Table 1). In other words this group is exposed to social denial.

4. Discussion

As it was mentioned earlier, about 60.4 percent of the heads of household have diversified their livelihood earning activities beyond crop produce and livestock-keeping. With the exception of formal employment, other off-farm activities are more or less influenced by food insecurity. Although diversification of livelihood activities is known as risk spreading, the observation shows that diversification to off-farm activities are often based on broad agricultural growth[16]. The prosperity of alternative livelihood activities reported in this study, such as local brewing, petty trades, construction of houses, casual labour, and *boda boda* driving may decrease with time due to the competitive nature of the activities and declining agriculture. These activities are also determined by agricultural performance since the majority in the study area derived their livelihoods from agriculture.

However, it is reported that participation in off-farm activities such as shoemaking, petty trading and charcoal burning may exist

[16] P.K. Assan, P. Kumar, *Introduction: Livelihood Options for the Poor in the Changing Environment*, „Journal of International Development", 21(2009), pp. 393–402.

irrespective of the apparent food insecurity[17]. In this regard, the petty trade found to be practised as an alternative activity to agriculture in the study area might be attributed to the system of land inheritance from father to sons. This system of land inheritance has been reported to contribute to land fragmentation, which cannot support family for food and hence off-farm activities. Cultivation in the study area has been practiced for long time demanding for soil fertilisation which is expensive. The increased cost of growing crops forced some households to diversify their livelihoods to off-farm activities[18].

For the majority with post-primary school education, who engaged in off-farm activities (see Table 1), their engagement could be attributed to being more trained in vocational and entrepreneurial skills than other social groups in the area. The same situation/correctness may be found in other regions and countries in Africa. For example, it was observed that farmers in Mlali Ward in Morogoro Region unsuccessfully engaged in off-farm activities because they had insufficient entrepreneurial training and capital[19]. Thus, the success of off-farm activities requires training and capital. Illiteracy and few job opportunities in northern Burkina Faso have also been found to limit diversification toward off-farm activities[20].

The gender differences that females are slightly underrepresented than males in some off-farm activities, could be explained by the nature of some off-farm activities and the responsibilities

[17] Ibidem.

[18] M. Zorom, B. Barbier, O. Mertz, E. Servat, *Diversification and Adaptation Strategies to Climate Variability: A Farm Typology for the Sahel*, „Agricultural Systems", 116(2013), pp. 7–15.

[19] T.B. Below, K.D. Mutabazi, D. Kirschke, C. Franke, S. Sieber, R. Siebert, K. Tscherning, *Can Farmers' Adaptation to Climate Change*..., op. cit.

[20] B. Barbier, H. Yacouba, H. Karambiri, M. Zoromě, B. Somě, *Human Vulnerability to Climate Variability in the Sahel*..., op. cit.

female have at the family level. Stone masonry, *boda boda* driving and house construction were exclusively men dominant activities whereas petty trade was a largely female oriented activities because they do not require much energy and travelling. Females, who were found to dominate in petty trade involving the sale of perishable goods (see Plate 1), indicate that they were economically weak compared to men. It has also been found that petty trades such as selling agricultural produce, processed foodstuffs and beverages were predominantly female-based activities, which were seen largely as an additional source of income in most peasant households[21]. Some men, on the other hand, engaged in profitable long-distance trade in animals. The reasons for these disparities are greater mobility, fewer family duties and greater access to resource by men than women[22].

5. Conclusion and recommendations

Although off-farm livelihood diversification minimises risk under uncertain conditions, their success is determined by the characteristics of heads of household. Women, singles, elders, youths and individuals with primary and none formal education should be empowered through training and capital to raise their participation in off-farm livelihood activities that are profit-making.

REFERENCES

Assan P.K., Kumar P., *Introduction: Livelihood Options for the Poor in the Changing Environment*, „Journal of International Development", 21(2009), pp. 393–402.

[21] W. Laube, B. Schraven, M. Awo, *Smallholder Adaptation to Climate Change: Dynamics and Limits in Northern Ghana*, „Climate Change", 111(2012), pp. 753–774.

[22] Eriksen S.H., Brown K., Kelly P.M., *The Dynamics of Vulnerability*..., op. cit.

Ayeni A.I., *Adaptation Opportunities, Barriers and Strategies in Developing Countries: Focus On Drought Management in Nigeria. Drought and Desertification Department, Federal Ministry of Environment*, Abuja 2002.

Barbier B., Yacouba H., Karambiri H., Zoromĕ M., Somĕ B., *Human Vulnerability to Climate Variability in the Sahel: Farmers' Adaptation Strategies in Northern Burkina Faso*, „Environmental Management", 43(2009), pp. 790–803.

Below T.B., Mutabazi K.D., Kirschke D., Franke C., Sieber S., Siebert R., Tscherning K., *Can Farmers' Adaptation to Climate Change be Explained by Socio-economic Household-level Variables?*, „Global Environmental Change", 22(2012), no. 1, pp. 223–235.

Ellis F., *The Determinants of Rural Livelihood Diversification in Developing Countries*, „Journal of Agricultural Economics", 51(2000), no. 2, pp. 289–302.

Eriksen S.H., Brown K., Kelly P.M., *The Dynamics of Vulnerability: Locating Coping Strategies in Kenya and Tanzania*, „The Geographical Journal", 171(2005), no. 4, pp. 287–305.

Laube W., Schraven B., Awo M., *Smallholder Adaptation to Climate Change: Dynamics and Limits in Northern Ghana*, „Climate Change", 111(2012), pp. 753–774.

McDowell J.Z., Hess J.J., *Accessing adaptation: Multiple Stressors on Livelihoods in the Bolivian Highlands under a Changing Climate*, „Global Environmental Change", 22(2012), pp. 342–352.

Meena H.E., O'Keefe P., *Sustainable Livelihoods in the Context of Vulnerability and Adaptation to Climate Change Impacts in Tanzania: A Case Study of Kilimanjaro Region. The Netherlands Climate Association Program*, Netherlands 2007.

Mongula B., *Food Security, Appropriate Technology and Micro-Industry: The Case of Drought Areas of Rombo District in Tanzania*, Dar es Salaam 2000.

Salick J., Byg A., *Indigenous People and Climate Change*, Oxford 2007.

Shemsanga C., Omambia A.N., Gu Y., *The Cost of Climate Change in Tanzania: Impacts and Adaptations*, „Journal of American Science", 6(2010), no. 3.

Stringer L.C., Dyer J.C., Reed M.S., Dougill A.J., Twyman C., Mkwambisi D., *Adaptation to Climate Change, Drought and Desertification: Local Insights to Enhance Policy in Southern Africa*, „Environmental Science and Policy", 12(2009), pp. 748–765.

United Republic of Tanzania, *National Adaptation Programme of Action (NAPA) for Tanzania. Division of Environment*, 2007, [http/:unfccc. int/ resource/doc/ napatza01.pdf.], retrieved on 28th May 2010.

Zorom M., Barbier B., Mertz O., Servat E., *Diversification and Adaptation Strategies to Climate Variability: A Farm Typology for the Sahel*, „Agricultural Systems", 116(2013), pp. 7–15.

Chapter 3.

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OFF-FARM EMPLOYMENT RESPONSE TO IDIOSYNCRATIC SHOCKS TO CROP INCOME IN KILOMBERO VALLEY, TANZANIA

ABSTRACT

This paper investigates the mechanism in which off-farm employment offsets the effect of crop income shocks. Using data collected from paddy farming households in Kilombero Valley, Tanzania, we examine the interaction between seasonal farm and off-employment activities and how this interaction enables households to address crop income shock. A set of participatory rural appraisal approaches supported by economic estimation is used. Results from focus group discussions and seasonal calendars show that, availability of some off-farm incomes such as those related to farm wage do not covary with farm income, a feature that is critical for *ex post* shock strategies as it enables households to smooth income during the farming season. Evidence from econometric estimation showed that engagement in non-farm self-employment, which is largely available during the farming off-season, plays an essential risk management role and cushions against crop-based income shocks. These findings imply that insurability of off-farm employment depends not only on the type of off-farm activities, but is also shaped by seasonality. Therefore, given

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the prevailing condition of imperfection in credit and crops insurance market in rural areas, formulation of policies that enhance growth and diversification of income sources out of farming is of utmost importance in addressing crop related susceptibility.

Key words: Off-farm employment, Off-farm income, paddy price, seasonality, Kilombero valley.

1. Introduction

Rural households in Tanzania, like in most other developing countries, are exposed to a broad range of shocks resulting from climate and market related factors. Crop production failure mainly due to unfavourable weather and seasonal crop price variation (as a result of imperfect output markets) are two important variables that contribute to households shocks[1]. These shocks lead to variation in crop income. Nonetheless, formal mechanisms to deal with these shocks are poorly developed. One strategy, for example, would be through credit institution or crop insurance but this is poorly developed. Alternatively, governments may intervene through output price regulation or loan facilitation to reduce household exposure to output market related income shocks[2], though this is not affordable for most poor countries Tanzania included. As a consequence, rural households devise a number of informal strategies to reduce and cope with shocks. Informal strategies that households engage in include *ex ante* self-insurance via savings, mutual insurance system combined with *ex post* dissaving, selling

[1] S. Dercon, J. Hoddinott, T. Woldehanna, *Shocks and Consumption in 15 Ethiopian Villages, 1999–2004*, „Journal of African Economies", 14(2005), no. 4, pp. 559–585; OECD, *Managing Risk in Agriculture: Policy Assessment and Design*, Paris 2011, http://dx.doi.org/10.1787/9789264116146-en.

[2] C. Kwon, P. Orazem, D. Otto, *Off-farmLabor Supply Responses to Permanent and Transitory Farm Income*, „Agricultural Economics", 34(2006), pp. 59–67.

of assets, reducing consumption or engaging in off-farm employment[3]. When households fail to capitalise on these strategies and are unable to cope with shocks, they can find themselves in what Carter and Barret[4] call poverty traps, a situation in which households find it hard to escape chronic poverty and are pulled into destitution. Apparently, this leads to income poverty.

There is a handful of literature[5] on the role of off-farm employment on poverty and vulnerability in Tanzania. Nonetheless, little has been done on the interaction between off-farm employment/income and income shocks brought by seasonal crop output market fluctuations among rural farming households. A closely related attempt by Dercon[6] that attributed crop income risk and shocks to off-farm activities focused largely on cattle dominated livelihoods, whose shock behaviour response may be different from crop growers. These crop growers are more likely to be affected by the shocks related to the seasonal market price, an idiosyncratic shock type which is the main focus of this paper.

This paper draws a case from paddy farming households in Kilombero Valley to enrich literature on shock management. The

[3] J. Faschamps, A. Quisumbing, *Social roles, Human Capital, and the Intra – households Division of labour: Evidence from Pakistan*, „Oxford Economic Papers", 55(2003), pp. 36–80; S. Dercon, J. Hoddinott, T. Woldehanna, *Shocks and Consumption*..., op. cit.

[4] M.R. Carter and C.B. Barrett, *The Economics of Poverty Traps and Persistent Poverty: An Asset – Based Approach*, „Journal of Development Studies", 42(2006), no. 2, 178–199.

[5] P. Lanjouw, J. Quizon, R. Sparrow, *Non-agricultural earnings in peri-urban areas of Tanzania: evidence from household survey data*, „Food Policy", 26(2001), pp. 385–403; F. Ellis, N. Mdoe, *Livelihoods and Rural Poverty Reduction in Tanzania*, „World Development", 31(2003), no. 8, pp. 1367–1384; I. Katega, P. Lifuliro, *Rural Non-farm Activities and Poverty Alleviation in Tanzania. Research Report 14/7*, Dar es Salaam 2014.

[6] S. Dercon, *Wealth, Risk and Activity Choice: Cattle in Western Tanzania*, „Journal of Development Economics", 55(1998), pp. 1–42.

purpose is first, to identify main sources of crop related shocks and the processes of the intra-annual seasonality of paddy sell price, farm income and income needs and how these are construed with availability of off-farm income. And second, to estimate the effect of off-farm employment on crop income shocks management.

1.2. Theoretical background

Generally, off-farm employment and income fall within a broad range of different income generating activities which are grouped into three broad functional categories. These are: (i) farm wage labour, (ii) non-farm wage employment and (iii) non-farm self-employment. Category one consists of income generated from casual labour on other people's farms or plantations. Category two refers to wage earnings from different employment activities including salaried work whereas category three consists of income generated from self-employment activities, i.e. brick making, brewing and charcoal burning and selling, and other trading activities. This categorization is adopted from Ruben and Van den Berg[7]. In this study, three different forms of off-farm employment and income sources are explored and linked with processes of seasonality in grain (paddy) price/sale fluctuation and resultant shocks.

Other concepts that need some clarity are seasonality and shocks. Seasonality[8] refers to any regular pattern or variation that correlates

[7] R. Ruben, M. Van den Berg, *Nonfarm employment and Poverty alleviation of Rural farm Households in Honduras*, „Word Development", 29(2001), no. 3, pp. 549–560.

[8] Seasonality can also be interpreted as a shock. For example, Devereux, (1999) considers seasonality as a 'regular' shock because it is predictable. The author differentiates it with unpredictable shocks such as drought and floods which are random shocks. Household responses to address the two are thus different.

with season. The patterns of concern in the current analysis are: farm activities, off-farm activities, paddy sale price and household income needs. The central focus is to treat all patterns as a system with seasonal interaction between its elements (patterns). A shock is defined based on Dercon [et al.][9] to mean adverse events that are costly to individuals and households in terms of loss of income, assets or reduction in consumption. Generally, households' response to seasonal fluctuation of output (paddy) market has a consequence and brings adverse income loss and threatens consumption. Price (paddy market) fluctuation is considered to be variability in price offered to farmers for their paddy sales within one year period. Thus, in essence, the shock described is both idiosyncratic as it is specific to individual households and transitory as it results from the seasonal effect of crop income availability. Off-farm income is considered as one of the informal strategies to counteract the effect of such shocks. To analyse the interaction between shock and off-farm employment, the risk management theory is evoked as shocks result from inability to offset risk.

Based on the risk management theoretical insight, it is expected that households may invoke off-farm strategies in an attempt to reduce or cope with price shock, as a result of seasonal price fluctuations. Therefore, under a risky environment, households may engage in off-farm activities as an *ex ante*[10] risk reducing measure strategy[11]

[9] S. Dercon, J. Hoddinott, T. Woldehanna, *Shocks and Consumption*..., op. cit.

[10] *Exante* refers to the period before a shock whereas *expost* means the period after a full blown shock

[11] J. Lanjouw, P. Lanjouw, *The Rural Non-farm Sector: Issues and Evidence from Developing Countries*, „Agriculture Economics", 26(2001), no. 4, pp. 1–23; E. Rose, *Ex Ante and Ex Post Labor Supply Response to Risk in a Low-Income Area*, „Journal of Development Economics", 64(2001), no. 2, pp. 371–88; D. Cervantes-Godoy, S. Kimura, J. Antón, *Smallholder Risk Management in Developing Countries*, „OECD Food. Agriculture and Fisheries Papers", no. 61, 2013, http://doi.org/10.1787/5k452k28wljl-en.

or ex post risk coping strategy[12]. For example, as an *ex ante* strategy, households may avoid selling their produce at a low price (the period immediately after harvest) by having off-farm income sources during the low price season and hence less exposed to the potential crop income shock. Similarly, engagement in off-farm employment, such as farm wage employment after full blown shocks entails an *ex post* strategy in response to income loss. The income loss here refers to less profit from the sale conducted during or immediately after the harvest (post-harvest season). This is a legitimate concern in the context of Kilombero Valley since households incur costly production of paddy, but mostly earn little profit from paddy sales[13].

Considering off-farm as a shock coping strategy, Kochar[14] found that farm wage has an important *ex post* shock role among rural farming households in India. The author noted that males increased their time working off-farm for a wage (farm labour) responding to unreliable variations in income from their produced crops. This is particularly relevant when households do not have income during the farming season as they may have less crop stock to sell during this high price season. Hence, seasonal variability of different off-farm employments is expected to respond to seasonal variation in income.

In attempt to describe off-farm employment role, we extend the argument put forth by Ruben and Van de Berg[15] in recognizing the

[12] A. Kochar, *Smoothing Consumption by Smoothing Income: Hours of Work Responses to Idiosyncratic Agricultural Shocks in Rural India*, „Review of Economics and Statistics", 81(1999), pp. 50–61; C. Porter, *Shocks, Consumption and Income Diversification in Rural Ethiopia*, „Journal of Development Studies", 48(2012), no. 9, pp. 1209–1222; R. Dimova, S. Gangopadhyay, K. Michaelowa, A. Weber, *Off-Farm Labor Supply and Correlated Shocks: New Theoretical Insights and Evidence from Malawi*, „Economic Development and Cultural Change", 63(2015), no. 2, pp. 361–391.

[13] F. Kato, *Development of a Major Rice Cultivation area in Kilombero Valley, Tanzania*, „African Study Monography. Supplement", 36(2007), pp. 3–18.

[14] A. Kochar, *Smoothing Consumption by Smoothing Income*..., op. cit.

[15] R. Ruben, M. Van den Berg, *Nonfarm employment and Poverty*...,op. cit.

heterogeneity role of off-farm employment and the apparent need to distinguish different categories of off-farm employment: that is those related to farm (wage) labour employment on one hand and those related to wages outside the agricultural sector and non-farm self-employment activities. Theoretically, this distinction matters as these activities and income may have seasonal variability. Hence, off-farm employment response to a particular kind of shock also depends on its seasonal availability. Consequently, this may result in different implications as far as ex *ante* risk management and *ex post* coping strategies of off-farm employment are concerned. Thus, based on this brief theoretical review, it is hypothesised that off-farm employment has an insurability role by preventing households' exposure to shocks. This role, though, is shaped by the aspect of seasonality.

Although seasonality does not feature in risk management theory, it is highly related to crop income shocks[16]. This being the case, it is assumed that the ability of off-farm employment to provide a buffer against shocks is also determined by the aspect of seasonality. This is largely because of seasonal variation of crop income which is an important feature in the study area. Seasonality is not treated as a shock *per se* but rather as a precursor to shock events.

2. Study area and methodology

2.1. Study area

The study was conducted in the Kilombero Valley which is a swath of fertile lowland spreading across Kilombero and Ulanga Districts in Morogoro Region. Historically, the valley is dominated

[16] S. Devereux, *Making less Last Longer: Informal Safety Nets in Malawi, IDS Discussion Paper 373*, Brighton 1999, http://www.ids.ac.uk/files/dp373.pdf.

by subsistence paddy farming, although maize, sugarcane, bananas and sesame are also produced in small quantities. The 1999–2005 paddy production data show that the valley produces more than 40% of Morogoro Region's rice[17].

Paddy farming households in Kilombero Valley face a number of challenges including unreliable market and low output prices[18], leading to low surplus income from produced crops. This apparently increases vulnerability and susceptibility of paddy farming households' earning and consequently leads to seasonal income shocks. Kilombero provides an interesting case considering further that timing of the study coincided with the 2012/13 cropping season that experienced a considerable fall in rice (major output) price in the study area. This price fall was mostly severe around three post-harvest months[19] (June, July and August). Thus, the need for carrying out this investigation on seasonality of the price and crop income shock was imperative.

2.2. Data collection

Two sets of data were collected. These are quantitative households' level survey data and qualitative data gathered from focus group discussion (FGD) and in-depth interviews. Data collection was carried out between February 2014 and May 2014. Prior to data collection, a preliminary survey was conducted in August

[17] Agricultural Council of Tanzania (ACT), *Report on Output Market Support. Centre for Sustainable Development Initiative (CSDI)*, 2007, www.tap.or.tz.

[18] F. Kato, *Development of a Major Rice Cultivation area*..., op. cit.; Ministry of Agriculture, Food Security and Cooperative (MAFC), *Tanzania Bread basket Transformation project. Annex A, District profile*, 2011, www.agriculture.go.tz/.../TBBT%20Project_Annex%20A_District.

[19] Because the main harvesting period for paddy in the study area is June, the post-harvest season is considered to be between June and August. The other dominant crop grown by few households is maize which is rarely used as a tradable crop and may have two harvesting season depending on availability of rain.

2013 to gather data on community characteristics via interviews with village and district leaders in Kilombero and Ulanga Districts.

Quantitative data: a structured questionnaire was used in gathering quantitative data. The tool was administered to the heads of the household. The purpose of the survey was to examine types of shocks and attributes that determine crop income shock exposure including off-farm employment engagement. Information was thus gathered on the households' socio-economic profile, types of off-farm employment as well as types of shocks most experienced by the same in the year prior to the survey.

Qualitative data: to have a better understanding of the processes and pattern of shocks, qualitative data were also collected: At community level, focus group discussion was held in each village. Each FGD contained 10 participants. Apart from being a useful source of qualitative data, the FGDs, which preceded the household survey, provided information that assisted refinement of the questionnaire, based on the context and key attributes of the study villages. In addition, a seasonal calendar was also used to gather community level data. The seasonal calendar was useful in identification and categorizing livelihood tasks by season[20]. This method was employed in order to highlight the distribution of different farm and off-farm activities during the year. The same participants for the FGDs took part in describing the seasonal calendar, whereby participants described activities and trends for the 12 months calendar, based largely on specific seasons, rather than months in which they undertook certain activities. In-depth interviews with selected 20 households heads were also employed to compliment community level data gathered though the FGDs.

[20] *Power, Process and Participation*, eds. R. Slocum, L. Wichhart, D. Rocheleau, B. Thomas-Slayter, London 1995.

2.3. Sampling

Five villages with more dominance of paddy cultivation and which represent the socio-economic diversity of the study area were purposively selected. These villages were Malinyi, Mngeta, Lupilo, Mwaya and Lumemo. Malinyi, Mngeta and Lupilo villages were regarded as remote with poor road accessibility. In these three villages, roads are often damaged to the extent that they are impassable during the rainy season which is mostly associated with flooding in Kilombero. The two villages of Lumemo and Mwaya were regarded as accessible, land constrained and poorly endowed with agriculture resources. The contrasting differences between these villages were expected to have a differential impact on their exposure and response to shocks. In sampling households the target was to have a sampling intensity of 5% for each village. The total sample used was thus 309 which according to Gray[21], is a sufficient sample size for statistical analysis for a population with a low degree of heterogeneity. Kilombero Valley as the study area is considered more homogeneous in terms of households' occupations and other socio-economic characteristics. The focus was on paddy farmers i.e. those who had at least grown paddy in 2012/13 and 2013/14. Generally, available village registers were adopted as the sampling frame.

2.4. Data analysis approach

Qualitative data collected from the FGDs and in-depth interviews were organized in meaningful themes and presented in narratives. The use of narratives is ideal in capturing the lived experience of participants[22]. Since the overall aim was to explain processes that revolve around farm/off-farm seasonality and resultant shocks,

[21] D. Gray, *Doing research in the real world*, 2nd edition, Los Angeles 2014.
[22] Ibidem.

an approach that captures assessment of temporal sequences of households' livelihoods was useful. We analyzed this temporal aspect using community level data from the seasonal calendar.

Because of the binary nature of the dependent variables a probit model was appropriate to examine the association between off-farm employment and income shock. The dependent variable was constructed based on whether a household made a low price paddy sale or otherwise. It was assumed that selling greater proportions of 2012/13 season crops immediately after harvest indicated potential income loss and shock exposure during the preceding season (2013/14), since the interest was on such transitory and idiosyncratic shock. Thus, households which sold more than 75% of the harvest before the start of the proper 2013/14 farming season (December 2013) were considered as shock affected, and those which did not were unaffected. Therefore, the outcome variable took the value '1' and '0' for shock affected (exposed) and unaffected (not exposed) households respectively.

The probit model specified in the analysis is represented by the following equation:

$$\text{Log } [p/(1-p)] = \beta_0 + \beta_1 \times_1 + \beta_2 \times_2 + \beta_3 \times_3 + u_i$$

Where:

Log [p/(1–p)]= Natural logarithm of the odds of probability of being exposed to income shock. For the dependent variable '1' represents shock affected and '0' otherwise (unaffected)

β_0 = constant

β = estimated parameter

X_1 = a vector off-farm employment categories

X_2 = a vector of individual and household characteristics, including ownership of assets

X_3 = a vector for the location of farm households in different study villages

u_i = error term

Explanatory variables: The main explanatory variables are farm wage employment, non-farm self-employment and non-farm wage employment. These variables were measured as dummies. That is '1' if households participate in the relevant employment category and '0' otherwise. It is expected that households engagement in any of these off-farm categories to be associated with less exposure to shock, as income generated from these activities can provide a buffer against potential income loss.

To control for individual characteristics, households' heads education was included. This was a dummy variable for secondary education. The variable was 1 if a household head had secondary education and 0 otherwise. Education has been shown to influence the extent by which households can buffer economic shocks in rural Africa[23], as it enhances income. Similarly, age was specified in the model expecting that a higher age is associated with more farming experience and thus greater ability to control shocks.

Households in at least three villages in the study area usually own larger tracts of land than what they are actually able to cultivate. In addition, such households may make substantial amount by renting out extra farm land to land-constrained farmers. Thus, large land ownership was hypothesized to be associated with less exposure to shocks and two variables, farmland owned (ha) and farmland under cultivation (ha) were adopted. To capture for a household's ability to preserve harvested crop (paddy), a variable for possession of good storage facility was included. Households with crop storage facilities may be less prone to sell their harvest early when prices are low. As done

[23] Z. Yilma, A. Mebratie, R. Sparrow, D. Abebaw, M. Dekker, G. Alemu, A. Bedi, *Coping with shocks in rural Ethiopia*, „Journal of Development Studies", 50(2014), no. 7, pp. 1009–1024.

elsewhere in literature[24], the variable access to credit is specified as this provides a buffer and assists households to smooth consumption. Access to credit reduces the urge for post-harvest low price sale, and hence susceptibility to crop income shocks. A dummy variable, advanced crop sale, was also included. This variable was equal to '1' if the household had borrowed money during the pre-harvest 2012/13 season and '0' otherwise. This loan is usually repaid later with harvested crops of an equivalent value.

Finally, to account for village differentials in infrastructure endowment, a dummy variable of household location in Lumemo or Mwaya was included. Compared to the other three villages, these villages (Lumemo and Mwaya) have access to an all-weather road. This access ensures better functioning markets and profitability in selling harvested crops, leading to reduced exposure to income shocks.

3. Results

3.1. Off-farm employment distributions among households

All households were categorized into different main income generating activities. Percent distribution of these major employment categories is shown in Table 1. The results in Table 1 show that close to three-quarters (71.2%) of households had a household head or a spouse engaged in off-farm employment. This engagement is slightly similar to the 69.5% reported by Katega and Lifuliro[25] in a semi-arid area of rural Tanzania.

[24] A. Islam, P. Maitra, *Health Shocks and Consumption Smoothing in Rural Households: Does Microcredits have a Role to Play?*, „Journal of Development Economics", 97(2012), pp. 232–243.

[25] I. Katega, P. Lifuliro, *Rural Non-farm Activities*..., op. cit.

Table 1. Distribution of the main employment categories (n=309)

Employment Categories	Frequency	Percent
Households without off-farm employment	89	28.8
Households engaging in off-farm employment	220	71.2
Households with non-farm self-employment	128	58.3
Households with farm labour employment	52	23.5
Household with non-farm wage employment	40	18.2

Farm wage which employs 23% of the sampled respondents is dominated by 'piece work' on other people's farms and seasonal farm wages in plantations. Three main plantations were identified in the study area. These are Kilombero sugar plantation which is close to Mwaya, Kilombero Plantation Limited (KPL), which deals with rice cultivation in Mngeta, and Kilombero teak plantation which is a tree plantation located near Lupilo village. All of the farms are owned by multinational companies. On the other hand non-farm wage is dominated by unskilled workers as there were few opportunities for skilled employment except in a few government institutions such as schools. The largest off-farm employment category constituted largely households employed in low investment enterprises which had both low entry barriers and earnings. Due to numerous entry barriers to the well paid employment opportunities. Participation in low paying marginal activities is a salient feature of rural labour force and is observed elsewhere in sub Saharan Africa as noted in Fabusoro [et al.][26] study in rural Nigeria.

3.2. Main causes of shock exposure

Households were asked to mention the main shock events that led to severe income loss which they might have encountered in

[26] E. Fabusoro, A. Omotayo, S. Apantaku, P. Okuneye, *Forms and determinants of rural livelihoods diversification in Ogun State, Nigeria*, „Journal of Sustainable Agriculture", 34(2010), no. 4, pp. 417–438.

the previous 12 months. More than three quarters (89.4%) of the households reported to have been affected by one event or another. The proportions of households reporting a particular shock is presented in Table 2. With the liberalized market structure for agricultural products in Tanzania, market price was a cause of great concern to paddy farming households in the Kilombero Valley. This was a concern to about a third (34%) of the households. A similar concern has been reported elsewhere in Africa. For example, Salimona and Falusi[27] reported households in rural Nigeria affected by market failure and price fluctuation to be 54% and 46.6% respectively. A plausible explanation for this high percent of market related shock reported in the study area is that, during the year (2013/14) in which household survey for this study was conducted the price of paddy had greatly plummeted. The price for a100 kg bag of paddy during cropping season was 70 000 Tshs in 2011/12 whereas in 2013/2014 the price was 40 000 Tshs. To explain the cause for this, respondents from the five FGDs complained that there was too much of imported rice in the market that led to the decline in their output's value. To emphasise on this, one participant in FGD claimed:

> "...last season was the year of loss for all paddy farmers, the price was predominantly low even during months in which we normally get a good price. That is why some people in the village have not been able to grow paddy this season as they had little money obtained from paddy sales from last season. Hence lack of money for this year's farm preparation" (A male FGD participant aged 37 in Mwaya, 2 April 2014).

The most critical concern is how paddy price varies over seasons, which is explained in sub-sections 3.4 and 3.5. Since price

[27] K.K. Salimonu, A.O. Falusi, *Sources of Risk and Management Strategies among Food Crop Farmers in Osun State, Nigeria*, „African Journal of Food Agriculture and Development", 9(2009), no. 7, pp. 1591–1605.

related shock is one of the main adverse events that may have considerable implication to households' income, in the above mentioned subsections, further empirical analysis dwells on this particular shock type.

On the other hand, crop destruction due to infestation by pests and infection by diseases was a significant shock reported by more than a quarter (28%) (see Table 2) of the households as their main shock event during the 2012/13 season. This is consistent with the findings by Salimona and Falusi[28] who reported pest and diseases to be among major risks related to shocks in rural Nigeria. Relatively few households, less than a fifth (17.5%), reported to be affected by weather related shock events i.e. drought and floods.

Table 2. Events that cause crop shocks among households (n=279)

Shock type	Frequency	Percent
Crop failure due to pests,	80	28.6
Crop failure due to flood	49	17.5
Illness/death of household member	31	11.1
Low price for paddy	96	34.4
Others (i.e. crop theft, land conflicts)	24	8.6

The last category 'other' includes idiosyncratic shocks related to crime or conflict with other farmers or agro-pastoralists. This category also includes some households whose shock of concern was weighing determination unit of their produce by the buyers. From the field observations, it was revealed that some buyers used a 30 kg size tin instead of the conventional 20 kg size tin to weigh paddy. Generally, farmers are on the receiving end and have less power to control this measurement as they are in a desperate need for cash after harvest.

[28] Ibidem.

3.3. Socio-economic characteristics of households and shock exposure

Socio-economic characteristics determine the likelihood of being a victim of income shock resulting from selling harvested crop products at a low price. Table 3 shows statistics of the socio-economic characteristics differentiated by whether households are affected or not affected by the crop income shock. Few variables including those which show significant differences are of interest and deserve attention. One of these significant variables is total household income. For those households unaffected by shock, their total household income is higher than affected households. The difference between the two was significant (p=0.05) as shown in Table 3. This is probably because they were able to fetch a good price for their crops, which potentially enhanced their total income.

Table 3. Summary statistics of selected socio-economic characteristics

Variable name	All Households (n=309)	unaffected (n=198)	Shock affected (n=111)	t-test statistics
	Mean (S.D)	Mean (S.D)	Mean (S.D)	
Working adult (persons)	2.7 (1.6)	2.7 (1.9)	2.6 (1.4)	1.19
Landholding under ownership	1.5 (1.4)	1.6 (1.6)	1.4 (1.1)	1.38
Land holding under cultivation	1.0 (1.1)	1.1 (1.0)	1.1 (1.3)	–0.53
Education (years of schooling of the head of household head)	6.7 (3.0)	6.9 (3.1)	6.4 (2.8)	1.68*
Total household income (Tshs)	1 137 046 (1 439 017)	1 376 427 (2 275 815)	882 709.6 (985 072)	2.17**
Farm income (Tshs)	425 220.2 (608 238)	532 346 (592 301.4)	333 314.7 (624 173)	0.86
Other crop cultivated	52.1	39	65.1	NA
Head with secondary education	22.5	29.3	15.2	NA
Storage facility	24.1	24.2	24.3	NA
Access to credit (%)	30.5	35.8	25.2	NA
Advanced crop sale (%)	21.9	25.2	18.6	NA

Note: a) ** and * denote statistical significance at 5 and 10 percent level respectively; the null hypothesis is that the means for unaffected households are equal to those of affected households b) Incomes and landholding are calculated per adult equivalent. c) 'NA' indicates that the variables were not suitable for t-test statistics. [a] n = 220

The other variable which differentiates between the two groups is education level of the households head. Shock affected households' heads were relatively poorer educated than unaffected ones. This suggests an inverse relationship between education and exposure to shocks which are further tested in section 3.6. on crop diversification. Table 3 also shows that shock affected households were comparably more diverse in terms of other crops grown than the unaffected households. About 65% of the affected households reported growing other crops such as maize, banana, and cassava in addition to paddy and only 39% of unaffected households did the same.

With regards to a few selected assets, households on average owned 1.51ha of farmland and cultivated 1.04 ha. The cultivated land is about three-quarters of the farmland owned. It seems households are not able to invest on the whole land (farm) they own, and this may predispose them to shock as cultivating small areas could also lead to low crop income. On the other hand, shock affected households were more predisposed to advance crop sale. These households borrow money using yet to be harvested crops as collateral. This behaviour, which is practised by more than a fifth (21.3%) of the sampled households in Kilombero valley, is usually damaging as the lender usually buys paddy at a relatively low price as the terms do not favour the desperate households who need cash during the cash shortage pre-harvest season.

3.4. Shocks, seasonality and off-farm employment

This section draws on the data from the focus group discussions (FGDs), in-depth interviews and seasonal calendar to show the seasonality in the price of the paddy (the main food and cash crop), households' cash needs and off-season employment. Whereas, Table 4 provides the annual distribution of different households' activities and related consumption and income needs, Fig. 1 used

price data[29] which were validated by rice traders in Malinyi and Lumemo villages to discern the specific variation of paddy price across seasons.

With respect to off-farm employment, Table 4 shows two marked trends among off-farm activities: whereas activities related to non-farm wage employment are less seasonal compared to farm wage and non-farm self-employment, and are evenly distributed across the year, farm wage was nonetheless mostly seasonal as it goes parallel with the farming season. It is further shown that non-farm self-employment which encompasses business activities flourish more during the post-harvest season between June and November/December. This is because most households obtain cash from selling harvested paddy which could be used as a start-up capital.

Farming is dominated largely by a single season of paddy production. Farming activities can loosely be spread into two seasons: these are the farm season proper which is between December and June, and the off-farm season between August and October. As shown in Table 4 the main activities during the farming season are planting (January), weeding (February and March) and harvesting (May-June). Farm preparations during December and January are usually done by tractors or animal traction, and thus less human labour requirements.

The second column in Table 4 shows a marked variability of paddy price across seasons. These data are complemented with more quantitative results in Fig. 1. Generally, combining Table 4 and Fig.1 one sees that the paddy price was highest during the farming season, specifically from March to May and lowest during post-harvest season as expected. This finding is consistent with results

[29] Visiting the study area during post-harvest season (August 2013) and pre-harvest season (February – April 2014) enabled the researcher to further validate the price trend of paddy in different seasons.

of another study conducted in the Kilombero Valley by Musamba [et al.][30] in which the price of paddy during April and May was found to be three times higher than the price in July – August.

Table 4. Intra-annual seasonality of different livelihood aspects

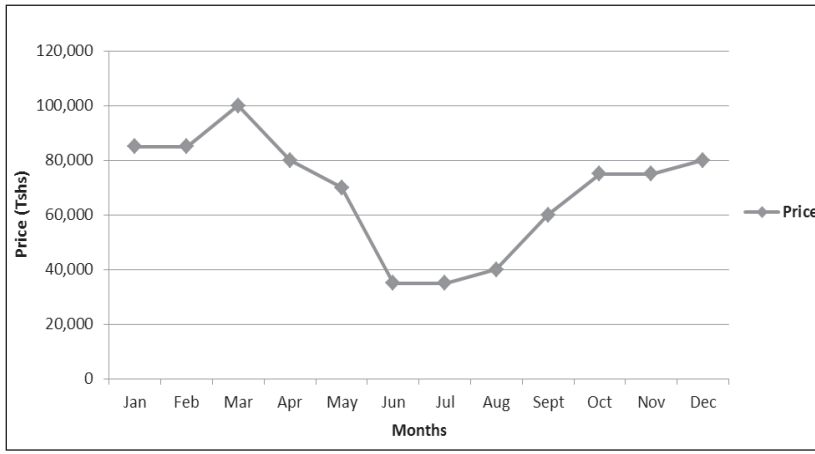
Month	Paddy sale price	Cash needs	Farm activities	Availability of off-farm employment
December – January	High:	High: farm input needs i.e. tilling school fees	Planting season	Some non-farm self-employment dominates
February – April	Highest, but most households face shortage of supply	Moderate: farm input needs for herbicides, labour	Weeding season, but largely February and March	Period of most farm casual waged activities, i.e. those related to weeding
May – June	Lowest, start of harvesting season, sales often at farm gate price	High: it is a festival season i.e. marriage, Second term school fees: capital for business start up	Harvesting season	Period for most farm casual wage activities in paddy harvesting, i.e. cutting, transportation
July – September	Low, plenty of supply	Low: few festivals around this time with little cash demanding farm tasks	Post-harvest, virtually no farm activities	Vibrant non farm self-employment activities, i.e. petty trade
October – November	Higher compared to June, July and August	Low: a few households start farm preparation	Households may start farm preparation	Some non farm self employment dominates

Overall, prices of paddy in 2013/14 season were lowest relative to the preceding four years prior to the survey as noted during the FGDs conducted in all the villages. For example, the average price during post-harvest months July and August was 80 000 TShs in 2011/12 where as for the same period in the 2013/14 season the average price was 40 000 TShs as reported in Mngeta and Malinyi

[30] E. Musamba, Y. Ngaga, E. Boon, A. Richard, R. Giliba, A. Sirima, L. Chirenje, *The Economics of Water in Paddy and Non-paddy Crop Production around the Kilombero valley Ramsar site, Tanzania: Productivity, Costs, Returns and Implication to Poverty Reduction*, „Journal of Agricultural Science", 2(2011), no. 1, pp. 17–27.

villages. More attention is paid to this trend as it has implications on households shock exposure.

Figure 1: Seasonal (intra-annual) variation of paddy price in 2013/2014



Notes: Price in the Y-axis is in Tanzanian shillings per one bag of paddy. Paddy in the study area is stored and measured in a 100–120kg bag of unhusked rice

The other seasonal trend depicted in Table 4 is that of households cash needs which is high during December and January. This is the start of the proper[31] agricultural season in which cash to hire tractors for farm preparation is critically needed. Similarly, prior to paddy harvest (June – July), there is a high demand for cash for paying school fees, and some post-harvest festival activities and ceremonies e.g. wedding. Thus, most households begin to sell paddy[32]in large

[31] The typical paddy farming season may start as early as September when a few well-off households may start tilling theirfields. But in most cases the majority of farmers would start farm preparation around December, the time during which even the cost of hiring a tractor for tilling is relatively higher compared to earlier months.

[32] Paddy sale price nonetheless varies across villages depending on village location in relation to the main urban centre (Ifakara town). However, during

quantities around June in order to satisfy their cash needs around this time. Survey data show that by January 2014 more than three-quarters of households had already sold about three-quarters of their paddy stock. Generally, sales made shortly after harvest are usually regarded as distress sales because of the low sell price as shown in Fig. 1. One interviewee in an in-depth interview in Lupilo village complained that; 'one bag of paddy was sold at a price that would not even enable one to hire a tractor for 1 hectare farm preparation during the start of the next farming season'.

The results on seasonality presented in Table 4 and Figure 1 are relevant in the discussion of households' exposure to transitory income shocks. Seasonality patterns shape and determine the *ex ante* and *ex post* strategies responses that households adopt. These responses are presented in the subsequent sections.

3.5. Off-farm employment responses to households shocks

So far the pertinent question is how different forms of off-farm employment and income thereof play a role in reducing income shock. To address this question, narratives from the FGDs and in-depth interviews are used. The FGD conducted in Mngeta was particularly relevant to explain cases of farm wage as a considerable number of households were engaged in farm wage employment in this village. This is because of the presence of a rice plantation (KPL) close to the village that provided seasonal waged labour employment. This type of off-farm employment is an important part of livelihood strategies as far as income shock

harvesting season (June and April) the cost for a bag of paddywas between 30 000 – 40 000 Tanzanian shillings. The peak price was recorded in February 2014 in which the price ranged between 50 000 – 70 000 Tshs. These average estimates of the price were confirmed by key informants. The value of 1 USD was equivalent to 1,635 Tanzania shillings during months of the survey period. Tanzania shillings (Tsh) is the currency unit for Tanzania.

is concerned. One participant elaborated this scenario in the FGD held in Mngeta as:

> "A lot of people engage in casual labour at KPL during masika[33] not because the wages are high, but rather as a result of shortage of food due to selling a large proportion of their harvest during the post-harvest season. Thus, the little wage they get supports their basic consumption till the next harvesting season..."

Generally, households with farm wage employment have to divide most of the intense period of farming season (February – March) switching between their own farm work and plantation. This has an implication on food production as they have less time for own farm labour as pointed out by one participant in the quotation below:

> "...For some of us, paddy fields are located far from the village, so we always have low harvest because we do not have time to attend our farms. We need to do weeding in our farms and at the same time we have to work in the plantation".

Discussions with a key informant, a sub-village (hamlet) leader, in Mngeta revealed that the daily wage of 3 800 Tshs (2.3US$) from the plantation work during the income shortage season was barely enough for basic necessities. This daily wage was not even sufficient to hire labour to work in their paddy farms to replace the labour used in plantation work.

Off-farm employment may as well be a preventive mechanism against shocks. In this sense non-farm self-employment income enables households to reduce exposure to risk as income gained from these activities can prevent shortfall during a season of shortage. This was pointed out in another FGD held in Malinyi in which a male participant said:

[33] *Masika isakiswahili* word *that* literally meansa long rainy season. The term is also used as a metaphor to imply time of acute income shortage associated with farming season in which there are few income generating opportunities.

"Having other off-farm income gaining activities is important in this village because you cannot rely on selling paddy. The price is very low now (August 2013) compared to the cost we incurred in farming. In this village off-farm income helps people to have alternative sources of income which enables them not to sell their paddy immediately after the harvest until February and March when its price is high. The harvest also needs to satisfy your food needs till the next season, as people in this village depend on paddy for food and cash..."

The key result in this sub-section is that poor households which are motivated by seasonal income shortfall rely on supplying off-farm labour during paddy farming season. This, thus, partially corroborates Samal and Pandey[34] claim made among rice farming community in India that marginal farmers rely on rice wages whereas big farmers cope with shortfalls of consumption by engaging in non-farm self-employment activities. In addition, the result is also consistent with an Indonesian study on income shock[35].

3.6. The role of off-farm employment on households' income shocks exposure

While discussion in section 3.4 described the processes under which households cope with income shock, depending on their off-farm income endowments, it did not provide the quantitative estimate on the extent to which having off-farm employment determines a household's exposure to shocks. As described earlier, exposure to shock is proxied by a household's decision to sell their

[34] P. Samal, S. Pandey, *Climatic Risks, Rice Production Losses and RiskCoping Strategies: A Case Study of a Rain-fed Village in Coastal Orissa*, „Agricultural Economics Research Review", 18(2005), pp. 61–72.

[35] G. Berloffa, F. Modena, *Income Shocks, Coping Strategies, and Consumption Smoothing: An Application to Indonesian Data*, „Journal of Asian Economics", 24(2013), pp. 158–171.

output during the low price season. Results of probit estimates are presented in Table 6. The overall model is significant ($P \leq 0.01$), suggesting that the variables specified are jointly significant in explaining households exposure to shocks.

Table 5. The Role of off-farm employment on reducing exposure to shocks-Probit model results

	Coefficient	Standard Error	Z	P>|z|
Household head's Education	–0.371	0.196	–1.89	0.059*
Household head's age	–0.010	0.005	–1.95	0.052*
Access to credit	–0.264	0.167	–1.58	0.114
Other crops cultivated	–0.502	0.163	–3.07	0.002**
Advanced crop sale	0.346	0.188	1.84	0.066*
Farm holding owned	–0.047	0.022	–2.13	0.033**
Farm holding cultivated	0.050	0.027	1.85	0.064
No. of working adult	–0.049	0.052	–0.94	0.345
Farm wage	–0.318	0.229	–1.39	0.165
Non–farm self–employment	–0.482	0.193	–2.50	0.012**
Non–farm wage	–0.296	0.253	–1.17	0.243
Households in Mwaya/Lumemo	–0.332	0.160	–2.07	0.038**
Storage facility	0.123	0.191	0.65	0.518
LRchi(13)	37.04			
Prob>chi2	0.0004			

Note: *= Significant at 10% (p=0.1); ** = Significant at 5% (p=0.05)

On our explanatory variables of interest, only non-farm self-employment income was negative and significant ($p \leq 0.05$). This implies that engagement in non-farm self-employment was associated with an increased probability of selling their crop during the peak price season. Thus, households with this status are more likely to make profit and avoid exposure to income shocks during the next paddy planting season (other things remaining constant).

Such households are likely to be able to manage price seasonality shock and their consumption needs. This result is consistent with Kijima [et al.][36] who found out that households in Uganda responded to agricultural shocks by expanding self-employment business thereby increasing their household income. A study conducted by Porter[37] in Ethiopia showed similar results.

Possession of secondary education by household head was negative and significantly ($P \leq 0.059$) associated with exposure to shocks, suggesting that household heads without secondary education compared to those with that level of education are more likely to fetch good price during high price season and avoid being affected by income shocks. Education increases awareness and skills in different production decisions including those related to the selling of farm produce. Similarly, an inverse relationship was found between farm area owned and the probability of being exposed to shock, with farm size holding being significant ($P \leq 0.05$) as shown in Table 5. This implies that those with large farms are unlikely to sell their crop at low prices and thus, avoid income loss. The plausible reason for this is that ability to cultivate large farms may be associated with more income as households may rent extra land and earn income, which can buffer against potential shock.

The results in Table 5 further show that advanced crop sale was positive and significantly ($P \leq 0.1$) associated with the likelihood of being exposed to shocks. This means that households, which accepted cash in advance for the unharvested paddy, were more likely to fall victim of income shortfalls. This was particularly common for poor households, in which households borrow money during the farming season and repay that money with harvested paddy on

[36] Y. Kijima, T. Matsumoto, T. Yamanoa, *Nonfarm Employment, Agricultural Shocks, and Poverty Dynamics: Evidence from Rural Uganda*, „Agricultural Economics supplement", 35(2006), pp. 459–467.

[37] C. Porter, *Shocks, Consumption and Income Diversification*..., op. cit.

terms set by the borrowers. The last variable which significantly determines exposure to income shock is village location. This variable was negative and significant ($P \leq 0.05$), indicating that residing in Mwaya or Lumemo was associated with decreasing the likelihood of being exposed to income shock. This may plausibly be associated with vibrant off-farm businesses that may provide enough income that satisfies household needs during the period of low price season.

4. Discussion

The findings have revealed a high rate of engagement in off-farm employment. The higher rate of engagement may be attributed to the study area having a high agricultural potential. It has been reported by Loening [et al.][38] and Mathenge [et al.][39] that off-farm activities prosper in favourable agro-climatic regions. This is plausibly explained as results of production linkages between farm and off-farm employment; that is output of one set of activities (i.e. farm) can be invested in another set (off-farm). More engagement in off-farm employment insures households against different types of shocks.

Shocks identified can be categorized into two broad types which are covariates shocks and idiosyncratic shocks. Notably, floods and draught are covariates shocks as they affect large groups of the population. These kinds of shock are though not the main focus of the analysis on this study. The majority of households had more

[38] J. Loening, B. Rijkers, M. Söderbom, *Nonfarm Microenterprise Performance and the Investment Climate: Evidence from Rural Ethiopia*, Policy Research Working Paper 4577. The World Bank Africa Region, Agriculture and Rural Development Unit & Development Research Group, 2008, www.microfinancegateway.org/library/rural-non-farm-sector-characteristics-importance-policies.

[39] M. Mathenge, M. Smale, D. Tchirley, *Off-farm employment and Input Intensification among Small holder Maize Farmers in Kenya*, „Journal of Agricultural Economics", 66(2015), no. 2, pp. 519–530.

concern with income loss resulting from low price for their paddy which caused income shortfalls during the farming season. Selling paddy at a low price by itself may strictly not be a shock. However, income shortage resulting from the low price and which occurs during the farming season in the study area could be treated as a shock. In such a case these types of shock that are seasonal and affecting certain segments of the population can be regarded as transitory and idiosyncratic. This seasonal nature of the shocks has a different implication on the insurance role of off-farm employment.

Our findings have shown that most of off-farm employment activities are largely seasonal. Their availability is closely related to seasonal variation of farm activities. For example, activities related to non-farm self-employment including those related to trading were dominant during the off-farm season. This may be due to two reasons. First, during the post-harvest season most households have enough cash obtained by selling the harvested paddy, and thus their purchasing power for off-farm goods and services is high. Second, most of those who engage in petty trade get their capital by selling paddy around the harvesting time (June-August). This is a typical farm-off-farm backward linkages as described by Haggblade [et al.][40] in which earnings from farm activities are invested in off-farm business ventures. When asked on the source of their capital, 76% of those who were engaged in non-farm self-employment mentioned income from their own paddy sales as their main source, implying production farm/non-farm linkages.

With respect to the role of off-farm employment in reducing or buffering against exposure to shocks, we suggest two important propositions. First, seasonal variation in availability of farm income

[40] S. Haggblade, P. Hazell, T. Reardon, *Introduction*, in: *Transforming the Rural Nonfarm Economy: Opportunities and Threats in the Developing World*, eds. S. Haggblade, P. Hazell and T. Reardon, Baltimore 2007, pp. 3–25.

and off-farm employment matters. Households with some forms of non-farm self-employment income during the post-harvest or off-farm season are strategically able to avoid selling their paddy immediately after the harvesting season. By doing so, they compromise their farm income. Generally, the highest net gain (profit) is obtained by selling at the start of the farming season or pre-harvest season (when the price is high). In this case they covary their main (two) income sources in an attempt to reduce *ex ante* their exposure to income and consumption shortfall. Further empirical evidence from estimation results (Table 5) shows that it is engagement in non-farm self-employment that reduces households' exposure to shocks, whereas farm wage and non-farm wage are statistically less relevant as *ex ante* mechanisms.

Second, farm wage employment income is inherently meant to vary with farm income, and this variation has a different implication to that of non-farm self-employment income. Because of the risky environment, households are by necessity compelled to engage in farm wage during the start of the farming season. This makes sense considering that the start of farming season corresponds to the time of most difficulty to meet household needs. Thus, different from non-farm self-income, the evidence from Kilombero Valley confirms that farm wage income is essentially an *ex post* coping strategy as it serves to smooth contemporaneous consumption and income during the farming and pre-harvest seasons. One should observe that this farm wage role may not be a unique case applicable to Kilombero Valley only; farm wage labour supply and demand have been responding well to destitution and/or transitory negative shocks in rural Malawi[41] and in rural India[42] as well.

[41] R. Dimova, S. Gangopadhyay, K. Michaelowa, A. Weber, *Off-Farm Labor Supply and Correlated Shocks*..., op. cit.

[42] A. Kochar, *Smoothing Consumption by Smoothing Income*..., op. cit.

At this point our findings and the resultant discussion adds to the theoretical perspective of risk management posited earlier by Cervantes-Godoy [et al.][43] and Kwon [et al.][44], whereby it is argued that the *ex post/ex ante* role of off-farm employment is structured and intricately featured within seasonality of these activities, their incomes and type of households shock events. This being the case, analysis of risk management role of off-farm employment must not only disaggregate off-farm employment activities but also their linkage with farm activities construed within the aspect of seasonality.

The distinction between *ex ante* and *ex post* shock reducing management roles is also relevant for policy interventions. For example, for farm wage and a few non-farm self-employment activities conducted during farming season, the goal is to smooth income *ex post*. In this case, activities to be encouraged should be low return and low risk, whereas for non-farm self-employment during the post-harvest season creation of employment should focus on high return activities as the goal is to mitigate farming seasonal income shock (*ex ante* measure). Thus, it is imperative to consider seasonal availability of different off-farm employment so as to accurately examine the robustness of off-farm income/employment as a coping or a risk management strategy.

5. Conclusions and recommendations

This paper has investigated the role of off-farm employment and income in responding to households' income shocks and how

[43] D. Cervantes-Godoy, S. Kimura, J. Antón, *Smallholder Risk Management*..., op. cit.

[44] C. Kwon, P. Orazem, D. Otto, *Off-farm Labor Supply Responses to Permanent and Transitory Farm Income*..., op. cit.

these responses are shaped by seasonality. Two main conclusions can be drawn. First, some off-farm activities and income sources have a seasonal variability which largely counters the farm season. Similarly, harvested crop (paddy) market price which affects crop income in Kilombero valley has a seasonal variation, and this seasonality is translated into shocks during the farming season for households that cannot take advantage of the price variations. Second, households employ different off-farm strategies in an attempt to counteract or manage the effect of income shock during the peak of farming (cultivating) season. For example, farm wage income enables households to cope with this shock by smoothing their income and consumptions. However, engagement in farm wage at the peak of the cultivating season compromises farm productivity for households with shortage of labour supply. Consequently, this leads to more vulnerability during the harvesting period which traps households into a cycle of income risk, uncertainties and shocks.

On the other hand, income from non-farm self-employment activities during the post-harvest season enables households to manage risks and prevent exposure to shocks during the farming season. The mechanism by which these risks and shocks are managed is through taking advantage and profitably exploiting crop price seasonal variability. Similarly, econometric evidence has confirmed that controlling for the set of individual, locational and household characteristics, off-farm employment increases the probability of selling paddy at a high price during the peak price season. This significantly reduces exposure to transitory income shocks.

From a risk management point of view, one broad insight can be made based on the specific scenario of Kilombero Valley; off-farm employment/income as a risk strategy does not only respond to the seasonal onset of shocks but is also shaped by these shock

events. This seasonality indeed determines its *ex post* and *ex ante* role when it comes to households that highly depend on cultivation of one seasonal crop (paddy) that they largely depend on for their income as is the case in the study area.

In terms of the policy relevance of our findings, first and foremost, it is hard to prevent intra-annual seasonal change in price of agricultural commodities such as paddy, which is the main cause of income shock at least in the study area. Generally, to some extent the market price is determined by structural forces related to global food prices. However, the state institutions such as local district councils (local government authorities) can play a role of facilitating growth of entrepreneurial off-farm activities, particularly during the off-farm season. Income from such activities may not only enable households to offset the adverse effects of the seasonal variations of consumption but could also enhance households' ability to manage and cope with the seasonal income shortfalls. This might in turn have a positive implication on reduction of income poverty. It is thus recommended that more opportunities for off-farm employment should be made available in rural areas such as Kilombero Valley.

REFERENCES

Agricultural Council of Tanzania (ACT), *Report on Output Market Support. Centre for Sustainable Development Initiative (CSDI)*, 2007, www.tap.or.tz.

Berloffa G., Modena F., *Income Shocks, Coping Strategies, and Consumption Smoothing: An Application to Indonesian Data*, „Journal of Asian Economics", 24(2013), pp. 158–171.

Carter M.R. and Barrett C.B., *The Economics of Poverty Traps and Persistent Poverty: An Asset–Based Approach*, „Journal of Development Studies", 42(2006), no. 2, 178–199.

Cervantes-Godoy D., Kimura S., Antón J., *Smallholder Risk Management in Developing Countries*, „OECD Food. Agriculture and Fisheries Papers", no. 61, 2013, http://doi.org/10.1787/5k452k28wljl-en.

Dercon S., *Wealth, Risk and Activity Choice: Cattle in Western Tanzania*, „Journal of Development Economics", 55(1998), pp. 1–42.

Dercon S., Hoddinott J., Woldehanna T., *Shocks and Consumption in 15 Ethiopian Villages, 1999–2004*, „Journal of African Economies", 14(2005), no. 4, pp. 559–585.

Devereux S., *Making less Last Longer: Informal Safety Nets in Malawi, IDS Discussion Paper 373*, Brighton 1999, http://www.ids.ac.uk/files/dp373.pdf.

Dimova R., Gangopadhyay S., Michaelowa K., Weber A., *Off-Farm Labor Supply and Correlated Shocks: New Theoretical Insights and Evidence from Malawi*, „Economic Development and Cultural Change", 63(2015), no. 2, pp. 361–391.

Ellis F., Mdoe N., *Livelihoods and Rural Poverty Reduction in Tanzania*, „World Development", 31(2003), no. 8, pp. 1367–1384.

Fabusoro E., Omotayo A., Apantaku S., Okuneye P., *Forms and determinants of rural livelihoods diversification in Ogun State, Nigeria*, „Journal of Sustainable Agriculture", 34(2010), no. 4, pp. 417–438.

Faschamps J., Quisumbing A., *Social roles, Human Capital, and the Intra-households Division of labour: Evidence from Pakistan*, „Oxford Economic Papers", 55(2003), pp. 36–80.

Gray D., *Doing research in the real world*, 2nd edition, Los Angeles 2014.

Haggblade S., Hazell P., Reardon T., *Introduction*, in: *Transforming the Rural Nonfarm Economy: Opportunities and Threats in the Developing World*, eds. S. Haggblade, P. Hazell and T. Reardon, Baltimore 2007, pp. 3–25.

Islam A., Maitra P., *Health Shocks and Consumption Smoothing in Rural Households: Does Microcredits have a Role to Play?*, „Journal of Development Economics", 97(2012), pp. 232–243.

Katega I., Lifuliro P., *Rural Non-farm Activities and Poverty Alleviation in Tanzania. Research Report 14/7*, Dar es Salaam 2014.

Kato F., *Development of a Major Rice Cultivation area in Kilombero Valley, Tanzania*, „African Study Monography. Supplement", 36(2007), pp. 3–18.

Kochar A., *Smoothing Consumption by Smoothing Income: Hours of Work Responses to Idiosyncratic Agricultural Shocks in Rural India*, „Review of Economics and Statistics", 81(1999), pp. 50–61.

Kwon C., Orazem P., Otto D., *Off-farmLabor Supply Responses to Permanent and Transitory Farm Income*, „Agricultural Economics", 34(2006), pp. 59–67.

Kijima Y., Matsumoto T., Yamanoa T., *Nonfarm Employment, Agricultural Shocks, and Poverty Dynamics: Evidence from Rural Uganda*, „Agricultural Economics supplement", 35(2006), pp. 459–467.

Lanjouw J., Lanjouw P., *The Rural Non-farm Sector: Issues and Evidence from Developing Countries*, „Agriculture Economics", 26(2001), no. 4, pp. 1–23.

Lanjouw P., Quizon J., Sparrow R., *Non-agricultural earnings in peri-urban areas of Tanzania: evidence from household survey data*, „Food Policy", 26(2001), pp. 385–403.

Loening J., Rijkers B., Söderbom M., *Nonfarm Microenterprise Performance and the Investment Climate: Evidence from Rural Ethiopia*, Policy Research Working Paper 4577. The World Bank Africa Region, Agriculture and Rural Development Unit & Development Research Group., 2008, www.microfinancegateway.org/library/rural-non-farm-sector-characteristics-importance-policies.

Mathenge M., Smale M., Tchirley D., *Off-farm employment and Input Intensification among Small holder Maize Farmers in Kenya*, „Journal of Agricultural Economics", 66(2015), no. 2, pp. 519–530.

Ministry of Agriculture, Food Security and Cooperative (MAFC), *Tanzania Bread busket Transformation project. Annex A, District profile*, 2011, www.agriculture.go.tz/.../TBBT%20Project_Annex%20A_District.

Musamba E., Ngaga Y., Boon E., Richard A., Giliba R., Sirima A., Chirenje L., *The Economics of Water in Paddy and Non-paddy Crop Production around the Kilombero valley Ramsar site, Tanzania: Productivity, Costs, Returns and Implication to Poverty Reduction*, „Journal of Agricultural Science", 2(2011), no. 1, pp. 17–27.

OECD, *Managing Risk in Agriculture: Policy Assessment and Design*, Paris 2011, http://dx.doi.org/10.1787/9789264116146-en.

Porter C., *Shocks, Consumption and Income Diversification in Rural Ethiopia*, „Journal of Development Studies", 48(2012), no. 9, pp. 1209–1222.

Power, Process and Participation, eds. R. Slocum, L. Wichhart, D. Rocheleau, B. Thomas-Slayter, London 1995.

Rose E., *Ex Ante and Ex Post Labor Supply Response to Risk in a Low-Income Area*, „Journal of Development Economics", 64(2001), no. 2, pp. 371–88.

Ruben R., Van den Berg M., *Nonfarm employment and Poverty alleviation of Rural farm Households in Honduras*, „Word Development", 29(2001), no. 3, pp. 549–560.

Samal P., Pandey S., *Climatic Risks, Rice Production Losses and RiskCoping Strategies: A Case Study of a Rain-fed Village in Coastal Orissa*, „Agricultural Economics Research Review", 18(2005), pp. 61–72.

Salimonu K.K., Falusi A.O., *Sources of Risk and Management Strategies among Food Crop Farmers in Osun State, Nigeria*, „African Journal of Food Agriculture and Development", 9(2009), no. 7, pp. 1591–1605.

Yilma Z., Mebratie A., Sparrow R., Abebaw D., Dekker M., Alemu G., Bedi A., *Coping with shocks in rural Ethiopia*, „Journal of Development Studies" 50(2014), no. 7, pp. 1009–1024.

Chapter 4.

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CHALLENGES ENCOUNTERED BY SMALLHOLDER FARMERS IN ADAPTING TO ADVERSE EFFECTS OF CLIMATE CHANGE AND VARIABILITY IN SEMI-ARID AREAS OF CENTRAL TANZANIA

ABSTRACT

This article investigates adaptation measures and challenges facing smallholder farmers in adapting to climate change and variability effects in semiarid areas of Dodoma region, central Tanzania. Mixed method research approach under cross-sectional survey design was employed in data collection. Descriptive statistics and thematic analysis have been used in analyzing and presenting the findings. The study results indicate that smallholder farmers have observed variations in rainfall and temperature trends that were linked to reduced cereal crop yields. The study noted that the farmers respond to reduced cereal crop yields by implementing various adaptive strategies. They include growing drought tolerant crop varieties, practicing intercropping, shifting the planting to earlier/later dates, increase farm sizes and out-migration. It was further found in this study that smallholder farmers encountered a number of challenges when they take adaptation measures to overcome declining crop yields. The challenges include inadequate capital, elevated agricultural equipment and input prices and absence of soft loans arrangements. Other

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challenges include low price for agricultural produce, poor weather information and agricultural extension services all of which rendered negative effects on cereal crop production and household food security. The impact of climate change and variability are conclusively evident in this study while effective smallholder farmer's adaptation mechanisms are limited. To ensure household food security, purposeful institutional intervention plans and optimal support on extension services and provision of credit facilities are needed on viable adaptation strategies against impacts of climate change and variability in semiarid areas of Tanzania.

Key words: Climate change and variability, adaptive strategies, challenges, food security, Dodoma, Tanzania

1. Introduction

Climate change and variability have already impacted majority of developing countries particularly Sub-Saharan Africa, including Tanzania. Increasing vulnerabilities and impacts to these countries have been attributed to low income levels and low technology to be able to adapt to environmental changes[1]. The United Nations Development Programme (UNDP) warns that the progress in human development achieved over the last decade may be slowed down or even reversed by climate change and variability as new threats emerge to water, agricultural production, nutrition and public health (UNDP, 2008).

While all places are likely to be affected by climate change and variability effects, semiarid areas of Africa, such as those of central

[1] Intergovernmental Panel for Climate Change (IPCC), *Climate change 2001: synthesis report*, Cambridge UK 2001; Intergovernmental Panel for Climate Change (IPCC), *Climate change impacts*, adaptations and vulnerability: Contribution of working group II to the fourth assessment report of IPCC, Cambridge UK 2007; J. Paavola, *Livelihoods, vulnerability and adaptation to climate change in Morogoro region: Tanzania centre for social and economic research on the global environment*, „Working paper EDM", Norwich 2003.

Tanzania seem to be more vulnerable to these effects due to their drier conditions, high poverty levels, poor technology use and lack of viable information on appropriate measures to be taken[2]. In times of resultant droughts, smallholder farmers in these areas have been reported to change their farming strategies in order to cope with these changes. A number of adaptation strategies have been implemented particularly, shifting in planting dates, change of crop varieties, intensification of farm production and improvement of land management practices[3].

As a response to climate change and variability effects, several governments in Africa have managed to establish policies, plans and programs to combat these effects. However, these efforts are not much fruitful due to the existence of various limitations such as poor access to information and knowledge, inefficient institutions, limited empowerment, limited economic resources and limited infrastructure[4]. These in turn limit the effectiveness

[2] United Nations, *Facilitating an international agreement on climate change: Adaptation to climate change. A Proposal Paper by Global Leadership for Climate Change Action*, 2009, www.globalclimate.org, retrieved on 2nd November 2013.

[3] C. Shemsanga, A.N. Omambia, Y. Gu, *The cost of climate change in Tanzania: impacts and adaptations*, „Journal of American Science", 6(2010), no. 3, pp. 182–196, http://www.americanscience.org, retrieved on 13th March 2012; United Nations, *Facilitating an international agreement on climate change: Adaptation to climate change. A Proposal Paper by* Global Leadership for Climate Change Action, 2009, www.globalclimate.org, retrieved on 2nd November 2013; A.L. Mary, A.E. Majule, *Impacts of climate change, variability and adaptation strategies on agriculture in semiarid areas of Tanzania, The case of Manyoni District in Singida Region, Tanzania*, „Environmental Science and Technology", 3(2009), no. 8, pp. 206–218; J. Paavola, *Vulnerability to climate change in Tanzania: sources, substance and solutions: A Paper Presented at the Inaugural Workshop of Southern Africa Vulnerability Initiative (SAVI) in Maputo, Mozambique June 19–20*, 2003.

[4] N. Suckall, E. Tompkins, L. Stringer, *Identifying trade-offs between adaptation, mitigation and development in community responses to climate and socio-economic stresses: Evidence from Zanzibar, Tanzania*, „Applied Geography", 46(2014), pp. 111–121; S. Di Falco, M. Yesuf, G. Kohlin, C. Ringler, *Estimating the impact*

and sustainability of strategies as well as the productivity of the agro-economic system[5].

Tanzania has taken several attempts to reduce the adverse effects of temperature and rainfall variations on various sectors including agriculture. The government and non-government institutions have, to some extent, been supporting smallholder farmers through provision of weather forecast information, education on farming methods, food aids during dire food shortages and improved crop seeds. Despite the anecdotal efforts taken, several challenges have been noted particularly, slow implementation of different funding programs, lack of sectoral coordination, low national capacity building, corruption, inadequate skills and low technology[6].

Even though institutional challenges in combating climate change and variability effects in Tanzania have been pointed out, little is known on the challenges facing smallholder farmers in implementing climate change and variability adaptation strategies at local level, particularly in the most vulnerable semiarid areas of the country. This study, therefore, focuses on this research gap by analysing the indicators of climate change and variability in central Tanzania, examining the adaptive measures taken by smallholder farmers and later examining the challenges facing

of climate change on agriculture in low-income countries: Household level evidence from the Nile Basin, Ethiopia, „Environmental and Resource Economics", 52(2012), no 4, pp. 457–478; E. Bryan, T.T. Deressa, G.A. Gbetibouo, C. Ringler, (2009). *Adaptation to climate change in Ethiopia and South Africa: options and constraints*, „Environmental Science and Policy", 12 (2009), no 4, pp. 413–426.

[5] A. Arendse, J. Crane, *Impacts of climate change on smallholder farmers in Africa and their adaptation strategies: What are the Roles of Research, International Symposium and Consultation (29–31 March, Arusha Tanzania)*, 2010.

[6] C. Shemsanga, A.N. Omambia, Y. Gu, *The cost of climate change in Tanzania...*, op. cit.; *United Republic of Tanzania, URT, National sample census of agriculture 2002/2003; Regional report: Dodoma Region, Volume V-A*, Dar es Salaam 2007.

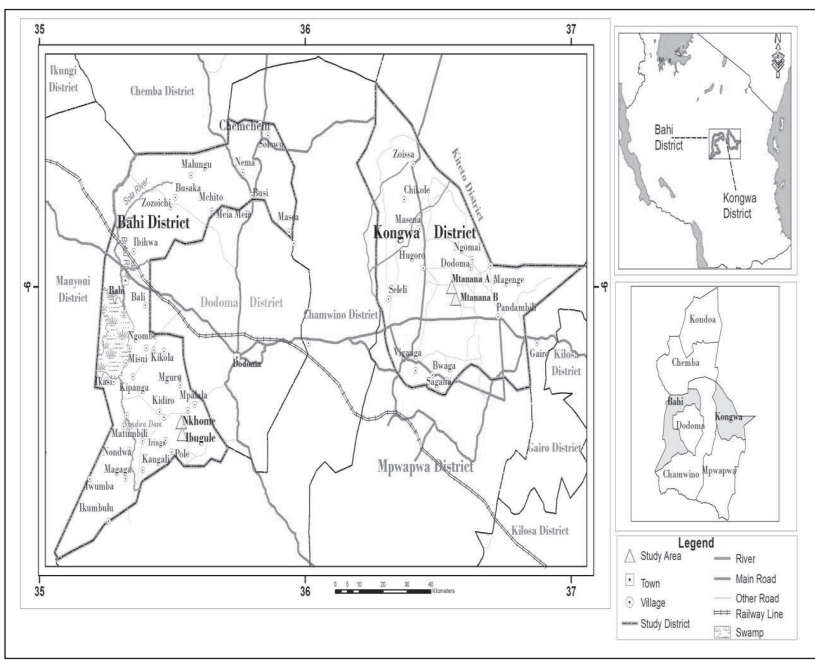
smallholder farmers in implementing climate change and variability adaptation strategies.

2. Materials and methods

2.1. Study area

The present study was conducted in semiarid areas of central Tanzania, represented by Bahi and Kongwa districts in Dodoma region, Tanzania (Figure 1). The study area was chosen because of its typical characteristics of semiarid conditions together with existence of smallholder famers whose main occupation is cultivation of local cereal crops including bulrush millet, sorghum and maize.

Figure 1. The study area and sampled villages



Bahi is located in the western part of Dodoma region, extending between latitudes 4° and 8° South and between longitudes 35° and 36° East. The district covers about 6,100 km^2. Bahi is divided into four divisions, 21 wards and 56 villages[7]. Kongwa district, with an area of about 4041 km^2 is located between latitude 5° to 6° South and longitude 36° to 37° East. Kongwa district has 3 divisions, 14 wards and 74 registered villages[8].

2.2. Study design and materials

This study employed a cross-sectional survey design constituting a mixed method research approach. Mixed research approach was applied in this study to provide triangulation and complementarities of the research findings[9]. Purposive sampling was used in the selection of the study area (Dodoma) due to its semiarid vulnerability condition, thus being more prone to climate change and variability variables. Thereafter, key informants, particularly agricultural officers, village leaders and elders, were purposively involved in focus group discussions (FGD) and in-depth interviews due to their potentiality to the research theme. Simple random sampling was used in the selection of smallholder farmers.

The sampling frame of this study comprised 4312 households selected from four villages, namely Ibugule, Nkhome, Mtanana A and Mtanana B[10]. Based on the sampling frame above, a total of 366 households were technically selected by using a formula

[7] Bahi District Council, District Agricultural Development Plans (DADPs) 2011/2012 – 2013/2014; Prime Minister's Office: Regional administration and local government, Bahi, Dodoma 2011.

[8] Ibidem.

[9] J.W. Creswell, *Research design: Qualitative, quantitative, and mixed methods approaches*, Los Angeles – London – New Delhi – Singapore – Washington DC 2013.

[10] United Republic of Tanzania (URT), *National climate change strategy and action plan; Division of Environment, Vice President's Office*, Dar es Salaam 2011.

proposed and used by Israel[11]. The formula which is based on 95% confidence level and P = 0.05 reads as:

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size to be calculated, N is total population of the study (households) and e is the level of precision measured by probability scale of 0.05%. Plugging data into the formula, the following was in order;

$$n = \frac{4312}{1 + 4312(0.05)^2} = 366$$

The calculated sample size was applied to compute the households' proportional samples in all villages that were determined by the number of households in each village. The formula used reads as:

$$\mathbf{n}_h = \frac{N_h}{N} n$$

This resulted in a proportional sample size selected in each village where Ibugule was represented by 41 household heads, Nkhome 107, Mtanana A 101 and Mtanana B 117 making a total of 366 household heads used in the sample size.

Both closed and open-ended questionnaires were administrated to smallholder farmers and government officials who were key informants. In-depth interviews, FGD and field observations were used to complete and control the quality of information collected

[11] G.D. Israel, *Determining sample size*, Agricultural Education and Communication Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences (IFAS), University of Florida. PEOD-6, 2009, http:/www.edis.ifas.ed/pd006, accessed on 20th March 2011.

by household socio-economic survey. The collected data were edited to improve the quality for coding. Analysis was carried out through the use of two software packages for data analysis namely Statistical Package for Social Sciences (IBM SPSS version 20) and Microsoft excel 2010. The software packages enabled the data to be summarized using summary statistics (frequencies and percentages) which simplified the description and presentation of the study findings. Qualitative data from focus group discussions, in-depth interviews and field observation were analysed through content analysis.

3. Results and discussion

3.1. Indicators of climate change and variability

Evidence of climate change and variability has been manifested at varying levels in Tanzania. The findings from this study indicate rainfall decline to be the major indicator attributed to climate change and variability in Bahi and Kongwa districts as pointed out by 87.7% of the respondents (Table 1). In both districts, decreased rainfall was highly noted but with higher percentage (89.3%) in Kongwa district compared to 86.2% in Bahi. Decreased rainfall has been associated with three variables, namely rainfall duration, intensity and intervals. Smallholder farmers reported that nowadays the amount of rainfall received is inadequate for proper local cereal crops' survival as it used to be. Similar smallholder farmers' perception results have been reported in Shinyanga and Singida region, both of semiarid areas of Tanzania by Kangalawe and Lyimo[12]. Decreasing rainfall as a result of climate change and variability has also been reported for Singida region in Tanzania

[12] R.Y.M. Kangalawe, J.G. Lyimo, *Climate change, adaptive strategies and rural livelihoods in semiarid Tanzania*, „Natural Resources", 4(2013), no. 3, pp. 266–278.

by Lema and Majule (2009). Meena [et al.] (2008) who surveyed different agro-ecological zones of Tanzania had similar results as those of the present study.

Table 1: Indicators of climate change and variability in Bahi and Kongwa Districts

Indicators	Bahi (n = 148)	Kongwa (n =218)	Total (N = 366)
	%	%	%
Decreased rainfall amounts	86.2	89.3	87.7
Decreased crop yields	87.5	84.2	85.8
Depletion of water sources	86.1	81.0	83.5
Unpredictable climate	89.4	76.3	82.8
Increased temperature	60.2	74.5	67.3
Changes on the growing seasons	43.0	28.2	34.1
Increased drought incidences	32.9	33.7	33.3
New plants and crop diseases	25.0	24.4	24.7

NB: Analysis based on multiple responses hence column tallies may exceed 366 and 100% respectively

The second indicator mostly identified by smallholder farmers in semiarid areas of central Tanzania is reduced crop yield. In this case about 85.8% of the farmers in both districts reported reduced crop yields as a result of climate change and variability. The largest percent (87.5%) was observed in Bahi district as compared with 84.2% in Kongwa district. The farmers linked reduced rainfall amount to have a greater effect on cereal crop yields. The farmers added that reduced amount of rainfall has affected even the drought tolerant crops which are known to tolerate harsh condition in the past 10 to 30 years. They further added that maize production has recently been the mostly vulnerable crop than other cereal grains particularly in Bahi district which is much drier than Kongwa. These findings match those of Kangalawe and Lyimo[13] who linked erratic

[13] Ibidem.

rainfall and recurrent droughts with reduced cereal crop yields in semiarid ares of Shinyanga and Singida regions of Tanzania.

Depletion of water sources was a third among the top indicators of the changing climate in Dodoma region as pointed out by 83.5% of the respondents in the two districts. Smallholder farmers in Bahi had higher percentage (86.1%) as compared to those of Kongwa (81.0%). The farmers reported that seasonal rivers, wells and dams, that acted as major source of water for their domestic and livestock purposes, have much less water for a longer time as it used to be in the past 10 to 30 years. The effects of changing climate were also reported during the FGD where smallholder farmers had this to share:

> "...Increased temperature and reduced rainfall are all noted in our area causing water stress in our local wells and dams. Actually, water from the mentioned sources was used for more than 5 months after the rainfall cessation, but nowadays it takes only 2 to 3 months".
>
> *Female, 43 years in Mtanana A village, Kongwa district.*

The same scenario was reported in Bahi district as one respondent lamented on effects of the changing climate:

> "...Really, there is an increase in temperature and decrease in rainfall. When I compare temperature and rainfall in 1960's and the current one, I note some differences. In those days, the rain season was marked with higher amount of rainfall which resulted into high production.....Nowadays temperature has increased and the duration of dry spells has increased causing crop failure almost each year".
>
> *Male, 78 years in Nkhome village, Bahi district.*

Smallholder farmers from central Tanzania further reported the occurrence of unpredictable rainfall to be another indicator of the changing climate. This indicator accounts for 82.8% of the farmers. Even though this problem is persistent in both districts, a higher percent of 89% of the respondents were from Bahi as compared to 76.3% from Kongwa. The smallholder farmers in both districts emphasized that nowadays rainfall is more

unpredictable as compared to the past 10 to 30 years. Their major emphasis was on rainfall onset and cessation periods. The smal holder farmers reported changes in rainfall onset whereby in the past rainfall used to start in late November and stop in late April or sometimes in early May. This is contrary to the current situation where it begins in late December through January and ends in late March or early April, thus causing frequent crop failures as it is seen in the following narration during in-depth interview:

> "Currently, rainfall is more unpredictable. The exact time we normally used to expect the onset of rain has changed. Normally, rainfall used to start in late November or early December and ended in April or early May. Mhhh, in these days, the situation has changed..., sometimes, till January no rain. Even if it may start in November or December, its frequency is very unpredictable hence affects seed sowing period. Sadly, it may be raining here, but no rains 5 km from here. This has led to disparities in harvests where one can have good harvest in the farm located in side A and poor harvest can be observed in another farm located in side B".
>
> *Female, 45 years in Mtatana B, Kongwa district.*

Other reported climate change and variability indicators included increased temperature, changed growing season, increased drought incidences, and emergence of new crop pests and diseases. The changing climate was associated with variations in temperature and rainfall which seem to have consequences on the outbreak of pests and diseases. Smallholder famers reported the increase of incidences of new pests and diseases that varied from one crop to another. Those who were growing bulrush millet and sorghum reported on the presence of pests such as stalk borers (*Calidea dregii*) locally known as *Mpipi*, and birds (*Qualeaqualea*). Not only that but also maize production was reported to be affected by pests such as armyworms and grain moths, and diseases such as *streak virus* and *leaf spot*. These findings concur with those of ICRISAT (2014),

URT[14] and Matari [et al.][15] that reports on the increase of drought incidences in different places that has also culminated to the emergence of new plant pests and diseases in semiarid areas of Africa.

3.2. Smallholder farmers' adaptive strategies on climate change and variability

As a result of observed changing climate, particularly in semiarid areas of central Tanzania, adaptive strategies were investigated. Smallholder farmers in this part of Tanzania were found to implement various strategies in adapting to the changing climatic conditions. The results in Figure 2 indicate that 39% of the farmers reported to have changed crop varieties by planting drought tolerant and earlier matured ones. The smallholder farmers in Kongwa district reported to use maize varieties that take shorter time to mature as compared to traditional maize varieties. The findings resemble those of Westengen [et al.][16] who reported that some smallholder farmers in semiarid areas of Tanzania are now cultivating new improved seed varieties of maize. However, a different observation was noted in Bahi district where respondents reported to abandon maize production and opt to grow new sorghum varieties that were more drought tolerant than maize. The option of growing drought tolerant and early mature crops in semiarid areas is also reported by Balama[17] in Kilombero district of Tanzania.

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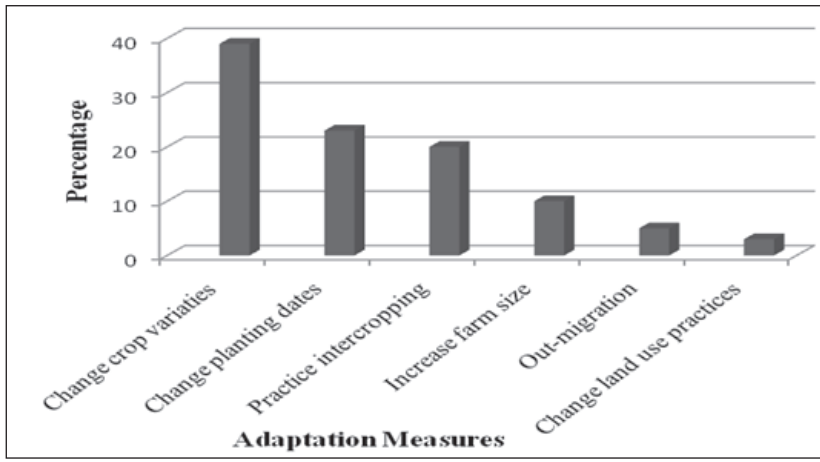
[14] United Republic of Tanzania (URT), *National climate change strategy and action plan*..., op. cit.

[15] E.R. Matari, L.B. Chang'a, G.E. Chikojo, T. Hyera, *Climate change scenario development for second national communication – Tanzania*, „TMA Research Journal", 1(2008), pp. 40–54.

[16] O.T. Westengen, A.K. Brysting, *Crop adaptation to climate change in the semiarid zone in Tanzania: the role of genetic resources and seed systems*, „Agriculture and Food Security", 3(2014), no. 1.

[17] C. Balama, S. Augustino, S. Eriksen, F. Makonda, N. Amanzi, *Climate change adaptation strategies by local farmers in Kilombero district, Tanzania*,

Figure 2. Adaptation measures to climate change and variability



Moreover, 23% of the farmers (Figure 2) reported to have changed the planting dates. Initially, farmers used to sow seeds before the onset of rainfall, but currently they sow part of their seeds before and some after the onset of rainfall. The major reason for changing planting dates was to reduce the risk of total yield loss during the adverse weather conditions. Changes in planting dates have also been reported by Mwamfupe[18] in Rufiji district. Similar results have been also reported by Below [et al.][19] in Mlali and Gairo wards of Morogoro region and Kangalawe [et al.][20] in Kasulu district of Tanzania.

„Ethiopian Journal of Environmental Studies and Management", 6(2013), no. 6, pp. 724–736.

[18] A. Mwamfupe, Assessment of local perceptions and potential roles of local institutions in climate change adaptation in Rufiji district, Tanzania, unpublished PhD thesis, University of Dar es Salaam 2014.

[19] T. Below, R. Siebert, S. Stefan, *Livelihood strategies and vulnerability in Mlali and Gairo wards of Morogoro region, Tanzania report, Sub Sahara strategies for adapting to climate change*, Muencheberg 2010.

[20] R.Y.M. Kangalawe, C. Mung'ong'o, P. Yanda, A. Mwakaje, E. Kalumanga, *Climate change and variability impacts, vulnerability and adaptive capacity of*

Additionally, 20% of smallholder farmers were found to practice intercropping. Smallholder farmers in Kongwa district were noted to mix maize and sunflower in the same field while those of Bahi planted bulrush millet, maize and sorghum in the same farm. Similar observations have been reported by Mary and Majule[21] who affirm that crop diversification serves as insurance against rainfall variability as it maximizes yield from the little available water. Shayo[22] further asserts that it is common in drought prone areas to find five different crops being grown on the same piece of land aiming at reducing crop failure risk.

Furthermore, change of farm sizes was also found to be among adaptive mechanisms against climate change and variability effects. The latter accounted for 10% of the smallholder farmers investigated. Smallholder farmers indicated that they have been increasing the cultivated area in order to maximize output in their cereal crop yields. The consequential increase of farmland attributed to climate change and variability has also been reported by Malley and Martsumoto[23] in Usangu plain, Tanzania.

Smallholder farmers in central Tanzania also cited out-migration (5%) and change of land use practices (3%) as among the adaptive strategies on the changing climate. The farmers argued that young people out-migrate to cities and towns to seek employment opportunities. The present findings on out-migration concur with

natural and social systems in Kasulu district, Tanzania, in: *Strengthening local agricultural innovation to adapt to climate change in Botswana*, eds. P.S. Maro and A.E. Majule, Malawi 2009, pp. 224–243.

[21] A.L. Mary, A.E. Majule, *Impacts of climate change*..., op. cit.

[22] C.M. Shayo, *Adaptation planning and implementation: agriculture and food security*, in: *UNFCCC African Regional Workshop on Adaptation, 21–23 September 2006*.

[23] Z.J.U. Malley, M. Taeb, T. Matsumoto, *Agricultural productivity and environmental insecurity in the Usangu plain, Tanzania: Policy implications for sustainability of agriculture*, „Environment, Development and Sustainability", 11(2009), no. 1, pp. 175–195.

those of Lobell and Field[24], who found that migration is pursued by various people around the world because it frequently improves the lives of migrants, their families and communities in both the place of origin and destination.

3.3. Community adaptation strategies to climate change and variability effects

Apart from individual initiatives to cope with climate change and variability, a number of traditional practices were reported to be employed in adapting to the changing climate through communal ways. These include labour sharing, food borrowing and seed exchange as reported by key informants hereunder:

> "In our village, helping each other is a traditional practice done for a long period of time. We help each other in farming activities and share the available food during critical food shortage".
>
> *A 60-year-old female, Nkhome village, Bahi District.*

Labour sharing is an informal organisation where farmers work together in farm preparation, land tillage, seed planting, weeding and harvesting upon notification. There is no cash payment to members; only local brew "*Ujimbi*" is prepared. All activities done are labour demanding, thus helping each other aims at reducing the burden of labour shortage, therefore facilitates climate change and variability adaptation. The practice is reported to be helpful in adaptation to climate variability as it increases labour power, thus improving farmers' adaptive capacity to climate variability. Similar strategy of farming groups have been reported by Mwamfupe[25] in Rufiji and Ajonol[26] in Northern Ghana.

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[24] D.B. Lobell, C.B. Field, *Global scale climate – crop yield relationships and the impacts of recent warming*, „Environmental Research Letters", 2(2007), no. 1, p. 014002.

[25] A. Mwamfupe, *Assessment of local perceptions and potential roles*..., op. cit.

[26] P. Ajonol, *How millet farmers are adapting to climate change in Northern Ghana*, 2012, Farm radio interaction script 95.12, December 1st.

Moreover, *cereal borrowing* practice locally called "*Songoleda*" was another community strategy used by smallholder farmers to cope with climate change and variability. A food insecure household seeks cereal loan from a food secured household promising to return the loan with agreed interest after the subsequent harvest. The longer the food unsecured household stayed with the borrowed cereals, the higher the interest. This was much applied in critical food shortage periods as reported by one respondent during the interview:

> "...Food borrowing is a traditional practice aiming at helping those who are in need. Before being given cereal as a loan, people help their fellows for free... Later on, the person is given the cereal grains of certain amount expecting to return back with interest after harvest".
>
> *A 52-year-old female, Nkhome village, Bahi district.*

The practice of food borrowing resembles social capital, where community members stay by helping each other during problems. This observation was also witnessed by Campbell [et al.][27] in Jamaica and Liwenga[28] in Mvumi who associates social capital with improvement in the level of resilience to climate change and variability effects.

Furthermore, *exchange of crop seeds* has also been reported in Dodoma region. Despite improved seeds being available, smallholder farmers have reported to have been exchanging the local crop seeds as reported by smallholder farmer during FGD:

> "...Seed exchange is done by community members depending on the need. Most us are unable to buy improved seeds which are sold at high price..... We therefore keep on exchanging our traditional seeds within our villages".
>
> *A 35-year-old male, at Mtatana B village, Kongwa District.*

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[27] D. Campbell, D. Barker, D. McGregor, *Dealing with drought: small farmers and environmental hazards in southern St. Elizabeth, Jamaica*, „Applied Geography", 31(2011), no. 1, pp. 146–158.

[28] E. Liwenga, *Food insecurity and coping strategies in semiarid areas; The case of Mvumi in Central Tanzania*, Stockholm 2003.

During the FGD, small holder farmers reported on their inability to afford high costs of improved seeds, thus they rely on traditional seeds even if they are not productive. The current results tally with that of Westengen and Brysting[29], in semiarid areas of Tanzania.

3.4. Adoption challenges facing smallholder farmers in overcoming climate change and variability effects

Results presented in Table 3 show that 84.4% of the smallholder farmers in Bahi and Kongwa districts cited lack of capital as their major challenge in adaptation to the changing climate. In both areas, more than three quarters of the farmers, (85.5% and 83.4%) in Bahi and Kongwa districts respectively, singled out inadequate financial capabilities to be a major hindrance to effective adaptation. The farmers argued that crop production needs capital to buy improved seeds and equipment but then majority of them are unable to acquire the mentioned inputs due to their low-income earnings.

Table 3. Responses on challenges encountered in adapting to changing climate

Challenges	Bahi (n = 148)	Kongwa (n =218)	Total (N = 366)
	%	%	%
Lack of capital	85.5	83.4	84.4
High price of agricultural inputs	73.5	72.3	72.9
Lack of soft loans	70.1	72.2	71.1
Low price of agricultural produce	70.3	62.4	66.3
Poor weather information	50.2	44.5	47.3
Frequent food insecurity	53.4	38.2	45.8
Labour shortage	32.9	23.3	28.1
Poor extension services	20.4	34.4	27.4
Poor soils	23.2	18.5	20.9

NB: Analysis based on multiple responses, hence column tallies may exceed 366 and 100% respectively

[29] O.T. Westengen, A.K. Brysting, *Crop adaptation to climate change*..., op. cit.

On the same argument, 72.9% of the farmers pointed high agricultural equipment and other inputs prices as limiting factors to their accessibility to such inputs. There were minor variations in terms of farmers' feelings as the effect of elevated farm inputs prices per district with 73.5% in Bahi and 72.3% in Kongwa. From this study, farming in semiarid areas of central Tanzania seems to be dominated by the use of hand hoe, with low impact on improving agricultural production. However, majority of smallholder farmers seem to fail to access farm equipment and other inputs, as opposed to few agro-pastoralists and petty traders who were in a position to access those inputs. This was more evident with the comments provided by one of participants in the FGD as follows:

> "Generally poor harvest has been culminated by poor agricultural inputs and equipment used by majority of smallholder farmers in our area. Majority of us do use hand hoe while wealthier smallholder farmers (livestock keepers and petty traders) own and use ploughs and power tillers. Though some people can hire them, but still the majority does not have enough money to pay for the service".
>
> *A female respondent aged 35 years at Mtanana B village, Kongwa district.*

Results presented in Table 3, further indicated that about 71% of the smallholder farmers cited lack of soft loans in both cash and kind as one of important challenges in adaptation to the negative effects of climate change and variability. Smallholder farmers in Kongwa accounted for a higher percentage (72.2%) compared to their fellows in Bahi with 70.1% on this aspect. The respondents reported less accessibility to loans that could have solved the problem of lacking capital and low use of improved inputs and equipment. It was reported by some smallholder farmers that only a few of them had access to soft loans that enabled them to purchase some agricultural equipment and other inputs. It was also noted that an access to agricultural equipment such as power tillers and

ploughs was not egalitarian because only livestock keepers and petty traders were eligible to loans as they were in a position to pay back the costs in instalments even if there was crop failure. Nevertheless, for some reasons, a minority of farmers indicated that few farmers in groups had a chance of obtaining some soft loans so long as they were able to contribute some amount to their group account as a start-up capital before they were entitled to have access to loans.

Furthermore, low price of agricultural products was seen to be another challenge facing smallholder farmers as reported by 66.3% of the respondents in the study area. Smallholder farmers reported to produce both food and cash crops. They further argued that during the good season they produce adequate crops, but always lack markets to sell their products at reasonable price. This was mostly reported in Bahi district (70.3%) where sunflower, groundnuts and simsim were reported to be mostly produced cash crops. Smallholder farmers reported to invest their little money expecting to get more after harvest but ended up frustrating due to low price of what has been harvested. Lack of reliable markets forces small holder farmers to sell their products to local traders who buy at low prices. On contrary, smallholder farmers in Kongwa district (62.4%) were in a better position because of the existence of Kibaigwa cereal grain market that help farmers to sell their products based on the planned government price. Smallholder farmers reported to benefit from this market as they are assured to sell their produce at good price.

Other challenges encountered by smallholder farmers in adapting to climate change and variability effects include lack of clear information on weather condition (47.3%), thus they fail to prepare for the changing climate, frequent food shortage (45.8%) which weakens manpower. Respondents reported that more money is directed in buying food during critical food shortage instead of

investing it in agricultural production. Apart from food shortage, a labour constraint was also pointed out by 28.1% of the respondents. Smallholder farmers emphasized that high out-migration of youth in search of better life in towns and cities have contributed to this shortage. In addition to that, poor extension service from agricultural officers was also among the reported challenge pointed out by 27.4% of the respondents in both areas. Smallholder farmers reported on the shortage of agricultural extension services due to limited manpower. They further argued that the available extension officers are unable to provide timely services as they are supposed to attend large number of clients. The last but not least challenge was poor soil mentioned by 20.9% of the respondents. Smallholder farmers linked poor soils with monoculture and poor farming techniques, which results in low production.

The reported challenges by smallholder farmers were further emphasized by the government officers, particularly agricultural district officers, as seen in the quotation hereunder:

> "...Climate change adaptation strategies have been affected by various obstacles including low knowledge on climate change issues, high prices of agricultural inputs (seeds, pesticides and fertilizers), lack of soft loans, lack of sustainable agriculture, shortage of agricultural extension workers, poor agricultural and livestock technology practices as well as poor enforcement and implementation of laws and by-laws related to land use planning and too much bureaucracy in disbursement of the requested project funds. This results in poor implementation of the proposed projects hence low output".
>
> *A male agricultural officer aged 43 years in Bahi district.*

These results concur with those of Latha (2012) in India, Malik [et al.] (2012) in Pakistan, Arendse and Crane[30] and Ludi[31] in Af-

[30] A. Arendse, J. Crane, *Impacts of climate change on smallholder farmers in Africa*..., op. cit.

[31] E. Ludi, *Climate change, water and food security: Overseas development Institute*, 2009, www.odi.org.ok., retrieved on 5th April 2012.

rica, Ndesanjo [et al.][32] and Mwamfupe[33] in Rufiji delta of Tanzania where smallholder farmers in the mentioned places reported to be challenged by multiple factors including poor access to information and knowledge, inefficient institutions, limited empowerment, limited economic resources and limited infrastructure. These in turn have limited the effectiveness and sustainability of the strategies in reducing the negative effects of the changing climate to smallholder farmers.

4. Conclusion and recommendations

Climate change and variability are evident in semiarid areas of central Tanzania. This condition has reported to affect more smallholder farmers who usually cultivate local small grain cereal crops in the area. It has been found in this study that farmers have implemented various measures in adapting to the changing climate. However, they have faced various obstacles in implementing most adaptive measures. The reported challenges include inadequate capital, high price of agricultural equipment and inputs, lack of soft loans, low price of agricultural products, poor weather information and poor agricultural extension services. In order to reduce the vulnerabilities and impacts of climate change and variability to smallholder farmers in semiarid areas of Tanzania and other places of the same nature, there is a need to involve various stakeholders in supporting the implementation of adaptation measures. Smallholder famers need to be provided with seeds of crop varieties that are resistant to drought, soft loans for agricultural inputs and equipment, and

[32] R. Ndesanjo, J.O. Ngana, P.Z. Yanda, *Climate change impacts and adaptive strategies in the Rufiji delta, Tanzania*, „UTAFITI Journal of the College of Arts and Social Sciences", 9(2012), no. 1 and 2, pp. 59–73.

[33] A. Mwamfupe, *Assessment of local perceptions and potential roles*..., op. cit.

reliable market for the produced cash crops. Additionally, it would be beneficial to smallholder farmers to access subsidized agricultural inputs and equipment, more education on climate change and variability effects and provision of support on rainfall water harvesting skills through construction of dams so as to facilitate irrigation farming to reduce the problem of unpredictable and inadequate rainfall.

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REFERENCES

Ajonol P., *How millet farmers are adapting to climate change in Northern Ghana*, 2012, Farm radio interaction script 95.12, December 1st.

Arendse A., Crane J., *Impacts of climate change on smallholder farmers in Africa and their adaptation strategies: What are the Roles of Research, International Symposium and Consultation (29–31 March, Arusha Tanzania)*, 2010.

Bahi District Council, District Agricultural Development Plans (DADPs) 2011/2012 – 2013/2014; Prime Minister's Office: Regional administration and local government, Bahi, Dodoma 2011.

Balama C., Augustino S., Eriksen S., Makonda F., Amanzi N., *Climate change adaptation strategies by local farmers in Kilombero district, Tanzania*, „Ethiopian Journal of Environmental Studies and Management", 6(2013), no. 6, pp. 724–736.

Below T., Siebert R., Stefan S., *Livelihood strategies and vulnerability in Mlali and Gairo wards of Morogoro region, Tanzania report, Sub Sahara strategies for adapting to climate change*, Muencheberg 2010.

Bryan E., Deressa T.T., Gbetibouo G.A., Ringler C., *Adaptation to climate change in Ethiopia and South Africa: options and constraints*, „Environmental Science and Policy", 12(2009), no 4, pp. 413–426.

Campbell D., Barker D., McGregor D., *Dealing with drought: small farmers and environmental hazards in southern St. Elizabeth, Jamaica*, „Applied Geography", 31(2011), no. 1, pp. 146–158.

Creswell J.W., *Research design: Qualitative, quantitative, and mixed methods approaches*, Los Angeles – London – New Delhi – Singapore – Washington DC 2013.

Di Falco S., Yesuf M., Kohlin G., Ringler C., *Estimating the impact of climate change on agriculture in low-income countries: Household level evidence from the Nile Basin, Ethiopia*, „Environmental and Resource Economics", 52(2012), no. 4, pp. 457–478.

International Crop Research Institute for the Semi- Arid Tropics (ICRISAT) (2008). *Climate change in the semiarid tropics: International crop research institute for the semi- arid tropics*, Andhra, Pradesh, India.

Intergovernmental Panel for Climate Change (IPCC), *Climate change 2001: synthesis report*, Cambridge UK 2001.

Intergovernmental Panel for Climate Change (IPCC), *Climate change impacts, adaptations and vulnerability: Contribution of working group II to the fourth assessment report of IPCC*, Cambridge UK 2007.

Israel G.D., *Determining sample size*, Agricultural Education and Communication Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences (IFAS), University of Florida. PEOD-6, 2009, http:/www.edis.ifas.ed/pd006, accessed on 20th March 2011.

Kangalawe R.Y.M., Lyimo J.G., *Climate change, adaptive strategies and rural livelihoods in semiarid Tanzania*, „Natural Resources", 4(2013), no. 3, pp. 266–278.

Kangalawe R.Y.M., Mung'ong'o C., Yanda P., Mwakaje A., Kalumanga E., *Climate change and variability impacts, vulnerability and adaptive capacity of natural and social systems in Kasulu district, Tanzania*, in: *Strengthening local agricultural innovation to adapt to climate*

change in Botswana, eds. P.S. Maro and A.E. Majule, Malawi 2009, pp. 224–243.

Kongwa District Council (2011). District agricultural development plans (DADPs) 2011/2012 – 2013/2014; Prime Minister's Office: Regional administration and local government, Kongwa, Dodoma.

Kweka D., Pallangyo D., *Climate change adaptation policy and legal study in Tanzania: Catalyzing action and Enhancing Synergies of Biodiversity and Climate Change response*, 2nd Regional Dialogue, Developing Legal Capacity for Climate Adaptation in Eastern and Southern Africa, Dar es Salaam Tanzania.

Liwenga E., *Food insecurity and coping strategies in semiarid areas; The case of Mvumi in Central Tanzania*, Stockholm 2003.

Lobell D.B., Field C.B., *Global scale climate – crop yield relationships and the impacts of recent warming*, „Environmental Research Letters", 2(2007), no. 1, p. 014002.

Ludi E., *Climate change, water and food security: Overseas development Institute*, 2009, www.odi.org.ok., retrieved on 5th April 2012.

Ludwig,F., Terwisscha, C.S., Verhagen,J., Kruit,B., Lerland, E., Dellink,R., Bruin, K., Kabat, P., *Climate change impacts on developing countries – EU accountability*, Policy department economics and scientific policy, 2007.

Malley Z.J.U., Taeb M., Matsumoto T., *Agricultural productivity and environmental insecurity in the Usangu plain, Tanzania: Policy implications for sustainability of agriculture*, „Environment, Development and Sustainability", 11(2009), no. 1, pp. 175–195.

Mary A.L., Majule A.E., *Impacts of climate change, variability and adaptation strategies on agriculture in semiarid areas of Tanzania, The case of Manyoni District in Singida Region, Tanzania*, „Environmental Science and Technology", 3(2009), no. 8, pp. 206–218.

Matari E.R., Chang'a L.B., Chikojo G.E., Hyera T., *Climate change scenario development for second national communication – Tanzania*, „TMA Research Journal", 1(2008), pp. 40–54.

Mwamfupe A., Assessment of local perceptions and potential roles of local institutions in climate change adaptation in Rufiji district, Tanzania, unpublished PhD thesis, University of Dar es Salaam 2014.

Ndesanjo R., Ngana J.O., Yanda P.Z., *Climate change impacts and adaptive strategies in the Rufiji delta, Tanzania*, „UTAFITI Journal of the College of Arts and Social Sciences", 9(2012), no. 1 and 2, pp. 59–73.

Orindi, V. A., Murray L.A., *Adapting to climate change in east Africa: A strategic approach*. Gatekeeper Series 117: International Institute for Environment and Development, 2005.

Paavola J., *Livelihoods, vulnerability and adaptation to climate change in Morogoro region: Tanzania centre for social and economic research on the global environment*, „Working paper EDM", Norwich 2003.

Paavola J., *Vulnerability to climate change in Tanzania: sources, substance and solutions: A Paper Presented at the Inaugural Workshop of Southern Africa Vulnerability Initiative (SAVI) in Maputo, Mozambique June 19–20*, 2003.

Rosenzweig, C., Hillel, D., *Potential impacts of climate change on agriculture and food supply: Consequences of climate change*, 1 and 2, 1– 18, 1995.

Shayo C.M., *Adaptation planning and implementation: agriculture and food security*, in: *UNFCCC African Regional Workshop on Adaptation*, 21–23 September 2006.

Shemsanga C., Omambia A.N., Gu, Y., *The cost of climate change in Tanzania: impacts and adaptations*, „Journal of American Science", 6(2010), no. 3, pp. 182–196, http://www.americanscience.org, retrieved on 13th March 2012.

Suckall N., Tompkins E., Stringer L., *Identifying trade-offs between adaptation, mitigation and development in community responses to climate and socio-economic stresses: Evidence from Zanzibar, Tanzania*, „Applied Geography", 46(2014), pp. 111–121.

United Nations, *Facilitating an international agreement on climate change: Adaptation to climate change. A Proposal Paper by Global Leadership*

for Climate Change Action, 2009, www.globalclimate.org, retrieved on 2nd November 2013.

United Republic of Tanzania (URT), *Managing risk and reducing vulnerability of agricultural system under variable and changing climate: Soil – water management research program*. Sokoine University of Agriculture Government Printer, Dar es Salaam 2007.

United Republic of Tanzania (URT), *National sample census of agriculture 2002/2003; Regional report: Dodoma Region, Volume V-A*, Dar es Salaam 2007.

United Republic of Tanzania (URT), *National climate change strategy and action plan; Division of Environment, Vice President's Office*, Dar es Salaam 2011.

Westengen O.T., Brysting A.K., *Crop adaptation to climate change in the semiarid zone in Tanzania: the role of genetic resources and seed systems*, „Agriculture and Food Security", 3(2014), no. 1.

PART II

FOOD PRODUCTION AND STORAGE

Chapter 5.

ASNATH ALBERTO MALEKELA
AGNES M.S. NYOMORA

DYNAMICS OF FOOD PRODUCTION AND THEIR DISTRIBUTION IN URBAN AREAS
A case of Dar es Salaam City, Tanzania

ABSTRACT

With rapid urbanization in many parts of the world, urban and peri-urban agriculture has become an integral part of the urban fabric as a response and adaptation to food insecurity. This study examined the dynamics of urban and peri-urban agriculture (UPA) in Dar es Salaam city. Primary and secondary data were collected using structured interviews, observations, focus group discussions and desk research methods. About 201 respondents engaging in urban and peri-urban agriculture were interviewed. IBM SPSS statistical package version 20 was used to analyze the data. Also, geographical information system (GIS) was used in mapping the spatial and temporal changes of agricultural land from 1981–2016. The findings revealed that food production in and around the cities is dynamic in many ways, it is gender sensitive whereby 54.2% growers were females, also it is characterized by shifting cultivation as (34%) respondents admitted to have shifted due to lack of land, water scarcity (25%) and urban sprawl (15%). In its mode of production, farmers worked on individual basis (71.6%) and others (28.4%) worked in groups. Agricultural products were sold mostly to local markets (98.1%) including supermarkets. Urban and

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peri-urban agriculture was dominated by the rural-urban migrants (90.5%). The dominant crops grown were vegetables (76.1%) and fruits (23.9%). Livestock kept were dairy cattle, broilers and layers chicken. GIS analysis showed that agricultural land decreased by 22% between 1981 and 2016 due to urban sprawl. The study recommends that urban and peri-urban agriculture should be given special attention because in surveyed local markets 47% of food products were sourced from UPA.

1. Introduction

Cities are facing enormous challenges not only in social fabric, but also in the food systems due to unprecedented population growth, making urban and peri-urban agriculture of great importance. Cities occupy a small percentage (4%) of land globally but now are habitats for over half of the global population[1]. African cities are described as having grown in pseudo manner with ruralisation of urban lifestyles, particularly with respect to agriculture in cities[2].

The African population is expected to become more urbanized, with the majority of the continent's inhabitants living in cities by 2030. Urban and peri-urban agriculture (UPA) plays an important role in diversifying urban diets and providing environmental services in urban and peri-urban areas by greening of the cities and making productive reuse of urban wastes[3].

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[1] D. Potts, *Challenging the myths of urban dynamics in sub-Saharan Africa: the evidence from Nigeria*, „World Development", 40(2012), no. 7, pp. 1382–1393; K.C. Seto, M. Fragkias, B. Güneralp, M.K. Reilly, *A Meta-Analysis of Global Urban Land Expansion*, „PLOS ONE", 6(2011), no. 8, e23777, doi: 10.1371/journal.pone.0023777.

[2] D. Maxwell, *Urban food security in Sub-Saharan Africa, in: For hunger-proof cities: sustainable urban food systems*, eds. M. Koc, R. MacRae, L.J.A. Mougeot & J. Welsh, Ottawa 1999, pp. 26–29; UN-Habitat, *Planning for Sustainable Cities; Global Report on Human Settlements 2009*, UN-Habitat Series, London 2009.

[3] E. Oyedipe, *National Food Crisis Response Programme*, Food and Agricultural Organization of the United Nations (FAO), Abuja 2009; M.R.S. Mlozi,

Although Tanzania is still predominantly rural, there is a rapid urbanization happening especially in the city of Dar es Salaam[4] which is one of the fastest growing cities in Sub-Saharan Africa. Urban agriculture in Tanzania has been in existence for many decades. Presently, urban agriculture is both extensive and intensive involving farmers from all walks of life i.e. from highly placed government civil servants and wealthy businessmen to the most disadvantaged slum dwellers[5]. Studies by Mlozi [et al.][6] in Dar es Salaam indicated that urban and peri-urban agriculture involves many people ranging from the very poor, the landless up to the middle and high-income residents.

Urban and peri-urban agriculture has been defined as "the production, processing and distribution of foodstuff from crop and animal production, fish, ornamental plants and flowers within and around urban and peri-urban areas"[7]. However, for the purpose of this study, UPA can be defined as the production, processing and distribution of food stuffs from crop and animal production.

A. Lupala, S.W. Chenyambuga, E. Liwenga, T. Msogoya, *Building Urban Resilience: Assessing Urban and Peri-urban Agriculture in Dar es Salaam, Tanzania*, eds. J. Padgham, and J. Jabbour, Nairobi 2014; S.J. Oltmans, *A case study on the food retail environment of Accra, Ghana. Graduate Theses and Dissertations*, paper 13634, Ames 2013.

[4] United Republic of Tanzania (URT), *Dar es Salaam Region Socio-Economic Profile*, Dar es Salaam 2014.

[5] Z.S.K. Mvena, *The Past, Present and Future if Urban Agriculture in Tanzania*, „Journal of Agricultural Economics and Development", 3(1999).

[6] M.R.S. Mlozi, A. Lupala, S.W. Chenyambuga, E. Liwenga, T. Msogoya, *Building Urban Resilience*..., op. cit.

[7] L.J.A. Mougeot, *Urban agriculture: definition, presence, potentials and risks*, in: *Growing cities, growing food: urban agriculture on the policy agenda*, eds. N. Bakker, M. Dubbeling, S. Gündel, U. Sabel-Koschella, H. de Zeeuw, Feldafing 2000, pp. 1–42.

2. Dynamics of food production and their distribution in cities

The development of UPA is strongly influenced by the dynamics of the urban social, economic, political, ecological and spatial systems with which it is connected[8]. Urban and peri-urban areas tend to undergo dramatic changes over a given period of time due to massive influx of people from rural areas, population density increases, and increased land prices due to emerging multiple land uses. Such changes affect the agricultural production systems, which tend to become smaller in scale with more intensive production, and shift from staple crops towards more perishable crops and animal production (meat, milk and eggs)[9]. The city is in a constant process of building and abolishing. Open spaces get built on and their formal or informal temporary users become evicted and are forced to find an alternative location or give up farming. As new roads and power lines get built, they create new vacant open spaces. Often, such newly created open spaces are soon gradually occupied by urban producers/growers thus demanding new informal leases (occupation or temporary leases). In this way, UPA is characterized as 'shifting cultivation' in space and time since its locations within the city may vary over time[10].

Environmental problems such as pollution caused by human activities, particularly industrial activities in cities, may force UPA to move to sites further away from the sources of pollution or make adaptations in the farming e.g. crop choices and irriga-

[8] FAO, *Profitability and sustainability of urban and peri-urban agriculture*, „Agricultural management, marketing and finance", occasional paper 19, Rome 2007.

[9] Ibidem.

[10] P. Drechsel, S. Graef, M. Sono, O.O. Cofi, *Informal irrigation in urban West Africa: an overview*, „IWMI Research Report 102", Colombo 2006.

tion methods[11]. Urban and peri-urban farmers can operate on an individual or family basis, formally or informally, and be organized in a group, cooperative or other types of farmer organizations[12]. Output distribution begins after harvested products are assembled and prepared for consumption. It involves post-harvest handling and marketing services such as cleaning, washing, sorting, grading and standardization, packaging, storage, processing and transportation[13].

Various studies have shown that the main actors along the production and supply chain are mainly women. Women play an important role in household food supply: through their productive labour; through their decision-making about production, consumption and division of food; and through the income they generate, which is often used to buy food[14]. In the current study, 54.2 percent of respondents were females.

3. Methods and materials

The study was conducted in Dar es Salaam region in Tanzania. This area was selected because it is one of the regions in Tanzania with the highest population, some with rural background and it has the largest number of urban farmers. A total of ten wards which engage in UPA from five districts of Dar es Salaam region were

[11] FAO, *Profitability and sustainability of urban and peri-urban agriculture...*, op. cit.

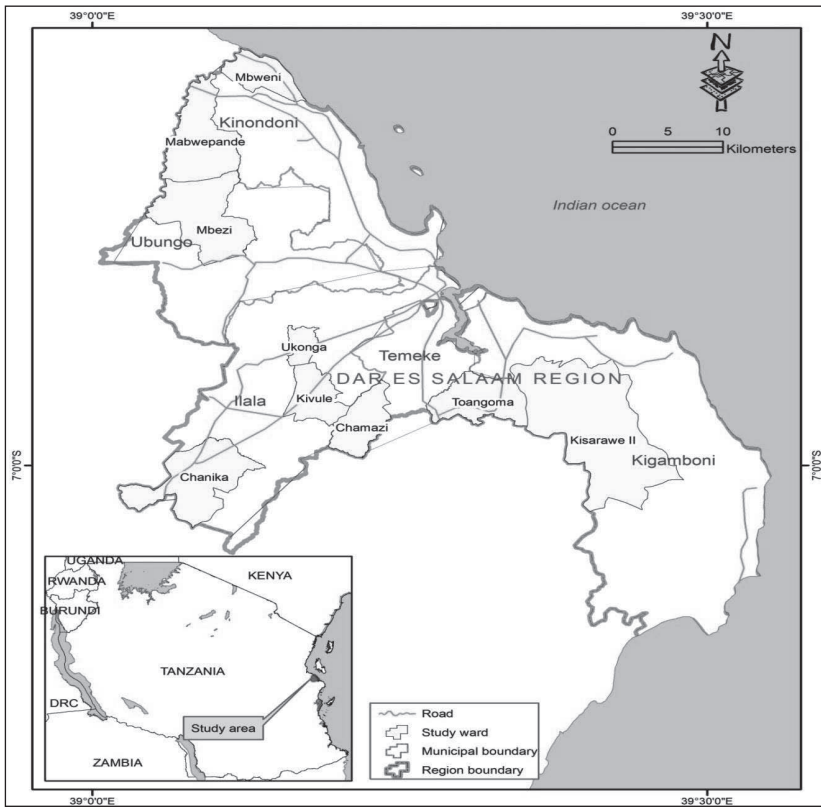
[12] Ibidem.

[13] I.S. Egyir, E.E. Ackah-Nyamike, *Urban and Peri-Urban Agriculture: Towards A Better Understanding Of Low-Income Producers' Organizations. ACCRA City case study report*, Legon 2006.

[14] FAO, *Urban and Peri-Urban Agriculture. A briefing guide for the successful implementation of Urban and Peri-urban Agriculture in Developing Countries and Countries of Transition. 1st Edition*, 2001, http//SPFS/DOC/27.8 Revision 2 Handbook Series.

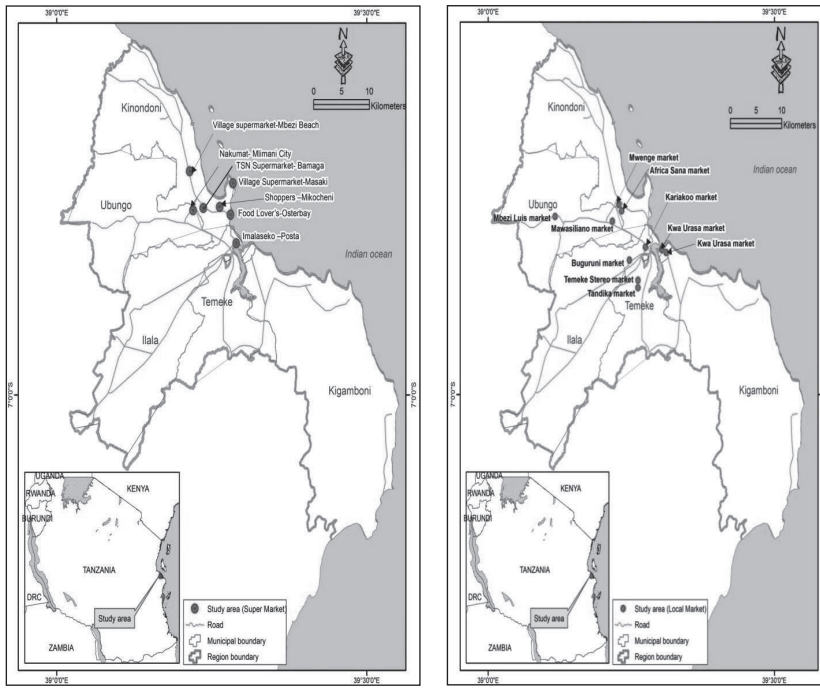
selected for the study: Toangoma, Chanika, Kivule, Ukonga, Kipunguni B, Mbezi, Kisarawe II, Mabwepande and Mbweni (Figure 1).

Figure 1. Map of Dar es Salaam showing studied wards



Ten local markets, namely Temeke Sterio, Tandika, Buguruni, Kariakoo, Kwa Urasa, Kigamboni-Feri, Mwenge, Afrika Sana, and Mbezi Luis local markets, were selected as avenues where urban farmers sold their products. Also, seven supermarkets namely Village, TSN, Food Lovers, Shoppers Plaza and Nakumat were studied (Figure 2).

Figure 2. Map showing the location of studied local markets and supermarkets



Primary data were collected using questionnaires, structured interviews and focus group discussions with the agriculturalists and local authority in Dar es Salaam city on the dynamics of food production and their distribution. In addition, direct observations were carried out in the study area to identify different crops and livestock raised.

Secondary data were collected through the documentary review. Quantitative data were analyzed using IBM SPSS statistical package version 20 in terms of descriptive statistics and cross tabs. Also, geographical information system (GIS) was used in mapping the spatial and temporal changes of agricultural land from 1981–2016.

4. Results and discussion

4.1. Profile of the respondents

The ages of the urban and peri-urban agriculturalists in the study area ranged from 18 to 61+ years, averaging between 41 to 60 years as shown in Table 1.

Table 1. Distribution of urban and peri-urban agriculturalists by age and sex

Age (Years)	Gender		Total
	Male	Female	
18–30 (n=13)	61.5	38.5	100
31–40 (n=72)	44.4	55.6	100
41–60 (n=107)	43.9	56.1	100
Over 61 (n=9)	55.6	44.4	100
Total (n=201)	45.8	54.2	100

It is generally perceived that food production in and around cities is normally dominated by people with rural background. In the study 90.5 percent of the respondents were migrants and only 9.5 percent were natives, which corroborates the general perception. The same was also revealed by Mvena[15] who found that urban and peri-urban agriculturalists were migrants from rural areas.

Gender wise, females seemed to be engaging highly in UPA by 54.2 percent than males who had 45.8 percent. Women play an important role in household food supply: through their productive labour; through their decision-making about production, consumption and division of food; and through the income they generate, which is often used to buy food[16].

[15] Z.S.K. Mvena, *The Past, Present and Future*..., op. cit.

[16] FAO, *Urban and Peri-Urban Agriculture*..., op. cit.

4.2. Sustenance in agricultural sites

The development of UPA is strongly influenced by the dynamics of the urban social, economic, political, ecological and spatial systems with which it is connected[17]. Findings from the study area revealed that 42.3 percent of the respondents had shifted from one location to the other due to various reasons. The findings from the study area revealed that 34 percent of the urban and peri-urban agriculturalists had shifted from one location to the other due to lack of land (Figure 5), this is an important factor which forces farmers to shift from place to place. Most of urban and peri-urban agriculturalists do not have their own land thus they depend on rented land and this makes them shift from place to place. And the majority farmed between 0.2–0.1 hectares by 61.3 percent as shown in Table 2.

Table 2. Farm size for UPA in the study area

Land size (ha)	Number of respondents	Percent
0–0.1	10	4.0
0.2–0.1	152	61.3
0.4–0.81	76	30.6
0.8 –2.02	8	3.2
2.02 –4.05	1	0.4
More than 4.05	1	0.4
Total	248	100

*Based on multiple responses

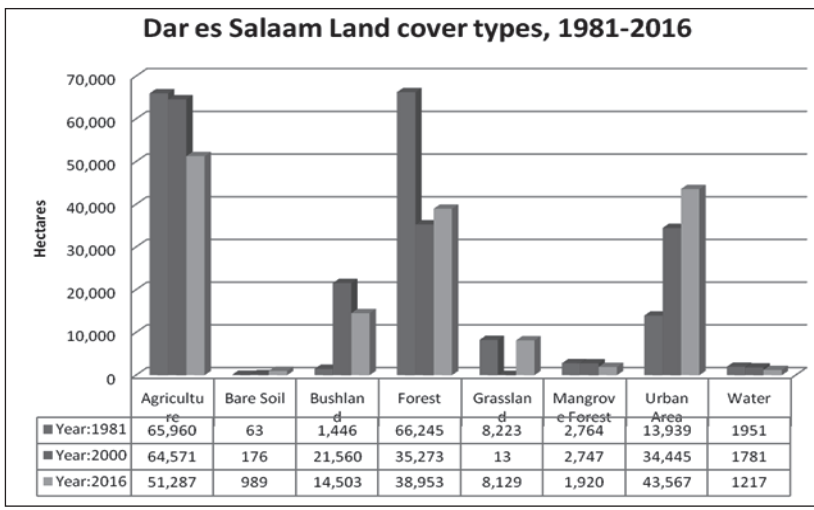
In the study area, it was revealed that about 15 percent of the respondents had shifted from place to place due to urban

[17] FAO, *Profitability and sustainability of urban and peri-urban agriculture...*, op. cit.

sprawl (Figure 5). FAO reported that urban and peri-urban areas tend to undergo dramatic changes over a given period of time due to massive influx of people from rural areas, population density increases, land prices tend to go up and multiple land use emerges.

Furthermore, Geographic Information Systems (GIS) analysis which was used to map the spatial and temporal land cover changes over the past 30 years from 1981–2016 showed that there was a significant change of agricultural land due to urban sprawl. While in 1981 the agricultural land in Dar es Salaam city was 65,960 hectares, this shrank to 51, 287 hectares in 2016. On the other hand, urban area (built land) expanded from 13,939 hectares in 1981 to 45, 467 hectares in 2016 as shown in Figure 3.

Figure 3. Types of land cover in Dar es Salaam region from 1981–2016

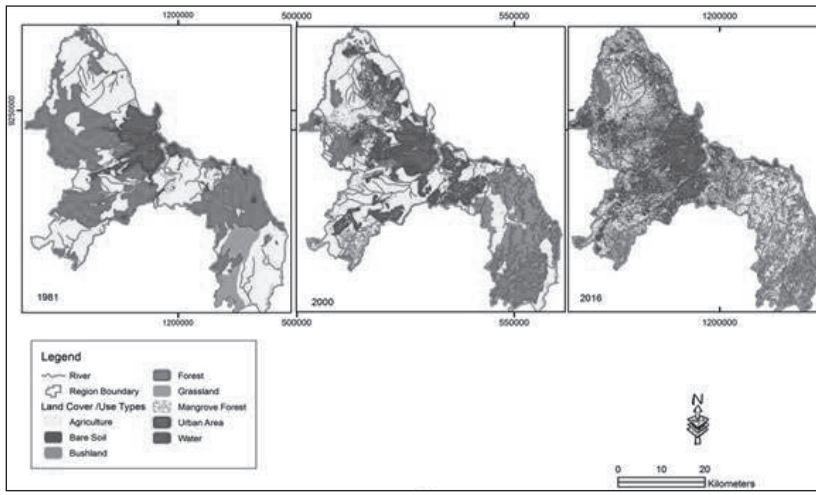


	Agriculture	Bare Soil	Bushland	Forest	Grassland	Mangrove Forest	Urban Area	Water
Year:1981	65,960	63	1,446	66,245	8,223	2,764	13,939	1951
Year:2000	64,571	176	21,560	35,273	13	2,747	34,445	1781
Year:2016	51,287	989	14,503	38,953	8,129	1,920	43,567	1217

In 1981 most parts of Dar es Salaam region were covered by agricultural lands and forests where only small parts were built

up, specifically in the city centre as shown in the Figure 4. In 2000 agricultural land continued to diminish as built land expanded as shown in figure. Furthermore, in 2016 many parts of Dar es Salaam region had changed into built settlements.

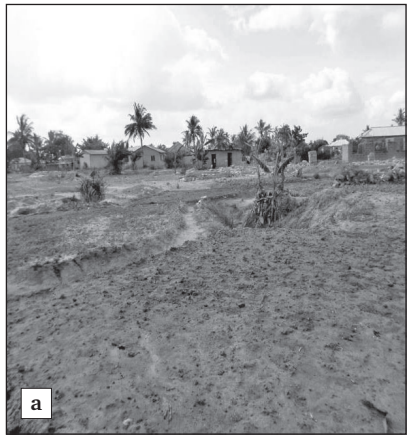
Figure 4. Land cover/use types in the study area in 1981, 2000 and 2016



Population increase in urban areas poses conflicts with access to water resources between urban residents and peri-urban residents and farmers. It has been observed that the priority for access to water has generally been given to urban residents at the expense of urban and peri-urban farmers.

Drying of water sources is one of the reasons that has made UPA to be dynamic. From the study area, 25 percent of the respondents mentioned that they had shifted due to drying of water caused by competition on water uses, increased temperatures and limited rainfall.

The findings from the study area revealed that about 12 percent of the urban and peri-urban agriculturalists had shifted after



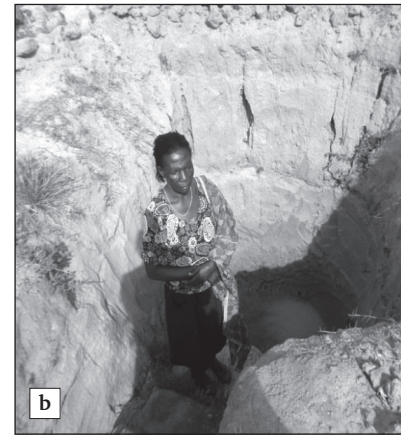
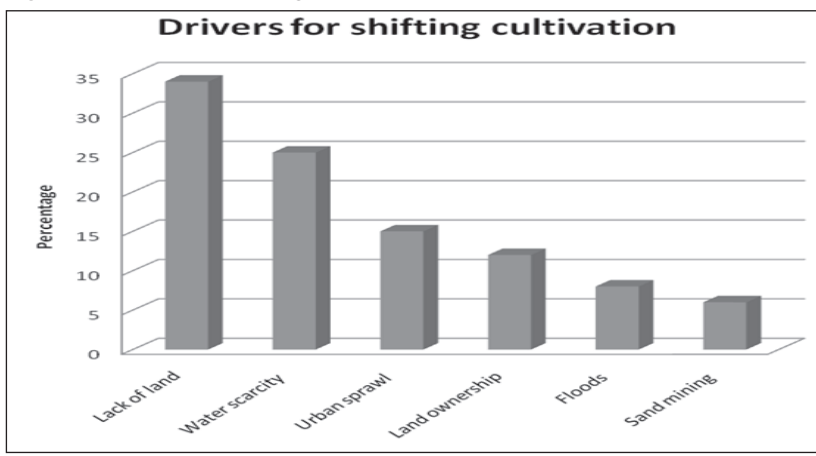


Plate 1. Drying farms in the study area (a) Bonde la Kikwete (b) Bonde la Amani in Kipunguni 'B' ward

acquiring their own land. This is because most of urban and peri-urban agriculturalists depend on rented land, thus if someone manages to buy own piece of land elsewhere, they normally shift to that new area.

Figure 5. Drivers for shifting cultivation



4.3. Mode of cultivation and distribution of urban and peri-urban agricultural products

This study revealed that urban and peri-urban farmer adopted two ways of operation whereby 71.6 percent mentioned to be working individually while 28.4 percent mentioned to be working in organized groups. Other reports also corroborate that urban farmers can operate on an individual or family basis, formally or informally, and be organized in a group, cooperative or other types of farmer organizations[18]. In the study area, some people worked in organized groups with the hope of being assisted either by the government or NGO's. Six (6) wards out of the 10 wards studied had agricultural groups named Kiwaumba, Amani, Majanipesa, Amani, Mabwe Gardeners and Muungano groups (Table 3).

Table 3: Agricultural groups in the study area

District	Ward	Agricultural group
Kigamboni	Kisarawe II	Kiwaumba Group
Ilala	Chanika	Amani group
Temeke	Toangoma	Majanipesa
Ilala	Kipunguni B	Amani group
Kinondoni	Mabwepande	Mabwe gardeners group
Ubungo	Mbezi	Muungano group

These groups admitted to have been assisted with agricultural machines i.e. tractors, water pumps, cassava grinding machines and water tanks as well as subsidies on some agricultural inputs such as cassava seeds. These machines and other subsidies were provided by the government through District Agriculture Development Plan (DADEP) and NGO's such as World Vision.

[18] FAO, *Profitability and sustainability of urban*..., op. cit.

Urban and peri-urban agricultural producers are able to satisfy their food needs and supply the market with agricultural products mainly crops, vegetables, poultry, eggs, milk, livestock and fruits[19]. In the study area, 50.2 percent of the respondents produced vegetables followed by 15.8 percent who produced fruits. Also 12.2 percent mentioned to be engaged in rice farming, 7.9 percent produced maize and cassava followed by 2.5 percent who produced beans and only 1.7 percent who mentioned to grow carrots and potatoes.

In the study area, some farmers were involved in keeping dairy cattle, broiler and layers chickens, ducks, pigs, goats, beef cattle and local chickens for eggs and meat. Livestock keeping in cities is common in many developing countries. Goats, sheep, cows, horses, camels, chickens, buffaloes, pigeons, rabbits/mice etc. can be found in cities around the world, FAO[20]. Livestock raising has often been part and parcel of urban agriculture; livestock keeping now seems to be recognized for the positive role that it can play in urban living conditions across the world by providing the urban dwellers with meat, eggs and milk[21]. It occurs on a small scale, with both small and large animals and it is subject to change.

Much of the food is produced for own consumption, with occasional surpluses sold to local markets FAO[22]. Output distribution

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[19] G. Yihdego, B. Kassa, *Urban and Peri-Urban Agriculture: An Important Form of Land Use, Employment Opportunity and Food Supply in Mekelle City and Enderta Woreda*, „Journal of the Drylands", 2(2009), no. 1, pp. 25–31.

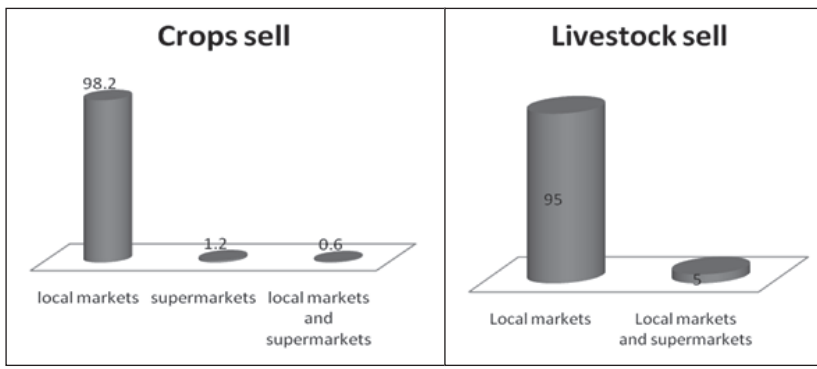
[20] FAO, *Urban and Peri-Urban Agriculture*..., op. cit.

[21] RUAF, „Urban Agricultural Magazine", 1(2000), no. 1 & 2; *Growing cities, growing food: urban agriculture on the policy agenda*, eds. N. Bakker, M. Dubbeling, S. Gündel, U. Sabel-Koschella, H. de Zeeuw, Feldafing 2000; FAO, *Peri-urban livestock systems. Problems, approaches and opportunities*, by J.B. Schiere, *Report prepared for FAO-AGA*, Rome 2000.

[22] FAO, *Urban and Peri-Urban Agriculture*..., op. cit.; I.S. Egyir, E.E. Ackah-Nyamike, *Urban and Peri-Urban Agriculture*..., op. cit.

begins after harvested products are assembled and prepared for consumption[23]. In the study area, 98.1 percent of the agricultural products were sold to the local markets, 1.2 percent of the products were sold to the supermarkets and only 0.6 percent of respondents mentioned to sell their products to supermarkets and local markets. About livestock products, 95 percent of the respondents mentioned to sell their products to the local markets and only 5 percent mentioned to sell their products to the local markets and supermarkets (Figure 6). However, in the study area crop farmers and livestock keepers claimed to have very little access to the supermarkets.

Figure 6. Avenues where produced crops and livestock were sold by respondents



5. Conclusion and recommendation

Urban and peri-urban agriculture changes over space and time due to various factors accompanied by population increase which puts pressure on water and land resources thus make urban and peri-urban agriculture very dynamic. In the distribution of UPA products, most of farmers sell their products to the local markets

[23] Ibidem.

despite the fact that there is significant number of supermarkets in Dar es Salaam. Thus, the study recommends that urban and peri-urban agriculture should be given special attention by the city planners and agricultural researchers and extension staff.

REFERENCES

Burgin S., Webb T., Rae D., *Stakeholder engagement in water policy: Lessons from peri-urban irrigation*, „Land Use Policy", 31(2013), pp. 650–659.

Drechsel P., Graef S., Sono M., Cofi, O.O., *Informal irrigation in urban West Africa: an overview*, „IWMI Research Report 102", Colombo 2006.

Egyir I.S., Ackah-Nyamike E.E., *Urban and Peri-Urban Agriculture: Towards A Better Understanding Of Low-Income Producers' Organizations. AC-CRA City case study report*, Legon 2006.

FAO, *Profitability and sustainability of urban and peri-urban agriculture*, „Agricultural management, marketing and finance", occasional paper 19, Rome 2007.

FAO, *Urban and Peri-Urban Agriculture. A briefing guide for the successful implementation of Urban and Peri-urban Agriculture in Developing Countries and Countries of Transition. 1st Edition*, 2001, http//SPFS/DOC/27.8 Revision 2 Handbook Series.

FAO, *Peri-urban livestock systems. Problems, approaches and opportunities*, by J.B. Schiere, Report prepared for FAO-AGA, Rome 2000.

Growing cities, growing food: urban agriculture on the policy agenda, eds. N. Bakker, M. Dubbeling, S. Gündel, U. Sabel-Koschella, H. de Zeeuw, Feldafing 2000.

Huang Shu-Li, Chen Yu-Hwa, Kuo Fei-Yu, Wang Szu-Hua, *Energy-based evaluation of peri-urban ecosystem services*, „Ecological Complexity", 8(2011), no. 1, pp. 38–50.

Maxwell D., *Urban food security in Sub-Saharan Africa*, in: *For hunger-proof cities: sustainable urban food systems*, eds. M. Koc, R. MacRae, L.J.A. Mougeot & J. Welsh, Ottawa 1999, pp. 26–29.

Mlozi M.R.S., Lupala A., Chenyambuga S.W., Liwenga E., Msogoya T., *Building Urban Resilience: Assessing Urban and Peri-urban Agriculture in Dar es Salaam, Tanzania*, eds. J. Padgham, and J. Jabbour, Nairobi 2014.

Mougeot L.J.A., *Urban agriculture: definition, presence, potentials and risks*, in: *Growing cities, growing food: urban agriculture on the policy agenda*, eds. N. Bakker, M. Dubbeling, S. Gündel, U. Sabel-Koschella, H. de Zeeuw, Feldafing 2000, pp. 1–42.

Mvena Z.S.K., *The Past, Present and Future if Urban Agriculture in Tanzania*, „Journal of Agricultural Economics and Development", 3(1999).

Oltmans S.J., *A case study on the food retail environment of Accra, Ghana. Graduate Theses and Dissertations*, paper 13634, Ames 2013.

Oyedipe E., *National Food Crisis Response Programme*, Food and Agricultural Organization of the United Nations (FAO), Abuja 2009.

Potts D., *Challenging the myths of urban dynamics in sub-Saharan Africa: the evidence from Nigeria*, „World Development", 40(2012), no 7, pp. 1382–1393.

RUAF, *Urban Agricultural Magazine*, 1(2000), no. 1 & 2.

Seto K.C., Fragkias M., Güneralp B., Reilly M.K., *A Meta-Analysis of Global Urban Land Expansion*, „PLOS ONE", 6(2011), no 8, e23777, doi: 10.1371/journal.pone.0023777.

UN-Habitat, *Planning for Sustainable Cities; Global Report on Human Settlements 2009*, UN-Habitat Series, London 2009.

United Republic of Tanzania (URT), *Dar es Salaam Region Socio-Economic Profile*, Dar es Salaam 2014.

Yihdego G., Kassa B., *Urban and Peri-Urban Agriculture: An Important Form of Land Use, Employment Opportunity and Food Supply in Mekelle City and Enderta Woreda*, „Journal of the Drylands", 2(2009), no. 1, pp. 25–31.

Chapter 6.

EMILIA K. BAMWENDA
GRATIAN R. BAMWENDA

IDENTIFYING AGRO-VALUE ADDING SECTORS THAT MAY CATALYZE ACCELERATED RURAL INDUSTRY DEVELOPMENT IN TANZANIA

ABSTRACT

This paper reviews and identifies key scalable agro-value adding sectors that will enable realization of the Tanzania Development Vision 2025, which envisions transformation of the country from a low productivity agricultural economy to a semi-industrialized one led by modernized and highly productive agricultural activities which are effectively integrated and strengthened by supportive industrial and service activities in the rural and urban areas. In addition, the paper discusses and proposes solutions on how to overcome the identified critical sector constraints. The top three sectors that were selected by stakeholders for driving rural industry development are: edible oil, grain, cassava, pulses-based processed food products and milk, and dairy products. The raw materials and products from these sub-sectors can be competitively value added in all agro-ecological zones in Tanzania, and are highly demanded country-wide, both in regional markets (EAC, SADC, COMESA)and in global markets. The output from this paper will be useful for policy dialogue at national and sub-national level, industrialization planning, may influence the direction of economic management and implementation schedules, and will inform policy

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and decision making during the preparation of strategic sector and district development plans.

Key words: Rural Industry Development, Value addition, Priority Sectors

1. Introduction

Currently, there is an ongoing exercise in Tanzania to identify and designate sectors and provide the necessary factor conditions that will generate high value added 'niche products' that will be new drivers of resource-based industrialization to realize the aspirations of the Tanzania Development Vision 2025 (TDV 2025), Sustainable Industrial Development Policy for Tanzania (SIDP), National Five Year Development Plan II 2016/17–2020/2021 (FYDP II), and Global Sustainable Development Goals (SDG 8: Decent work and economic growth; SDG 9: Industry, innovation and infrastructure; and SDG 1: No poverty). The aim is to tran form the economy from a low productivity agricultural economy to a semi-industrialized one led by modernized and highly productive agricultural activities which are effectively integrated and strengthened by supportive value-adding industrial and service activities in the rural and urban areas (URT, FYDP II, 2016).

Recently, Local Government Authorities (LGA) have started to identify sectors and create the appropriate policy and regulatory reform, investment and productive environments, promotion and supporting adoption of good agricultural practices and good manufacturing practices, and incentives and by-laws to support rural industrial development[1].

[1] G.R. Bamwenda, O. Mashindano, M. Nzuki, A. Hassan, *Simiyu Investment Guide*, 2017.

In addition, the Government is working with the business community, civil society and development partners towards ensuring that poor rural people have sustainable livelihoods, decent employment and access to social protection[2]. Furthermore, the private and public sector stakeholders are providing technical capacities to entrepreneurs to enable them add value to agricultural, livestock, forestry and fishery products, improve their existing enterprise, reduce unemployment in the formal and informal sector, and to improve their livelihoods[3].

This paper focuses on identifying key scalable agro-value adding sectors that may significantly contribute to the achievement of the rural industry development objectives, and discuses initiatives that, if undertaken, will strengthen the dynamism and pace of growth of these identified sectors so that they can be the driving force for value addition and industrial development in rural Tanzania.

2. Methodology

Implementation of this assignment involved desk research followed with interviews with key informants, in Kagera, Mwanza,

[2] Poverty rate in Tanzania has declined from 33.3% in 2007 to 28.4% in 2012. About 43.5% of the population is living on less than $1.25 per day (World Bank, 2015). About 33.4% of the rural population lives in poverty compared to 4% in Dar es Salaam and 21.5% in other urban areas. According to THDR 2014, Tanzania was ranked 159th out of 187 countries on the Human Development Index, scoring 0.488. Moreover, the poverty rate only marginally declined from 33.3% in 2007 to 28.4% in 2012, with the persistence of significant regional and urban/rural disparities.

[3] G.R. Bamwenda, *Formulation of the Rural and Urban Development Initiatives Strategic and Action Plan 2015–2019*, USAID, 2014; J.L. Simbakalia, *The Role of Regional Administration and Local Government in Influencing Inclusive Growth Strategies: The Case of Mtwara Region*, „ESRF Policy Brief", 2012, no. 2; G.R. Bamwenda, O. Mashindano, M. Nzuki, and A. Hassan, *Assessment of Institutional Capacity and Mapping Best Practices and Development Opportunities in Bukoba, Bunda, Ikungi. Ileje, Nyasa, and Sengerema Districts*, URT, UNDP, and UNEP, 2015.

and Dar es Salaam regions. Interviews were conducted to validate the desk research. A total of 35 key informants were interviewed in one District in every Region. The key informants who were interviewed at Local Government level included the following policy and decision makers: the District Planning Officers (DPLOs), District Agricultural, Irrigation and Cooperatives Officer (DAICO), District Livestock and Fisheries Officers (DLFOs), District Land and Natural Resources Officer (DLNRO), District Environmental and Sanitation Officers (DESO). Others were the District Community Development Officer (DCDO), District Councillors, Ward Executive (WEs) and Village Executives (VEs). In addition, interviews were held with eminent people (i.e., influential community members and experts), owners of value adding enterprises, members of agricultural and livestock associations and cooperatives, and members of Savings and Credit Cooperative Society (SACCOS).

Some of the information was gathered while the authors took part in the studies on "Pro-poor Economic Growth and Environmentally Sustainable Development"[4], "Development of the Strategic Plan for Rural and Urban Development Initiatives"[5], and "Development of the Simiyu Region Investment Guide 2017[6], and "Food Security Situation Analysis in Tanzania"[7].

The selection of sectors was based on the following key criteria: (i) Size of market serviced and potential for export of products; (ii) Availability and ease of access to affordable productive resources;

[4] G.R. Bamwenda, O. Mashindano, A. Hassan, M. Nzuki, *The Assessment Study to Indentify Institutional, Legal, Financial, Agricultural, Environmental, and Gender Challenges Inhibiting Development in Six Districts in Tanzania*, Ministry of Finance and Planning, Presidents Office Planning Commission, UNDP, and UNEP, 2015.

[5] Ibidem.

[6] G.R. Bamwenda, O. Mashindano, M. Nzuki, A. Hassan, *Simiyu Investment Guide...*, op. cit.

[7] H. Amani, O. Mashindano, G.R. Bamwenda, P. Kihinzile, *Food Security Situation Analysis in Tanzania, United Nations World Food Programme*, April 2016.

(iii) Availability of technically proficient personnel, technology/production processes, and production methodologies/practices; (iv) Potential for access to funding sources for early stage and growth finance for operations and upgrade; (v) Potential for making revenue generation and profitability; (vi) Competitiveness in terms of cost; (vii) Speed to market); and (viii) Investment Environment.

3. Study findings

3.1. Identification of subsectors for stimulating Tanzania's rural industrialization

The list of priority sectors selected by stakeholders for spurring rural industrialization is presented in Table 1. The top three sectors are: edible oil; grain, cassava, and pulses-based processed food products; milk and dairy. The products from these sub-sectors can be competitively produced in all agro-ecological zones in Tanzania, and are highly demanded country-wide, both in regional markets (EAC, SADC, COMESA) and in global markets[8]. The stakeholders were of the view that promoting and facilitating investments in the value chains of the selected sectors can significantly contribute to progressive proliferation of country-wide rural industrialization, generation of employment and income opportunities, and foreign exchange savings and earnings.

3.2. Overview of selected sectors

This section presents a brief overview of the selected sectors. The key factors that influence the demand for products from the

[8] *Making the Green Economy Work for Africa*, International Center for Trade and Sustainable Development, vol. 1, June 2012; *Tanzania Integrated Industrial Development Strategy 2025*; *East African Community Industrialization Strategy, 2012–2032*; SADC, *Industrialization Strategy and Roadmap 2015–2063*.

selected sectors are population growth and related food and nutrition security issues. Tanzania's population is forecast to grow significantly from 46 million currently to 65 million by 2030, and 110 million by 2050[9]. In addition, there is a significant ongoing shift from a rural-dominated population to one with a large urban population (UN World Population Prospects, 2017), i.e. rapid urbanization, with the percentage of urban population rising to almost 40% by 2030 and over 50% by 2050[10]). The following subsections present brief overviews of the edible oil, grain, cassava, and pulses-based processed food products, and milk dairy sectors.

3.2.1. Edible oil from oil seeds

In Tanzania, the edible oil is dominantly liquid products (75–80%). Edible oil is one of the main ingredients for food preparation in Tanzania. Edible oil mainly used is unsaturated vegetable oil and is mainly used for food preparation. Tanzania has a 23% share of Africa's vegetable oil output; the production is dominated by South Africa, 46%, Uganda, 15%, Morocco, 6%, and Egypt, 5% , and the rest by other countries. The demand for edible oil in Tanzania ranges between 300,000 and 400,000 tons per annum[11]

[9] United Nations, Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2008 Revision*, 2010, http://esa.un.org/unpp, Accessed April 27, 2010.

[10] Tanzania's population which is growing at a rate of 2.7%. It is expected that the population of URT will be about 65 million by 2030, with youth below 30 years constituting about 65% of the population. The age structure of Tanzania is: 0–14 years: 44.6% (male 11,173,655/female 10,962,186); 15–24 years: 19.5% (male 4,838,216/female 4,841,338); 25–54 years: 29.5% (male 7,340,129/female 7,289,483); 55–64 years: 3.5% (male 745,214/female 985,524); 65 years and over: 2.9% (male 629,483/female 833,910) (2014); The National Employment Policy (NEP) 2017.

[11] TEOSA, *Assessment of the Potential of Oil Seeds Produced in Tanzania*, October, 2012.

(Tanzania Chamber of Commerce, Industries, Agriculture, 2017). The UN Food Agriculture Organization recommends an average per capita consumption of 21 kilograms per annum; but the consumption in Tanzania is much lower than that, and estimated to be 5 kilograms per annum[12]. The key factors that will influence the demand for edible oil are the processes of urbanization that are altering the fundamental organization of production and consumption (rapid expansion of the urban population), implications of food availability and access, and demand for a more diverse diet in the future, including the change in diet towards fried foods.

Oil seeds production

Vegetable oil is mainly made from sunflower, cotton, groundnuts, sesame and palm oil seeds, and a certain amount is from imported palm oil. The breakdown by type of oilseed is as follows: Sunflower: 49%; Groundnuts: 26%; Sesame: 20%; Cotton seed: 4%; Palm kernel: 0.7%; and Soybean: 0.1%. Current estimates show that only between 40–50% of cooking oil is produced locally from small and medium factories in Singida, Dodoma, Arusha, Manyara, Dar es Salaam, Mwanza, Mbeya and Kigoma; the rest is imported from Indonesia and Malaysia (MITI, 2017).

The oil seeds, the raw material, used for production of oil are mainly cultivated by over four million smallholder farmers on 1–3 ha, using low technology, and with little inputs. The primary production of oil seeds is dominated by smallholder farmers (> 90%) and located in all parts of Tanzania's agro-ecological zones, even in areas with unreliable weather patterns, such as semi-arid Tabora, Dodoma, Singida and Manyara. In addition, there is a number of medium to large scale producers including institutional producers like Magereza, JKT, and a few private large

[12] Ibidem.

scale producers. It is worth mentioning that in the last decade Tanzania has witnessed an increased interest in investment in oil crops farming especially for the primary production of edible oil and biofuel products. In the year 2016/2017, Tanzania produced 6.667,893 million tons of oil seeds (sunflower, ground nuts, sesame, soybean, and palm kernel) (MITI, 2017). The production is expected to rise significantly in the next decades because more than 70% of the 163 Districts have selected oil seeds as strategic crops in the District Agricultural Development Plans (DADPS), One District One Product initiative, and production of oil seeds are included in the National Five Year Development Plan 2016/2017–2020/2021, and draft Agriculture Sector Development Plan II. Recently, a surge in the production of oil seeds has been observed in new entrant regions such as Katavi, Njombe, Iringa, Simiyu, and Rukwa.

In the last decade, there have been higher plantings encouraged by improved seed subsidy, sustainable market, high prices, and favourable climatic conditions, training of farmers in good agricultural practices, and increasing buyers of oil seeds. This has led to larger harvests and improved output.

Table 1. Production of Oil Seeds in the period 2009–2014

	Production (MT)					
Crop	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Sunflower	162,019	348,877	786,902	2,625,000	1,629,698	1,721,875
Groundnuts*	256,401	320,582	651,397	810,000	1,425,000	1,635,335
Cotton seed	170,000	168,212	103,075	142,340	224,000	155,000
Sesame	72,932	65,557	357,162	1,050,000	1,050,000	1,138,920
Palm kernels	8,999	9,000	10,000	10,500	11,000	11,428
Soybeans	3,900	4,300	2,500	3,490	5,830	6,025

*Groundnuts with shell
Source: Ministry of Agriculture, Livestock and Fisheries

Tanzania exports very little oilseeds or derivative products, about 30,000 tons annually to EAC, COMESA, and SADC countries, European Union, Middle East countries, and the trend is declining because oil seeds production is insufficient to supply domestic demand (MITI, 2017).

Table 2 presents yields of major oil seed in Tanzania from 2006/07 to 2012/13. As can be portrayed from the table, the yield trend for these crops is almost constant. This indicates that smallholders' oil seed productivity is generally lagging.

Table2. Yield Trends (Tons/Ha) for selected oil seeds for the period 2006/2007 – 2012/13

CROP	Area 2012/2013 (000 Ha)	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013
Sunflower	1629.7	1.3	0.7	0.8	0.7	1.0	1.0	1.2
Groundnuts	943.7	1.1	0.7	0.8	1.0	1.0	1.0	1.5
Sesame	860.0	1.3	0.4	0.6	0.7	0.7	0.7	1.2

Source: Ministry of Agriculture, Livestock and Fisheries

It is therefore evident from Table 2 that the agricultural productivity growth rate in the smallholder oil seed sector is very low. This is worrying because most of the annual growth is arising from increase in acreage at the expense of biodiversity and related environmental challenges. The effect of low growth rate of agricultural productivity is widespread in Tanzania, resulting in agricultural GDP growing at only 4 per cent. Productivity growth rates must be accelerated in order to match with increasing demand for vegetable oil products/raw materials, starting with improving mobilization and availability and accessibility of productive resources, strengthening research and development, producer skills development, encouraging technology modernization, investment attraction, and promoting and up-scaling intensification in the oil

seed production systems. If the latter issues are effectively implemented, significant gains can be made in increasing competitiveness at each stage of the vegetable oil value chain.

Value Addition

Value addition to produce oil is done through the process of crushing and removing of foreign particles, filtering, and oil storage. The main technologies used are crushing and cold pressing to produce mainly edible oil for the family, community or for selling and onward distribution to buyers' outlets. This method, which entails minimal processing, produces light, flavourful oil suitable for some cooking needs. In many small crushing units, the oil is then filled into 5–20 litre plastic containers and sold to the kiosks, market or to buyers from towns. The remaining by-product with high carbohydrate and oil content, i.e. the oil seed cake, is used for animal feed and a certain amount is exported.

There are also several factories in major oil seed producing regions, such as Arusha, Singida, Dodoma, which produce oil from oil seeds. In this case, oil production involves cleaning the seeds, grinding, pressing and extracting the crude oil, and further refining using physical and chemical processes to remove colour, odour, and bitterness. Efforts are needed from the stakeholders to facilitate these factories to upgrade their competitiveness and explore new markets, including improving the business environment, and committing adequate financial resources required.

The vegetable oil demand is expected to increase in the future because end-consumers are shifting from non-vegetable oils to vegetables oils because of fear of high content of low-density lipoprotein (LDL) cholesterol and its adverse effects on the blood circulation system and potential for heart diseases and stroke. Other interviewed stakeholders worried about the quality of imported cooking oils, feeling that it is substandard.

Key issues affecting performance of the edible oil value chain

The key issues constraining the performance of the edible oil value chain include: i) challenging availability and accessibility of adequate high quality, high yielding certified oil seeds; ii) availability of agricultural inputs including fertilizers and plant health substances and application of good agricultural practices; iii) access to finance and use of insurance across the value chain (stringent credit terms-security, high interest rates greater than 15%, and challenging repayment patterns); iv) access to high oil yielding technological processes and application of good manufacturing practices; v) availability and high cost of utilities; vi) compliance and adherence to internationally recognized food quality and safety standards; vii) attracting investors into medium and large scale oil seed processing; viii) limited research support; and ix) limited promotion and branding of locally produced edible oil. These issues and other challenges need to be addressed to enable the accelerated growth and competitiveness of the edible oil industry in rural settings.

There has been a surge in production of oil seeds to cater for increasing demand of healthy edible oil from oil seeds, which stands at more than 350,000 tons annually. Note that 45% is produced locally and about 55% is imported.

3.2.2. Grain, cassava, and pulses-based processed food products

Overview of grains, cassava, and pulses

Food crop production, in particular grains, cassava, and pulses, dominates the agricultural sector in Tanzania, which in the year 2015 contributed to 29.1% of the GDP. Out of the 5.1 million hectares cultivated annually, 80 percent of the area is under food crops. Crop production provides employment to 65.5% of the citizens. In the year 2016, Tanzania produced 16, 172, 841 tons of food crops. The country food needs for the period 2016/2017 was 13,159,326 tons. Hence, the country had a surplus of 3,013,515

tons, out of which 1,101,341 tons were cereals, and 1,912,174 were non-cereals. Tanzania produces a number of food crops, which range from cereal to non-cereal. For example, in the year 2016, Tanzania produced 6.1 million tons of maize, 2.2 million tons of rice, and 6.7 million tons of non-cereals. The food self-sufficiency was 123%. The country food self-sufficiency ratio over the past ten years has ranged between 88 and 120 percent[13].

Figure 1 presents production trends of main food crops in Tanzania. Maize is the most important food crop in most parts of Tanzania, followed by cassava, bananas, potatoes, and pulses. As seen in Fig. 1, in the period 1995–2001, the production of maize, rice, cassava, millet, sorghum, potatoes, pulses and bananas grew by an average of 3.5%[14]. Unusually good weather in these years was a major factor, particularly when one considers the fact that the overwhelming majority of agriculture in the country is rain-fed. The observed production undulations are due to variability in weather patterns and drought spells, inconsistencies in timely and adequate supply of inputs such as improved seeds and fertilizers, and variability of produce prices. For instance, the fall in farm gate prices during bumper harvests normally results in decrease in output in following season. Other factors causing undulations in food crop production levels include inadequate on-farm and post-harvest management and plant diseases. For example, in the last two decades, cassava in the major producing region of Lake Victoria Zone has been infested by a number of yield-reducing agents and pests such as Cassava mosaic virus-CMV causing Cassava mosaic disease, whitefly (*Bemisia tabaci*), cassava green mites-CGM, Cassava brown streak disease-CBSD, Cassava bacterial blight-CBB, which may lead to marginal or no yields.

[13] Ministry of Agriculture, Livestock and Fisheries, May 19, 2017.

[14] Tanzania Economic Survey, 2012.

Factors affecting production of grains, cassava, and pulses and proposed areas of focus

The interviewed stakeholders in Kagera and Mwanza region reported that the key factors affecting grains, cassava, and pulses production include: i) low production resulting from small size of land; ii) difficulties in accessing low cost capital for farming and value addition processes; iii) weather conditions (recurring climate shocks), low application of irrigation farming[15]; iv) low levels of mechanization[16], which is still relatively low as 64 percent of land is cultivated using hand hoes, with that using animal traction accounting for 24 percent and tractors (including hand-held powered tillers) covering 14 percent; v) inadequate provision of information, knowhow, and extension services leading to low use of agricultural good practices; vi) poor market integration, market development and market infrastructure challenges; and vii) agricultural production at household level is characterized by the use of traditional inputs.

Therefore, there is a need to develop and deliver programs aimed at improving supply side constraints such as agricultural productivity, access to finance and productive resources (seeds, fertilizers, pesticides, and agricultural techniques), postharvest losses; business environment issues such as coordination of the crop sub-sectors, complex application of taxes, and capacity strengthening of supporting institutions such as extension service; and addressing climate change adaptation and marketing development

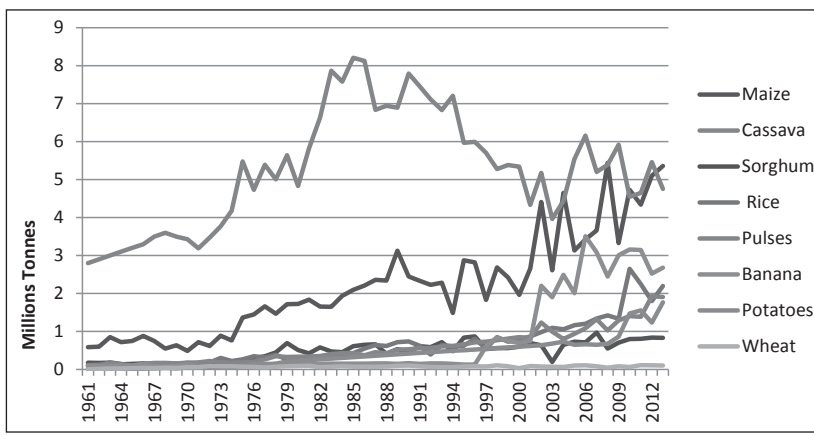
[15] Area under irrigation increased from about 200,000 ha in 2001 to 399,000 ha in 2011, short of set 1 million ha by 2015 (out of the high potential for irrigation area of 2.3 million hectares. The irrigation efficiency is still low with only 5 percent water retained (set target was 15 percent by 2015).

[16] The proportion of farmers using mechanized farming/tilling increased from less than 15 percent in 2001 to the current 20 percent, below the set target of 25 percent. The current annual demand for new tractors is approximately 1,800 units.

issues, such as compliance to quality and safety standards along the value chain, targeted market development interventions, sector clustering to promote collective production and marketing of products (e.g. cassava production and value addition in the Lake Zone, and Lindi and Mtwara area).

The interviews in Kagera and Mwanza, and the findings from the Poverty Environment Initiatives show that value addition and commercial grain processing of food crops is still low[17](URT, 2016). The main processes involve milling into flour and packaging by enterprises and by public organizations such as the Cereals and Other Produce Board. Aweak agro-processing industry in Tanzania contributes to huge post-harvest losses estimated at 30–40 percent for cereals and 40–60 percent for fruits, vegetables and fish[18].

Figure 1. Food crops production trends (MT)



Source: Data extracted from FAOSTAT 2015

[17] G.R. Bamwenda, O. Mashindano, A. Hassan, M. Nzuki, *The Assessment Study to Indentify Institutional...*, op. cit.

[18] Ministry of Agriculture, Food Security and Cooperatives (MAFC), *Assessment of the achievements of the agricultural sector development program (ASDP)*, 2012.

The majority of interviewees in this study and those who participated in the studies on Poverty and Environment Initiatives[19] (URT, 2016) were of the view that promoting and facilitating quality and efficient processing of grains, cassava, pulses, and non-grain food products and quality warehousing of products can significantly catalyze rural industrialization. They proposed: i) promoting and supporting financially investments (capital costs) in milling machines/plants and efficient technological processes for adding value including fortification processes; ii) training adequate number of technicians for operating mills and conducting maintenance; iii) ensuring stable, reliable, and low cost electricity in rural areas; iv) ensuring access to technical support services to ensure availability of spare parts and repair kits; v) facilitating access to information and direct business relationships and linkages between farmers and the processors/millers to ensure adequate and consistent supply of crops to enable millers to have adequate capacity utilization of the installed machines; and vi) the government and private sector should construct reliable commercial storage facilities, especially close to farmers' production areas and near millers, to ensure quality warehousing capacities, pest management, and adequate compliance to food safety standards.

This stakeholder consensus is similar to that observed in other parts of Tanzania[20]. In view of this, agro-processing was incorporated in the national industrialization processes and features

[19] G.R. Bamwenda, O. Mashindano, A. Hassan, M. Nzuki, *The Assessment Study to Indentify Institutional...*, op. cit.; SAGCOT, *Southern Agricultural Growth Corridor of Tanzania, Investment Blue Print*, January 2011.

[20] Evaluation of the Institutional Framework to Facilitate Tanzania's Industrialization Processes, Presidents Office Planning Commission, May 2013; L. Katera and C. Jahari, *Workshop on the Global Competitiveness Report: Findings for Tanzania*, REPOA, October 18, 2017.

predominantly in the Action Plan for Second National Development Plan 2018–2019[21]. In support of this, in November 2017, the Government has allocated substantial resources to support rural industrialization in the Budget Framework for National Development Plan for 2018/2019.

3.2.3. Milk and dairy sector

Trends in production and consumption of milk and dairy products

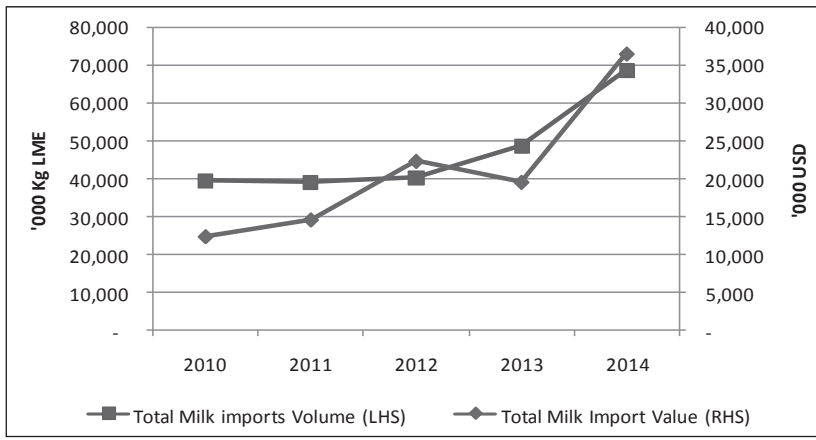
Table 3 presents the national milk production trends. As seen, the bulk of the milk originates from indigenous cattle that form over 90% of the cattle population. As of the year 2016/2017, Tanzania has 28.44 million cattle and 16.67 goats, and 5.01 million sheep (MALF, 2017). But milk and dairy products are mainly produced from cattle. Most of the milk is consumed at household level and local market; only about 3% of the milk filters through to the formal market and for processing purposes. Most of the raw milk is sold directly by farmers and small scale traders to the final consumer without it passing through processing facility. As seen in Table 3, milk production in Tanzania has been increasing steadily with time. According to the Ministry of Agriculture Livestock and Fisheries and other studies, the observed increase by both indigenous and improved dairy cattle is mainly due to increase in herd size rather than productivity of cattle. In addition, the supply of milk is affected by seasons. The supply normally falls in the dry season from July to November, and picks again with rainfall and abundance of feed in December to February, dips slightly again from February to April, and then there is an upward swing from April to July due to rains in March and subsequent increase in

[21] *Second National Development Plan 2016/17–2020/21: Nurturing Industrialization for Economic Transformation and Human Development*, Ministry of Finance and Planning, March 2016.

grass quantities in most cattle grazing ecological zones, and then it starts to drop thereafter.

According to the recent study by[22], Tanzania is a net importer of milk, in spite of the tremendous potential of milk production in the country (Figure 2). As shown in Table 4, domestic supply alone does not meet the local demand for milk and milk products. The estimated current formal milk consumption is about 112 million litres. This figure is conservative as it does not include milk consumption most of the remote rural areas, which do not go through the market, which is estimated to be 90 per cent of the total domestic milk production.

Figure 2. Trend Milk Imports Volume and Value in Tanzania



Source: UNCOMTRADE, 2016

As seen in Figure 2, in the period from 2010 to 2014, milk imports in Tanzania almost doubled from less than 40 million litres Liquid Milk Equivalent (LME) per annum in 2011 to 70 million

[22] TAMPA, *Effects of Milk Imports on Domestically Processed Milk Competitiveness in Tanzania*, June 2016.

litres LME per annum in 2014. In other words, the country has been spending more than USD 20 million per annum since 2010, with a spike seen in 2014 rising to more than USD 35 million. This is a very significant amount spent only in importing milk into the country rather than exporting milk which consequently results in loss of millions of dollars every year.

In the case of Liquid milk (Harmonized System Code of Milk and Cream, HS 0401), which largely comprises UHT milk, more than 98 per cent of all imports originate from Kenya (62 per cent), South Africa (32 per cent) and Uganda (4 per cent) (UN-COMTRADE, 2016).

Table 3. National milk production from dairy cattle, tons

Years	Indigenous Cattle	Improved Dairy Cattle	Total National Milk Production
2001	514,000	300,000	814,000
2002	578,000	322,500	900,500
2003	620,700	359,800	980,500
2004	813,700	366,300	1,180,000
2005	920,000	466,400	1,386,400
2006	941,815	470,971	1,412,786
2007	945,524	475,681	1,421,205
2008	980,000	520,000	1,500,000
2009	1,012,436	591,690	1,604,126
2010	997,261	652,596	1,649,857
2011	1,135,422	608,800	1,744,222
2012	1,255,938	597,161	1,853,099
2013	1,297,775	623,865	1,921,640
2014	1,339,613	650,570	1,990,183
2015	1,381,451	677,275	2,058,726
2016	1,423,288	703,979	2,127,267

Source: Ministry of Agriculture, Livestock and Fisheries, 2016, and Budget Speeches 2010–2017, Economic Survey Books 2010–2014

Table 4. Estimated Milk supply and demand in Tanzania in liters (Without Imports)

	2014
Total Milk processed (l/day)	166,620
Less: Azam Dairies	45,000
Local milk processed (l/day)	121,620
Local milk processed (l/yr)	44,391,300
Add: total milk imports (l/yr)	68,775,066
Total Supply of marketable milk (l/yr)	113,166,366
Less: Exports	394,992
Total Domestic Consumption (Demand) (l/yr)	112,771,374

Source: TAMPA 2016, UNCOMTRADE

The milk products produced and preferred by customers are presented in Tables 4 and Figure 3 and they indicate that customers in Tanzania mainly prefer fresh milk followed by powdered milk and cheese. Other products in great demand are ice cream and yoghurt. At local level, these preferences may vary greatly.

A study by Covarrubias [et al.][23] showed that in rural areas, most of the milk is consumed at home. The dairy consumption is almost equal in both rural and urban areas, i.e., 14.64 litres and 15.61 litres, respectively. In addition, as shown in Table 5, the total value of expenditure on fresh milk and dairy products is double in urban areas compared to rural areas. The study further reveals that rural households that do not participate in livestock production purchase a much greater quantity of dairy products. And for those that undertake livestock production, dairy products account for more than 33% of livestock products consumed.

[23] K. Covarrubias, L. Nsiima, A. Zezza, *Livestock and livelihoods in rural Tanzania. A descriptive analysis of the 2009 National Panel Survey*, Joint paper of the World Bank, FAO, AU-IBAR, Ireland the Tanzania MALF with support from the Gates Foundation, 2012.

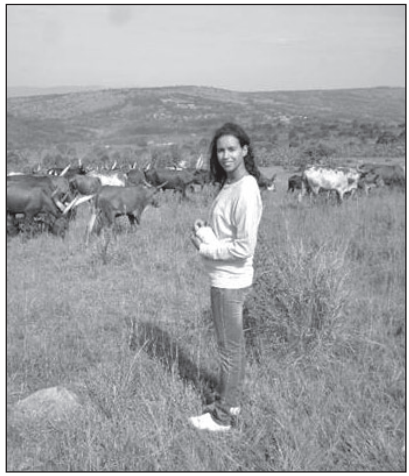
As shown in Table 5, consumption of dairy products in Tanzania shows a narrow product range. However, according to FAOSTAT, Tanzania's annual per capita consumption of milk has been gradually increasing over time, from 19.69 kg/capita/year in 2010 to 23.51 kg/capita/year in 2013. According to the MALF data (MALF, 2017), the average consumption of milk is 47liters/capita/year. The interviewees reported that processing of milk products may not only foster rural industry development but also may lead to product diversification and enhance the health of communities, in particular the children, who are affected by stunting, wasting, and underweight[24].

Table 5. Annual per capita value of dairy and livestock product consumption

Product	Urban (TZS)	Rural (TZS)
Dairy	12,021	7,819
Fresh milk	9,909	5,414
Butter	1,100	420
Other dairy products	1,012	1,985
Total value	24,042	15,638

Source: Covarrubias et al. (2012)
TZS: Tanzania Shilling

[24] Wasting, or low weight-for-height, is a sign of acute malnutrition and is far less common, at a prevalence rate of 4.9 percent. Finally, 16.2 percent of Tanzanian children under five are underweight or low weight-for-age, which reflects a combination of chronic and acute malnutrition (FAOSTAT, 2014). Stunted and underweight children are most likely to suffer from impaired development and are more vulnerable to diseases to the extent that an estimated 50 percent of the under-five mortality rate in Tanzania is caused by malnutrition (Amani, et.al. 2016). Nutrition indicators for children under five have shown some signs of improvement in recent years. Stunting, underweight and wasting rates among children aged 0 to 59 months declined from 44, 29.5 and 5.3 percent respectively in 1999, to 42, 16 and 3.8 percent in 2010. Anaemia is also highly prevalent among under-fives, with 72 percent of all children aged 6 to 59 months.

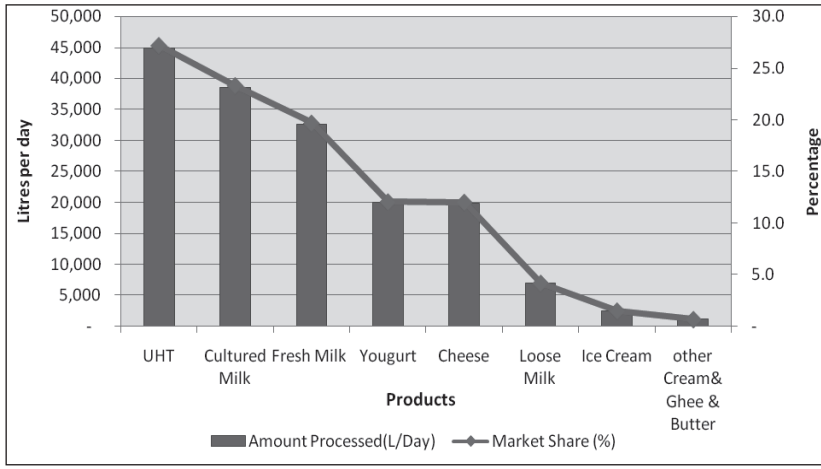



Ankole indigenous cattle feeding on natural organic grass in Nyaishozi, Kagera
Source: Authors from field work, 2015

Key issues impacting the milk and dairy subsector

The main issues facing the milk and dairy products sector are: i) seasonality in the supply of raw milk, whereby very little milk is supplied in the dry season; ii) failure to access good and reliable markets is one of critical problems, and this has been caused by cold storage and high transport costs involved in transporting the products to the markets; iii) use of low technology whereby products stay for very few days on shelves before getting spoilt; iv) lack of proper milk transportation facilities; v) lack of dairy trained personnel were also cited by processors as among the obstacles hindering them from operating at full capacities and from expansion; vi) underdeveloped market of milk products; and vii) for a sustainable supply of milk and to address the issue of seasonality of milk supply from the traditional cattle herd, there is a need to introduce dairy cattle farming in rural areas where there are potential markets for dairy products.

Figure 3. Market share of dairy products processed in Tanzania



Source: TAMPA, 2016

The stakeholders interviewed in this study and those from other recent studies[25] recommended that investment promotion to attract investors (beginning with about 1,000 liter daily capacity) should be made in the production of, in the descending order, Ultra High Treated (UHT) Milk, Cultured milk (Mtindi), Yoghurt, Ghee, Cheese, Cream, Butter, and powder milk when there is access of liquid milk, e.g. in the wet season. These products are demanded by consumers and by the tourism industry. The interviewees proposed that first and foremost huge investments must be made in dairy farming to produce quality and adequate milk, and in marketing and awareness raising on the benefits and value of milk products to health.

[25] L.R. Kurwijira, GR. Bamwenda, M. Baisi, A. Hassan, M. Nzuki, *Feasibility Study and Business Plan for Expansion of Meatu Milk Company Ltd*, 2017; URT, *Baseline Study of the Dairy Value Chain in Tanzania. Assessment of Challenges and Opportunities for Investment, Ministry of Agriculture, Livestock and Fisheries*, September 2016.

Priority factors that may facilitate accelerated development of the selected sub-sectors

The following factors and supportive sector conditions were frequently mentioned by stakeholders as key to driving the development and growth of the selected sub-sectors: (i) Developing industrial parks and special economic zones (SEZ):allocation, preparation of serviced industrial land in suitable locations in districts and construction of factory shell buildings/business premises with (supply of water, gas, electricity, and communication) that are ready for establishing value addition businesses and operations[26]; (ii) training and educational offerings to raise technical, management, and supervisory capacity: developing a human resources base to guarantee a knowledgeable and skilled workforce for existing and potential investments[27]. This includes training machine operators, supervisors, industrial engineers, management and administration cadre, and staff for maintenance, information technology, and logistics functions; (iii) facilitating access to long-term, low cost development, operational, and upgrading/modernization finance, with a cost of finance below 10% (currently the interest rate is between 14–16% per annum)[28]; (iv) creation of a strong and vibrant value adding enterprises with sustainable capacity utilization there is a need for continual improvement of the investment regime and climate, including tariff/taxation considerations, to attract additional domestic and foreign investments, to reduce the cost of doing business, enabling access to

[26] For instance, using the Public-Private Partnership Investment or Build Operate and Transfer Approaches.

[27] Using e.g. the National Skills Development Strategy, and Skills Development Levy.

[28] Enhancing provision of financial services at district level from financial institutions, private investors/venture capital, grant providers, vendors/customers, and development partner funding sources.

support services, and addressing critical issues that are impacting competitiveness; (v) adequate and stable supply of raw materials/ inputs at reasonable cost; (vi) modernization, use of innovations, and appropriate technology and systems to enhance productivity, product quality, and competitiveness level; (vii) working closely with research organizations to promote technology transfer and adaptability and to address emerging opportunities and opportunities, including compliance to buyer, regulatory, and market quality, safety, environmental and social standards; and (ix) facilitating regional and international market access through collection and delivery of strategic market intelligence, negotiations, product diversification, market planning and communication, e.g. through developing and promoting firm and district investment profiles.

4. Conclusion and recommendations

4.1. Conclusion

The stakeholder consultations revealed that the top three sectors that may provide an impulse for rural industry development are: i) edible oil; ii) grain, cassava, and pulses-based processed food products; and iii) milk and dairy products. The raw materials and products from these sub-sectors can be competitively produced and value added in all agro-ecological zones in Tanzania, and are highly demanded country-wide, in regional markets (EAC, SADC, COMESA countries) and in global markets.

These sectors have the potential not only to drive progressive rural industrialization but also to support livelihoods of household's country-wide along the value chains from production, value addition, marketing, transportation and retailing activities. In addition, with application of productivity and quality enhancing value addition technology, production methodologies, processing practices and compliance to market standards and buyer

and customer requirements and needs, this sector shows a great potential to generate foreign exchange generation from regional and international markets.

4.2. Recommendations

According to the interviewed stakeholders, the critical initiatives that need to be undertaken to support accelerated growth of the selected sectors are:

Special attention should be paid to formulation/review of compatible and implementable policies, regulatory framework, strategies, plans and interventions at national and local levels;

Passionate, knowledgeable and committed leadership to lead the effective implementation of needed interventions and sustaining the outcomes and long lasting impacts of those interventions;

Empowerment of actors through strengthening the capacity and capability of key entities in the value chains, including increasing technical skills and knowhow for enhancement of productivity, safety, and quality improvement, and efficiency in operations and business management;

Imparting innovation and entrepreneurship culture for harnessing sound and evidence based decision making, enterprise development, and pursuing profitable investments that yield sound returns;

Facilitating easy access of key affordable productive resources (informational, human resources, financial, and serviced land) needed by the respective value chains participants from production to consumption and export. Allocate and disburse adequate public resources to support unblocking of the key constraints affecting sector competitiveness in order to achieve desired outcomes;

Investment in functional infrastructure: energy/power, water, connectivity, and inclusive, profitable value and supply chains from raw materials production through product manufacturing to consumption.

The expected results from the effective development of the selected sectors are: i) increased business and technical capacity for existing value adding firms and business start-ups, ii increased access to productive resources such as financial services, technology and markets for products, (iii) increased value addition to agricultural, livestock and forestry products for local and export markets, and (iv) increased level of employment and income for the entrepreneurs from agricultural and value addition activities.

REFERENCES

Amani H., Mashindano O., Bamwenda G.R., Kihinzile P., *Food Security Situation Analysis in Tanzania, United Nations World Food Programme*, April 2016.

Bamwenda G.R., Mashindano O., Hassan A., Nzuki M., *The Assessment Study to Indentify Institutional, Legal, Financial, Agricultural, Environmental, and Gender Challenges Inhibiting Development in Six Districts in Tanzania*, Ministry of Finance and Planning, Presidents Office Planning Commission, UNDP, and UNEP, 2015.

Bamwenda G.R., Mashindano O., Nzuki M., Hassan A., *Simiyu Investment Guide*, 2017.

Bamwenda G.R., *Formulation of the Rural and Urban Development Initiatives Strategic and Action Plan 2015–2019*, USAID, 2014.

Bamwenda G.R., Mutani P., *Identification of Agricultural Special and Sensitive Products for Tanzania for WTO Doha Round of Negotiations*, FAO and UNDP, 2008.

Bamwenda G.R., *Analysis of the Oil Seed Value Chain in Tanzania*, Tanzania Investment Bank, 2012.

Bamwenda G.R., Abdallah R., *Tanzania Agricultural Research Strategy for Acceleration of Agricultural Growth and Food and Nutrition Security*, TAAS and MAFC, 2010.

Covarrubias K., Nsiima L., Zezza A., *Livestock and livelihoods in rural Tanzania. A descriptive analysis of the 2009 National Panel Survey*, Joint paper of the World Bank, FAO, AU-IBAR, Ireland the Tanzania MALF with support from the Gates Foundation, 2012.

Government of URT, *Tanzania Agriculture and Food Security Investment Plan (TAFSIP)*, Dar es Salaam, 2011.

Ministry of Agriculture, Food Security and Cooperatives (MAFC), *Assessment of the achievements of the agricultural sector development program (ASDP)*, 2012.

Ministry of Agriculture, *Livestock and Fisheries. Annual Report*, May 2017.

National Bureau of Statistics (NBS), *Demographic and Health Survey 2010*, Dar es Salaam.

SAGCOT, *Southern Agricultural Growth Corridor of Tanzania, Investment Blue Print*, January 2011.

TAMPA, *Effects of Milk Imports on Domestically Processed Milk Competitiveness in Tanzania*, June 2016.

TEOSA, *Assessment of the Potential of Oil Seeds Produced in Tanzania*, October 2012.

United Republic of Tanzania (2016), *Sunflower Sector Development Strategy, 2016–2020*.

United Republic of Tanzania (2016), *Value Chain Road Map for Pulses 2016–2020*.

United Nations, Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2008 Revision*, 2010, http://esa.un.org/unpp, Accessed April 27, 2010.

UN (2008). *UN world population prospects 2008*, http://esa.un.org/unpp/p2k0data.asp.

UN (2007). *UN world urbanization prospects 2007*, http://esa.un.org/unup/p2k0data.asp.

URT 2016. *Agriculture Sector Development Program Phase Two*, 2016.

URT 2016. *Baseline Study of the Dairy Value Chain in Tanzania. Assessment of Challenges and Opportunities for Investment, Ministry of Agriculture, Livestock and Fisheries*, September 2016.

URT 2016. *Evaluation of the Agriculture Sector Development Program I*, Ministry of Agriculture.

Chapter 7.

ELIEZA PAUL MILONGA

CUSTOMIZED HERMETIC BAG (CHB) FOR SAFE GRAIN STORAGE IN TANZANIA

ABSTRACT

The lack of efficient storage technologies in Tanzania is a major factor leading to high postharvest losses of grains, results from different research studies demonstrating that farmers lose up to 40% of the harvest through post-harvest food loss (depending on the crop and geographical area). This has a negative impact on their income, livelihood and production incentives. Customized Hermetic Bag (CHB) is a sturdy line-layer made of polyethylene, when tied it creates a hermetically sealed grain storage environment in which common pests cannot survive. After being tied it can be put into any type of available polypropylene bags. This technology shall encourage farmers to make decision and switch from using polypropylene bags to bags made of polyethylene in a cost effective manner. These sturdy polyethylene line-layers shall be in different sizes of 20 kg, 50 kg, 100 kg and 120 kg attached with flexibility to be put in any polypropylene bags available in local places as tarps. This technology is two times cheaper than other related technologies in the markets.

Key words: hermetic, postharvest loss, polyethylene, polypropylene.

1. Introduction and statement of the problem

Post-harvest food loss (PHL) is the term used to describe the crops lost to waste, spoilage, and other factors in between harvest

ELIEZA PAUL MILONGA – Program Manager, USAID-Kizazi Kipya Project at CODERT-MWANZA, Tanzania.

and consumption by the end user. Whereas conversations about loss in the U.S. and Europe centre on consumer food waste, in the developing world the majority of loss occurs before crops reach the market. In Sub-Saharan Africa, as much as 50% of fruits and vegetables, 40% of roots and tubers, and 20% of cereals are lost before they even hit the market. This astonishing level of waste substantially reduces the incomes of millions of smallholder farmers and contributes to food insecurity for African households. These dynamics are on display in Tanzania, where maize is a particularly important crop. Along with other cereals, it forms the bulk of the Tanzanian diet, yet 20–40% of the maize harvest is lost each year. Scaling back such losses could substantially improve the economic and health prospects of millions of Tanzanians.

The postharvest sector includes all points in the value chain from production in the field to the food being placed on a plate for consumption. In this regard, postharvest activities include harvesting, handling, storage, processing, packaging, transportation and marketing of agricultural products. Studies have shown that postharvest grain losses in Tanzania are high, and depending on the crop and geographical area it may range from 15 to 40%. The high postharvest losses have a negative impact on the income, livelihoods and motivation to expand production among farmers in the country. Inadequate storage, which is among the important causes of postharvest losses, constitutes a public health threat when people consume spoiled food, causes supply fluctuations and exacerbates the problem of high food prices.

Post-harvest Food Loss (PHL) is defined as measurable qualitative and quantitative food loss along the supply chain, starting at the time of harvest till its consumption or other end uses[1]. PHL

[1] A. Daminger, S. Datta, D. Guichon, *Reducing postharvest loss: A behavioral approach*, „ideas42", 2016; R.J. Hodges, J.C. Buzby, B. Bennet, *Postharvest Losses*

can occur either due to food waste or due to inadvertent losses along the way. Thus, food waste is the loss of edible food due to human action or inaction such as throwing away wilted product, not consuming available food before its expiry date, or taking serving sizes beyond one's ability to consume. Food loss, on the other hand, is the inadvertent loss in food quantity because of infrastructure and management limitations of a given food value chain. Food losses can either be the result of a direct quantitative loss or arise indirectly due to qualitative loss.

Factors that contribute to food loss range from mechanization of practices such as harvesting to handling, processing and others, to weather conditions, production practices, management decisions, transportation facilities, grading issues, infrastructure, consumer preferences/attitudes, and availability of financial markets. A typical post-harvest chain comprises a number of stages for the movement of harvested output from the field to the final retail market. The losses incurred at each step vary depending upon the organization and technologies used in the food supply chain. For example, in less developed countries where the supply chain is less mechanized, larger losses are incurred during drying, storage, processing and in transportation.

Tanzania has no specific policy and/or strategy for postharvest losses management. This can partly explain the persistence of the problem of high postharvest losses in the country. Notwithstanding the fact that the National Agriculture Policy[2] recognizes the significance of postharvest losses caused by pest and diseases, the policy does not explicitly show how this important challenge will be addressed. For instance, although in section 3.10, the policy

and Waste in Developed and Less Developed Countries: Opportunities to Improve Resource Use, „Journal of Agricultural Science", 149(2011), pp. 37–45.

[2] URT, *National Agriculture Policy*, 2013.

reiterates the gravity of the problem of postharvest losses for Tanzanian farmers, the policy objective which reads "production of quality products in order to improve competitiveness of agricultural products in the markets enhanced" does not explicitly show the need to reduce postharvest losses in the country. Consequently, it is not surprising that the policy statements related to the area of pests and diseases are not directed at addressing the issue of postharvest losses. This partly explains why farmers in the country have continued losing a substantial proportion of their crop produce through postharvest losses.

There is general consensus that policy reforms in the agricultural sector, especially in relation to the reduction of post-harvest losses (PHL) of main cereal crops, is a matter of priority. Results from different research studies demonstrate that farmers lose up to 40% of the harvest through PHL; this has a negative impact on their income, livelihood and production incentives. For cereal grains, the value of PHL in Sub-Saharan Africa is estimated at around 4 billion US$ annually or almost 15% of the total production value. Available data show that despite the increase of cereal crops production at national level, estimated at 3,897,500 tons on average per year, technologies used for harvesting and processing are poor and this has led the PHL to be 1,559,000 tons on average per year.

With this limited production of food crops in different regions in Tanzania, small holder farmers need to store what is being produced to last for the rest of the season. Lack of appropriate grain storage technologies leads up to 20–30% losses due to infestations. As a result, small holder farmers end up selling their grain soon after harvest and buying it back at high prices just a few months after harvest. This is a major source of transitory food insecurity in Tanzania; it causes a year-to-year variations in food prices and seasonal price fluctuation, domestic food production and house-

hold incomes. These are often caused by poor population's ability to store food as an essential stage in food chain, hence undermine long term development and cause loss of food and human capital from which it takes years to recover[3].

Therefore, Customized Hermetic bags shall provide many benefits to small holder farmers. Not only is it an effective insecticide-free, low-cost method of storing grain compared to other existing technologies in the market designed in different sizes, but it gives flexibilities for farmers. CHB bags can be stored and transported in family homes – making this an effective way for small holder farmers to protect their harvests. In addition, the CHB bags can be opened at any time – when they are unsealed the grain is ready to be consumed. The CHB bags can then be reused more times, provided they are free of holes and tears.

2. Methodology

Storing grain until when it reaches a high market value allows farmers to gain greater profits, and storage provides communities with food reserves during the post-harvest season. Even after several months of storage in CHB bags, the quality of the grain continues to remain as when it was first stored.

The following steps shall be undertaken to introduce, promote and scale up the use of CHB bags:

1. Finalization of legal registration process of Postharvest school that will be based in Shinyanga will be operating under Think Tank Innovation (TTI), a community-based non-profit organization (NGO), which is an empowerment platform and revolutionary innovative movement for all youth in Tanzania. It is a national platform for young people to assert their ideas in numbers, energy

[3] World Bank, *Food security: concepts and measurements*, 1986.

and imagination to transform Tanzania to be a beacon of hope for all its young people. TTI aimed at promoting, identifying, nurturing, linking innovative ideas that foster development activities in the country, coordinating and supervising community-driven innovations in Tanzania: opportunities, lessons and thoughts for the future population through a mix of linkages, referrals and support for capacity development.

2. Stakeholders analysis shall be designed to identify them appropriately to support the idea and a project in large.
3. Contracting manufacturing industries in and outside Tanzania to produce CHB bags in specified sizes.
4. Promoting and marketing the technology. It will include building awareness among farmers and working with the private sector to make the technology available to smallholder farmers in a country. Service providers including international and local organizations will train farmers in how to use the bag and connect them with vendors who will be involved in developing of the distribution systems.

CHB bags awareness campaign in Tanzania, under Postharvest school, shall be based on the concept of partnership and collaboration. The magnitude and complexity of the problem of postharvest loss during storage requires collaboration of actors and organizations involved, as no agent/vendor or food security activist acting alone can achieve meaningful results.

CHB bags awareness Campaign in Tanzania shall call on new activists from the private sector as well as non-profit organizations to be involved throughout the creation of CHB bags demand and supply chain to join the effort and contribute their time and knowledge. Postharvest school shall welcome food security activists who are to work in their local areas as CHB bags vendors, agents, advocates and supporters who will be ready to volunteer their time, talent, and creativity to promote the initiative through

physical selling of CHB bags to small holder farmers and the community in whole.

The requirements that a food security activist shall have are:

1. Should be willing to participate in a program to reduce postharvest loss, or have the serious intention to get involved in such activities in his/her local area,
2. Should be able to scan the current postharvest loss situation in his or her local area,
3. Must be willing, able and comfortable to spend most of time with small holder farmers promoting that they should adopt the CHB bag technology,
4. Should be able to create CHB bag demand through educating and demonstrating the technology to the farmers,
5. Should have public speaking skills for the work involves much on talking to farmers and extension staffs,
6. Should be able to keep records and write reports on his or her activities launched to promote CHB bags in his/her specific area,
7. Should possess some creative and marketing skills enough to come out with new promotional and marketing strategies.

Being a food security activist, a proper person shall be entitled to the following advantages:

– have access to updates, information and networking with other food security activists in Tanzania,
– receive technical advice and support from Postharvest school and suppliers in postharvest loss prevention program,
– have a chance to order and supply CHB bags at a discounted price that shall give some fringe benefits in someone own initiative-related activities,
– receive information material to advertise the Initiative,
– act as a focal person in all CHB bags campaign projects and initiatives in local area and be connected to other food security activists around.

2. Recommendation and conclusions

Coordination and collaboration among the many initiatives being implemented shall create a CHB bags demand and supply to promote and achieve good results. Postharvest school shall play a coordinating role by bringing together all organizations and companies, public and private, which would be involved in post-harvest loss prevention activities, either at regional or national level. It will bring together partners and food security activists that reach out to stakeholders and the general public, share information, ideas, questions and answers, support the implementation of CHB bags as a solution to post harvest loss in a community, and connect with each other to achieve significant results.

REFERENCES

Daminger A., Datta S., Guichon D., *Reducing postharvest loss: A behavioral approach*, „ideas42", 2016.

De Lucia M., Assennato D., *Agricultural engineering in development: postharvest operations and management of food grains*, FAO Agricultural Services Bulletin, 1994, no. 93.

ESRF&REPOA, Policy Brief no 3-enG (2013). *Post-harvest losses in Tanzania: Challenges and options for Mitigation, Tanzania markets pan, Policies that work 4 markets*.

Hodges R.J., Buzby J.C., Bennet B., *Postharvest Losses and Waste in Developed and Less Developed Countries: Opportunities to Improve Resource Use*, „Journal of Agricultural Science", 149(2011), pp. 37–45.

URT, *National Agriculture Policy*, 2013.

World Bank, *Food security: concepts and measurements*, 1986.

PART III

NATURAL RESOURCES, INVESTMENT AND DEVELOPMENT

Chapter 8.

KONRAD CZERNICHOWSKI

THE INVESTMENT ENVIRONMENT IN THE EAST AFRICAN COMMUNITY

ABSTRACT

Foreign direct investment (FDI) is crucial in social and economic development of East Africa. In particular, investment connected with new technologies plays an important role because it increases competitiveness of East African economies. However, a big share of FDI is directed to the mining sector, providing profits to multinational corporations rather than to the societies. The aim of the article is to present the volume and nature of foreign direct investment to the member states of the East African Community (EAC) as well as characterize the investment environment in Tanzania, Kenya, Uganda, Rwanda, Burundi and South Sudan. A number of reports will be used to assess it: *Doing Business* (by the World Bank), *Index of Economic Freedom* (by the Heritage Foundation), *Freedom in World Country Ratings* (by Freedom House), *Global Competitiveness Index* (by World Economic Forum), *Fragile States Index* (by Fund for Peace) and *Ibrahim Index* (by Mo Ibrahim Foundation). A macroindex combining all these six indices will be calculated.

Apart from a quantitative analysis, a qualitative analysis will be provided on the basis of research conducted by the author in Uganda in February 2016, as well as the accessible literature, including "World Investment Report 2017" published by the United Nations Conference on Trade and Development. A threat deriving from unlimited inflow of FDI will also be considered. In conclusion it will be explained why two EAC members (South Sudan and Burundi) hardly attract FDI. A recommenda-

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tion will be given how the governments of EAC members may ameliorate the investment environment. I am particularly grateful to scholars from Makerere University in Kampala, Uganda where I spent two weeks as a guest lecturer, notably to the hospitable and helpful Dean of School of Economics, Prof. Edward Bbaale. They offered me an insight not only into FDI, but also into other aspects of the integration processes in EAC.

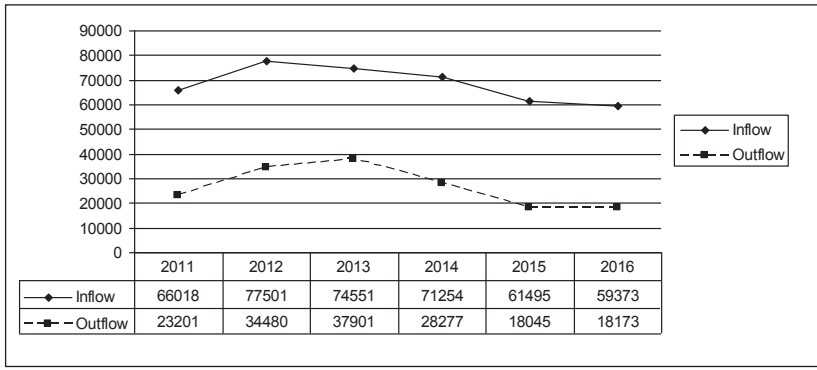
Key words: foreign direct investment, investment climate, East African Community, economic freedom, competitiveness, fragile states.

1. Trends in Africa

Both Foreign Direct Investment (FDI) inflows and outflows from Africa decrease (Figure 1). FDI inflows to Africa account for 3.4 per cent of all FDI, and FDI outflows – for 1.3 per cent[1]. East Africa, which received 7.1 billion of dollars in 2016, is only a margin of that. The biggest share of FDI to this region was attracted by Ethiopia (an increase by 46 per cent in comparison with 2015), which does not belong to EAC, whereas Kenya slumped by 36 per cent to 394 million dollars although it had reformed investment (Figure 2). A larger volume of FDI is directed to Southern, North and West Africa[2]. One of the greatest acquisitions was a purchase of 70 per cent of Telkom Kenya by the private equity fund Helios from Orange[3]. FDI to Tanzania declined by 15 per cent and were equal 1.4 billion dollars[4] (Figure 2). As far as FDI outflows from EAC are concerned, the change in the volume of FDI is not stable. Outflows from Kenya, which were the highest in EAC, reached its maximum of $66 million in 2016 (Figure 3). The outflows from Tanzania were lower than $10 thousand.

[1] UNCTAD, *World Investment Report 2017*, Geneva 2017, p. 42.
[2] Ibidem, pp. 45–46.
[3] Ibidem, p. 46.
[4] Ibidem, pp. 46–47.

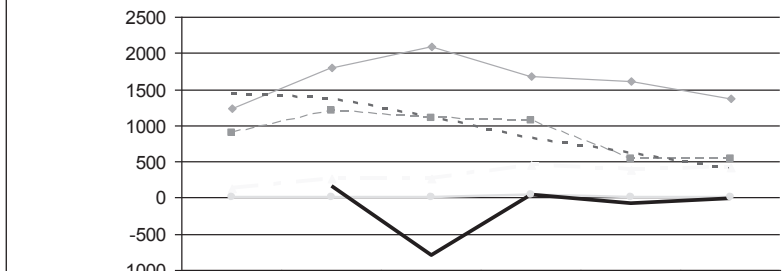
Figure 1. FDI inflows and outflows from Africa [$million]



	2011	2012	2013	2014	2015	2016
Inflow	66018	77501	74551	71254	61495	59373
Outflow	23201	34480	37901	28277	18045	18173

Source: Author's own study on the basis: UNCTAD, *World Investment Report 2017*, Geneva 2017, p. 222

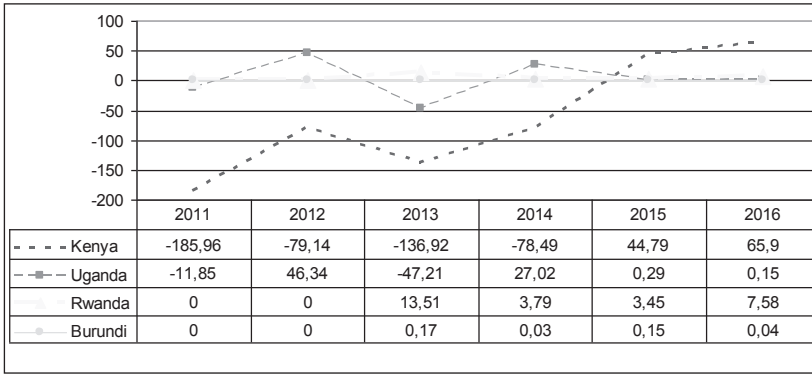
Figure 2. FDI inflows to EAC members [$million]



	2011	2012	2013	2014	2015	2016
Tanzania	1229	1800	2087	1673	1605	1365
Uganda	894	1205	1096	1059	538	541
Rwanda	119	255	258	459	380	410
Kenya	1450	1380	1119	821	620	394
Burundi	3	1	7	47	7	0
South Sudan		161	-793	44	-71	-17

Source: Author's own study on the basis: UNCTAD, *World Investment Report 2017*, Geneva 2017, pp. 222–223

Figure 3. FDI outflows from EAC members [$million]



	2011	2012	2013	2014	2015	2016
Kenya	-185,96	-79,14	-136,92	-78,49	44,79	65,9
Uganda	-11,85	46,34	-47,21	27,02	0,29	0,15
Rwanda	0	0	13,51	3,79	3,45	7,58
Burundi	0	0	0,17	0,03	0,15	0,04

Source: Author's own study on the basis: World Bank, *Foreign direct investment, net outflows (BoP, current US$)*, 2007, https://data.worldbank.org/indicator/BM.KLT.DINV.CD.WD?end=2016&start=2011&year_high_desc=true

2. Characteristics of EAC

EAC was first established in 1967, but it was dissolved in 1977. In its present form it has existed since 2000 after the Treaty for the Establishment of the East African Community (signed a year before) entered into force. Until 2007 it consisted of three states: Kenya, Tanzania and Uganda. In 2007 Rwanda and Burundi joined. The youngest member is South Sudan, which acceded to the Treaty in 2016[5]. Somalia applied for entry to the organization in 2012[6]. The population of EAC equals 174.2 million. Tanzania is the most populated member. The total GDP is nearly $439 billion (see table 1). An average GDP growth of this regional economic community (REC) during the last decade was 5.8 percent, which made EAC

[5] EAC, *Quick Facts about EAC*, 2017, http://www.eac.int/about/EAC-quick-facts [accessed: 25.07.2017].

[6] East African Community, *Barriers Come Down*, „Africa Research Bulletin: Economic, Financial and Technical Series", 49(2013), no. 12.

the fastest-growing region in Sub-Saharan Africa[7]. As far as social development is concerned, EAC member states have very low HDI (Human Development Index). In 2016 all but one were classified as Low Human Development. Only Kenya's Human Development is "medium" – it occupies the 146th position whereas the worst country in the ranking (Burundi) – the 184th place out of 188 states[8].

Table 1. Key indicators of EAC member states (2016)

Country	Population [million]	GDP (Parité de pouvoir d'achat) [$billion]	GDP per capita [$thousand]
Burundi	11.1	7.9	0.8
Kenya	46.8	152.7	3.4
Rwanda	13.0	22.0	1.9
South Sudan	12.5	20.9	1.7
Tanzania	52.5	150.6	3.1
Uganda	38.3	84.9	2.1

Source: Author's own study on the basis: *Africa. Burundi*, 2017, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/by.html [17.07.2017, accessed: 27.07.2017]; *Africa. Kenya*, 2017, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/ke.html [18.07.2017, accessed: 27.07.2017]; *Africa. Rwanda*, 2017, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/rw.html [19.07.2017, accessed: 27.07.2017]; *Africa. South Sudan*, 2017, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/od.html [19.07.2017, accessed: 27.07.2017]; *Africa. Tanzania*, 2017, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/tz.html [13.07.2017, accessed: 27.07.2017]; *Africa. Uganda*, 2017, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/ug.html [19.07.2017, accessed: 27.07.2017]

As far as the form of integration is concerned, EAC is a common market[9] with a perspective of becoming a monetary union (East

[7] C.E. Stevens, A. Newenham-Kahindi, *Legitimacy Spillovers and Political Risk: the Case of FDI in the East African Community*, „Global Strategy Journal", 7(2017), p. 16.

[8] UNDP, *Human Development Report 2016. Human Development for Everyone*, Washington 2016, p. 200.

[9] K. Czernichowski, *Bezpośrednie inwestycje zagraniczne w Afryce*, „Afryka", 2009, no. 29–30, pp. 161.

African Monetary Union, EAMU) in 2024[10]. The organization is composed of several organs[11]:

– the Summit – formed by heads of states to outline a general strategy; one of them presides its meetings, which take place once a year (after a year he is replaced by another president);
– the Secretariat – supported by the Secretary General office and the Counsel to the Community office; the Secretary General is appointed for a 5-year term and its Deputies – for a 3-year term; it may be prolonged once; its areas of interest are, among other things, administering EAC, strategic planning and monitoring development programs;
– the Council of Ministers – the most important executive body formed by ministers in charge of the regional cooperation; they meet twice a year; it implements the Summit's decisions;
– the Coordinating Committee – it is responsible before the Council of Ministers and coordinates the work of the Sectoral Committees; its meetings are organized twice a year;
– the Sectoral Committees – its meetings are held on an ad hoc basis;
– the East African Court of Justice – it makes sure that the community law is respected and correctly interpreted; its temporary headquarters are based in Arusha, Tanzania;
– the East African Legislative Assembly (EALA) – based in Arusha, it has been working since 2001; its members are elected by members of national parliaments; apart from them, ministers

[10] J. Bar, *Przystąpienie Republiki Sudanu Południowego do Wspólnoty Wschodnioafrykańskiej (East African Community, EAC): geneza i przebieg procesu akcesyjnego*, in: *Bilad as-Sudan – polityka i kultury*, eds. W. Cisło, J. Różański, M. Ząbek, Pelplin 2016, p. 141.

[11] K. Czernichowski, *Integracja afrykańska – uwarunkowania, formy współpracy, instytucje*, Warszawa 2010, pp. 162–165.

being in charge of regional cooperation also sit in EALA, yet without voting rights; it is authorized to create law (however, it can be vetoed by any head of a member state), which distinguishes this institution from other regional parliaments in Africa – bills may be initiated either by EALA's own initiative or by the Council; its important role is approving the EAC budget; the Assembly is financed by EAC[12];

– the Autonomous Institutions – Lake Victoria Basin Commission, Lake Victoria Development Programme, Lake Victoria Fisheries Organization, the East African Development Bank, the Inter-University Council for East Africa.

The main obstacles for doing business in East Africa are corruption (mainly in Burundi, Kenya, Uganda and Tanzania), tax rates (in Rwanda, Tanzania, Uganda and Kenya, in particular) and insufficient access to financing (especially in Rwanda, Tanzania and Burundi). Moreover, policy instability is an important problematic factor in Burundi, inadequately educated workforce in Rwanda (however, Rwanda and Kenya were appreciated by the World Economic Forum for the improvement of the skillset of their future workforce), inadequate supply of infrastructure in Tanzania, and inflation in Uganda[13]. What also impedes economic integration is overlapping membership[14]. Each member of EAC participates in at least two other regional organizations (see table 2).

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[12] U. Terlinden, *African Regional Parliaments – Engines of Integration and Democratisation?*, Bonn 2004, pp. 7–11.

[13] *Competitiveness Report 2016–2017. World Economic Forum*, ed. K. Schwab, Geneva 2016, pp. 57–348.

[14] E. Cieślik, *Consequences of Economic Integration Initiatives in Africa: Trade in the IGAD Region*, in: *Economic Integration, Currency Union, and Sustainable and Inclusive Growth in East Africa*, ed. A. Heshmati, Cham 2016, p. 14 (*Advances in African Economic, Social and Political Development*).

Table 2. Overlapping membership in EAC

Burundi	EAC, AU, ECCAS, COMESA
Kenya	EAC, AU, CEN-SAD, COMESA, IGAD
Rwanda	EAC, AU, COMESA
South Sudan	EAC, AU, IGAD
Tanzania	EAC, AU, SADC
Uganda	EAC, AU, COMESA, IGAD

Source: Author's own study on the basis: K. Czernichowski, *Integracja afrykańska – uwarunkowania, formy współpracy, instytucje*, Warszawa 2010, pp. 137–138; The IGAD Region, 2017, https://igad.int/about-us/the-igad-region [accessed: 28.07.2017]; *Member State Profiles* (2017), https://au.int/en/memberstates [accessed: 28.07.2017]

3. Investment climate in Eastern Africa

Common Market protocol was adopted by EAC on 1 July 2010. Movement of capital became free[15]. The conditions of FDI inflow improved as there is a positive correlation between a membership in a regional bloc and a volume of FDI flows[16]. Investment climate comprises various conditions that facilitate or disrupt the inflow of FDI. Table 3 presents some of indices used to assess the investment climate. Macroindex was created to include six different rankings: Doing Business (done by the World Bank), Index of Economic Freedom (Heritage Foundation), Freedom in the World (Freedom House), Global Competitiveness Index (World Economic Forum), Fragile States Index (Fund for Peace) and Ibrahim Index (Mo Ibrahim Foundation). The formula for the proposed macroindex is[17]:

[15] E.J. Balistreri, D.G. Terr, H. Yonezawa, *Deep Integration in Eastern and Southern Africa: What are the Stakes?*, „Journal of African Economies", 24(2015), no 5, p. 689.

[16] B. Mbembe, Good Governance and Foreign Direct Investment: A Legal Contribution to a Balanced Economic Development in the East African Community (EAC), PhD dissertation, Utrecht 2015, p. 4.

[17] K. Czernichowski, *Bezpośrednie inwestycje zagraniczne w Afryce*..., op. cit., pp. 144–145.

$1-\sum_{i=1}^{6}\frac{\frac{x_i}{n_i}}{6}$ if 6 indices are accessible (e.g. Burundi, Kenya, Rwanda, Tanzania, Uganda);

$1-\sum_{i=1}^{5}\frac{\frac{x_i}{n_i}}{5}$ if 5 indices are accessible (e.g. Central African Republic, Eritrea);

$1-\sum_{i=1}^{4}\frac{\frac{x_i}{n_i}}{4}$ if 4 indices are accessible (e.g. South Sudan);

$1-\frac{x_1}{n_1}$ if only 1 index is available (e.g. Western Sahara);

where:
x_i – position in i-th classification,
n_i – number of states classified in i-th ranking.

Thus, a classification taking into account different classifications emerged.

Table 3. Classifications describing investment climate in East African Community

Position in Africa 2017	Position in Africa 2009	Index	Doing Business 2017	2017 Index of Economic Freedom	Freedom in the World 2017	2016–2017 Global Competitiveness Index	2017 Fragile States Index*	2015 Ibrahim Index	Macroindex of the investment climate in Africa
		Institution	World Bank	Heritage Foundation	Freedom House	World Economic Forum	Fund for Peace	Mo Ibrahim Foundation	
		Number of classified states in Africa	54	51	55	35	54	54	
10.	28.	Rwanda	2	3	39	3	30	9	0.73
13.	13.	Tanzania	17	15	17	18	14	18	0.66
19.	10.	Kenya	7	29	23	9	39	12	0.62
20.	23.	Uganda	14	10	31	15	37	19	0.59
43.	46.	Burundi	31	32	43	33	43	43	0.25
54.	—	South Sudan	51	—	53	—	54	53	0.03

Source: Author's own study on the basis: World Bank, *Doing Business 2017*, Washington 2017, p. 7; Heritage Foundation, *Country Rankings*, 2017, http://www.heritage.org/index/ranking [accessed:

1.07.2017]; Freedom House, *Freedom in the World 2017. Populists and Autocrats: The Dual Threat to Global Democracy*, Washington, pp. 20–24; *Competitiveness Report 2016–2017*, World Economic Forum, ed. K. Schwab, Geneva 2016, p. XIII; Fund for Peace, *Fragile States Index*, 2017, http://fundforpeace.org/fsi/wp-content/uploads/data/fsi-2017.xlsx [accessed: 15.07.2017]; Ibrahim Foundation, A *Decade of African Governance 2006–2015*, London – Dakar 2016, p. 18; K. Czernichowski, *Bezpośrednie inwestycje zagraniczne w Afryce*, „Afryka", 2009, no. 29–30, pp. 146–147

World Bank investigates the regulations enhancing and constraining business activity all over the world for the 14th time. Ten factors are included in the ranking [World Bank 2017: III]:
– starting a business;
– construction permits;
– registering property;
– getting electricity;
– obtaining credit;
– taxes;
– exporting and importing;
– enforcing contracts;
– protecting minority investors;
– resolving insolvency.

Rwanda significantly improved its position from the 21st place to the 2nd place and is now followed solely by Mauritius in Africa[18]. The Heritage Foundation measures the economic freedom. Two EAC members, namely Rwanda and Uganda, are classified as "moderately free", and three others (Tanzania, Kenya and Burundi) – as "mostly unfree". South Sudan was not included in the ranking[19].

Freedom House Ranking concentrates on two non-economic factors, which however exert an impact on attracting FDI. These are political rights and civil liberties. Both categories fluctuate

[18] Ibidem, pp. 146–147.

[19] Heritage Foundation, *Country Rankings*, 2007, http://www.heritage.org/index/ranking.

between 1 (free) and 7 (not free). In 2017 the worst situation was in South Sudan (both indices were equal 7). Apart from this youngest world's state also the general Freedom Status and the Freedom of the Press 2016 Status of Burundi and Rwanda were "not free". Only Kenya and Tanzania were marked partly free. Uganda's Freedom of the Press 2016 Status was partly free, but its Freedom Status was not free (with political rights on the level 6 and civil liberties – 5)[20].

The World Economic Forum concentrates on competitiveness. Rwanda and Tanzania are among five African states, which improved their rankings by 3 to 6 positions (Rwanda from 58th to 52nd place and Tanzania from 120th to 116th place). They strengthen their education, infrastructure and institutions. Along with Burundi and Kenya, their development was classified as being in the very first stage, namely factor-driven stage[21].

FDI may be discouraged if the state is considered a failed (or fragile) state. The Fund for Peace has been calculating the Fragile States Index (previously Failed States Index) for a good number of years. Social, economic and political criteria are included in the analysis[22]. One of the EAC member states (namely, South Sudan) was announced the most fragile state in the world in 2017 due to its long-lasting armed conflict. Demographic pressures were worst assessed in Burundi, Kenya and Tanzania. Moreover, Rwanda and Kenya were affected by factionalized elites (representative leadership, ethnic equity and equality, among other things). Kenya's index was additionally boosted by group grievance (divisions between various groups of the society), whereas in Uganda an important

[20] Freedom House, *Freedom in the World 2017. Populists and Autocrats: The Dual Threat to Global Democracy*, Washington 2017, pp. 20–24.

[21] *Competitiveness Report 2016–2017. World Economic Forum*..., op. cit., pp. 7–25.

[22] K. Czernichowski, *Bezpośrednie inwestycje zagraniczne w Afryce*..., op. cit., p. 143.

factor was the high number of refugees and internally displaced persons[23]. The state has one of the most compassionate refugee policies all over the world. A settlement Bidi Bidi in North-Western Uganda hosts the most refugees (270,000) in the world[24].

Finally, it is worth noting the Ibrahim Index, which measures good governance in Africa. It is published by Ibrahim Foundation and covers four issues[25]:

– safety and rule of law;
– human development;
– sustainable economic opportunity;
– participation and human rights.

The worst performing member of EAC is unsurprisingly South Sudan followed only by Somalia. Due to internal political tensions, the position of Burundi is also distant. On the contrary, Rwanda comes ninth in the ranking. The biggest progress in the general classification was traced by Rwanda. In 2009 it occupied the 28th place and at present, this state is among ten African states with the most favourable investment climate. South Sudan stood at the last but one position. None of the EAC members was included in the 2017 A.T. Kearney Foreign Direct Investment Confidence Index ranking[26].

What is needed to improve investment environment in East Africa, is infrastructure, which would be more effective than import

[23] Fund for Peace, *Fragile States Index*, 2017, http://fundforpeace.org.

[24] J. Hattem, *Uganda at breaking point as Bidi Bidi becomes world's largest refugee camp*, 2017, https://www.theguardian.com/global-development/2017/apr/03/uganda-at-breaking-point-bidi-bidi-becomes-worlds-largest-refugee-camp-south-sudan, accessed: 15.07.2017.

[25] Ibrahim Foundation, *A Decade of African Governance 2006–2015*, London – Dakar 2016, p. 7.

[26] *The 2017 A.T. Kearney Foreign Direct Investment Confidence Index*, https://www.atkearney.com/gbpc/foreign-direct-investment-confidence-index [accessed: 29.07.2017].

substitution. To quote Sseruyange[27]: "If you know that Kenya has coffee and milk, how can you make [Ugandan] milk better? We need to add more value compared to what Kenya is producing". Both foreign and domestic investors would help to achieve it.

4. Investment policy

FDI plays an important role in development. However, if no limitations are imposed, negative consequences may appear in a short term. Matovu[28] explains why there are no Ugandan supermarket chains:

> „If you think about Ugandan supermarkets, they cannot compete with Shoprite. The same situation is in the banking sector and telecom sector. With very few Ugandan firms with the sort of capital and management skills required to run large businesses, the Ugandan economy has a high number of foreign firms crowding out local firms. This is more so in the banking, telecom, supermarkets and construction companies. This is partly explaining the poor performance of the current account – when foreign firms are free to repatriate profits made (in dollars) to shareholders abroad".

In 2015 the East African Community (EAC), the South African Development Community (SADC) and the Common Market for Eastern and Southern Africa (COMESA) merged into the Tripartite Free Trade. The investment policy at the regional level is yet to be implemented, as well as policy-making concerning intellectual property rights, competition policy and trade in services. The existence of this enlarged organization will simplify conditions

[27] J. Sseruyange, An authorized interview with John Sseruyange, PhD candidate in Wageningen University, Netherlands; Makerere University, Kampala, Uganda, 9.02.2016.

[28] F. Matovu, An authorized interview with Fred Matovu, PhD; Makerere University. Kampala, Uganda, 9.02.2016.

of investing in Eastern Africa since it can replace 100 bilateral investment treaties[29].

South Sudan and Burundi are the states with practically no FDI inflows. What is especially needed to attract foreign capital to these countries, is stabilizing political situation. South Sudan has been plunged into a domestic armed conflict since 2013. As a result, it became the most fragile state all over the world. At present, 11 million people face food shortages[30]. Burundi has been sunk in a political crisis since president Pierre Nkurunziza decided to run for his third term. 3 thousand people lost their lives[31]. When the peace is brought to these countries, it will be easier for the governments to address investment policies aimed at attracting more FDI.

REFERENCES

Africa. Burundi, 2017, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/by.html [17.07.2017, accessed: 27.07.2017].

Africa. Kenya, 2017, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/ke.html [18.07.2017, accessed: 27.07.2017].

Africa. Rwanda, 2017, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/rw.html [19.07.2017, accessed: 27.07.2017].

[29] UNCTAD, *World Investment Report 2017*..., op. cit., p. 113.

[30] *South Sudan marks independence with muted celebrations*, 2017, http://www.dw.com/en/south-sudan-marks-independence-with-muted-celebrations/a-39617391 [9.07.2017; accessed: 27.07.2017].

[31] C. Valade, *Alexis Sinduhije, opposant burundais en exil: «Je me sens assez souvent impuissant»*, 2017, http://www.rfi.fr/emission/20170718-burundi-opposant-alexis-sinduhije-sent-assez-souvent-impuissant [18.07.2017; accessed: 27.07.2017].

Africa. South Sudan, 2017, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/od.html [19.07.2017, accessed: 27.07.2017].

Africa. Tanzania, 2017, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/tz.html [13.07.2017, accessed: 27.07.2017].

Africa. Uganda, 2017, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/ug.html [19.07.2017, accessed: 27.07.2017].

Balistreri E.J., Terr D.G., Yonezawa H., *Deep Integration in Eastern and Southern Africa: What are the Stakes?*, „Journal of African Economies", 24(2015), no. 5.

Bar J., *Przystąpienie Republiki Sudanu Południowego do Wspólnoty Wschodnioafrykańskiej (East African Community, EAC): geneza i przebieg procesu akcesyjnego*, in: *Bilad as-Sudan – polityka i kultury*, eds. W. Cisło, J. Różański, M. Ząbek, Pelplin 2016.

Centrum Stosunków Międzynarodowych, *Leksykon krajów afrykańskich*, Warszawa 2016.

Cieślik E., *Consequences of Economic Integration Initiatives in Africa: Trade in the IGAD Region*, in: *Economic Integration, Currency Union, and Sustainable and Inclusive Growth in East Africa*, ed. A. Heshmati, Cham 2016 (*Advances in African Economic, Social and Political Development*).

Competitiveness Report 2016–2017. World Economic Forum, ed. K. Schwab, Geneva 2016.

Czernichowski K., *Bezpośrednie inwestycje zagraniczne w Afryce*, „Afryka", 2009, no. 29–30, pp. 136–157.

Czernichowski K., *Integracja afrykańska – uwarunkowania, formy współpracy, instytucje*, Warszawa 2010.

EAC, *Quick Facts about EAC*, 2017, http://www.eac.int/about/EAC-quick-facts [accessed: 25.07.2017].

East African Community, *Barriers Come Down*, „Africa Research Bulletin: Economic, Financial and Technical Series", 49(2013), no. 12.

Freedom House, *Freedom in the World 2017. Populists and Autocrats: The Dual Threat to Global Democracy*, Washington 2017.

Fund for Peace, *Fragile States Index*, 2017, http://fundforpeace.org.

Hattem J., *Uganda at breaking point as Bidi Bidi becomes world's largest refugee camp*, 2017, https://www.theguardian.com/global-development/2017/apr/03/uganda-at-breaking-point-bidi-bidi-becomes-worlds-largest-refugee-camp-south-sudan [accessed: 15.07.2017].

Heritage Foundation, *Country Rankings*, 2007, http://www.heritage.org/index/ranking.

Ibrahim Foundation, *A Decade of African Governance 2006–2015*, London – Dakar 2016.

Matovu F., An authorized interview with Fred Matovu, PhD; Makerere University. Kampala, Uganda, 9.02.2016.

Mbembe B., Good Governance and Foreign Direct Investment: A Legal Contribution to a Balanced Economic Development in the East African Community (EAC), PhD dissertation. Utrecht 2015.

Member State Profiles (2017). https://au.int/en/memberstates.

South Sudan marks independence with muted celebrations, 2017, http://www.dw.com/en/south-sudan-marks-independence-with-muted-celebrations/a-39617391 [9.07.2017 [accessed: 27.07.2017].

Sseruyange J., An authorized interview with John Sseruyange, PhD candidate in Wageningen University, Netherlands; Makerere University, Kampala, Uganda, 9.02.2016.

Stevens C.E., Newenham-Kahindi A., *Legitimacy Spillovers and Political Risk: the Case of FDI in the East African Community*, „Global Strategy Journal", 7(2017).

Terlinden U., *African Regional Parliaments – Engines of Integration and Democratisation?*, Bonn 2004.

The 2017 A.T. Kearney Foreign Direct Investment Confidence Index, https://www.atkearney.com/gbpc/foreign-direct-investment-confidence-index [accessed: 29.07.2017].

The IGAD Region, 2017, https://igad.int/about-us/the-igad-region [accessed: 28.07.2017].

UNCTAD, *World Investment Report 2017*, Geneva 2017.

UNDP, *Human Development Report 2016. Human Development for Everyone*, Washington 2016.

Valade C., *Alexis Sinduhije, opposant burundais en exil : « Je me sens assez souvent impuissant»*, 2017, http://www.rfi.fr/emission/20170718-burundi-opposant-alexis-sinduhije-sent-assez-souvent-impuissant [18.07.2017; accessed: 27.07.2017].

World Bank, *Doing Business 2017*, Washington 2017.

World Bank, *Foreign direct investment, net outflows*, 2017, (BoP, current US$), https://data.worldbank.org/indicator/BM.KLT.DINV.CD.WD?end=2016&start=2011&year_high_desc=true.

Chapter 9.

RICHARD R. MWAIPUNGU
LOLA Y. SELLE

CHALLENGES IN MANAGEMENT AND DEPLOYMENT OF EAST AFRICAN REGION NATURAL CAPITAL FOR SUSTAINABLE ECONOMIC DEVELOPMENT OF ITS CITIZEN

Tanzania case study

ABSTRACT

Development is everything and it is mainly characterized by changes in its dimension or direction. Development is both plastic, as it has potential to change and it is contextual as individuals involved respond to their environment changes throughout their existence. Economic developments enhance the welfare of people concerned. An environmentally sustainable society meets the basic resources needs of its people economic development in a just and equitable manner without degrading or depleting the natural capital that supplies these resources. Natural capital is the combination of natural resources and natural services that keep human beings and other species alive and support the economies. It is common knowledge that the success and failure in management and deployment of natural capital for economic sustainable development of East African region has many challenges. Some of these are lack of visionary leadership, capacity, and know-how. Furthermore, corruption, self-enrichment and nepotism are some of the undesirable acts that are in the midst of efforts towards achieving sustainable economic advance to all people of East African region. The paper based on literature reviews and authors exposure, looks at the above

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mentioned challenges and beyond, which affects the management and deployment of East African region natural capital for sustainable economic development of its citizen. The paper takes Tanzania as a mirror through which one can see how lack of knowledgeable society undermines creation of environmentally sustainable society. Moreover, the paper recommends awakening the mass through education, so as to be the vigilant keeper of their natural capital, as a measure once addressed in totality will see the East African society through this dilemma.

Key words: Natural capital, Sustainability, Environment, Development, Economy, Management.

1. Introduction

For the past four decades poverty eradication has been at the forefront of Tanzania's policy agend[1]. According to Kilindo[2] emphasis has always been placed on environmental sustainable economic growth as a means for raising private incomes and public revenues needed for sustainable development. Economic growth provides people with more goods and services, and economic development uses economic growth to improve living standards[3]. Economic growth is usually measured by the percentage change in a country's Gross Domestic Product (GDP), which is the annual market value of all goods and services produced by all firms and organizations, foreign and domestic, operating within a country. Changes in a country's economic growth per person are measured by *capita* GDP, which is also GDP, divided by the total population at mid-year. Empirical evidence shows that sustained economic development leads to sus-

[1] A.A.L. Kilindo, *Enhancing financial inclusion for poverty eradication: Which way for Tanzania?*, „Tanzania Journal of Population Studies and Development. Demographic Training Unit University of Dar es Salaam", 16(2009), no. 2, pp. 21–41.

[2] Ibidem.

[3] G.T. Miller jr., *Living in the Environment* (15th Ed.), Pacific Grove 2007.

tained poverty reduction. Furthermore, the ultimate goal of economic development of any country is to enhance the welfare of its citizen[4].

Any kind of development needs resources from natural capital which are inexhaustible. Natural capital is not fixed[5]. It has changed over millions of years in response to environmental changes such as global warming and cooling, and huge asteroids hitting the earth. Forests have grown and disappeared, as have grassland and deserts. Species have become extinct because of natural and human causes and new species have appeared. We have transformed many forests and grasslands into croplands – a more simplified form of natural capital created by humans. For the natural capital to be inexhaustible, and furthermore for the natural capital to be available to the future generation, it has to be sustainably everlasting. For natural capital to be preserved there must be proper management and good governance.

Tanzania is among East African countries which is rich in natural capital but poor economically. No one can deny that Tanzania is irrefutably among the brightest pearls among the countries harbouring the most staggering wildlife spectacles in the world[6], the credit for which lies with its huge variety of habitats, which is the key factor that enables the country to support a phenomenally diverse fauna and flora[7]. The country is also a host of long list of mineral resources, among these minerals is Tanzanite, a mineral which is found only in Tanzania. Ironically the country has no single industry to add value to Tanzanite. Most of Tanzanite industries are found in South Africa.

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[4] J.O. Borariniwa, *Good governance and economic development: The challenges of democratic sustainability in Nigeria*, „African Journal of Governance and Development", 2(2013), no. 2, pp. 4–17.

[5] G.T. Miller jr., *Living in the Environment*..., op. cit.

[6] O. Marttila, *The Great Savanna, The natural parks of Tanzania and other key conservation area*, Tampere 2011.

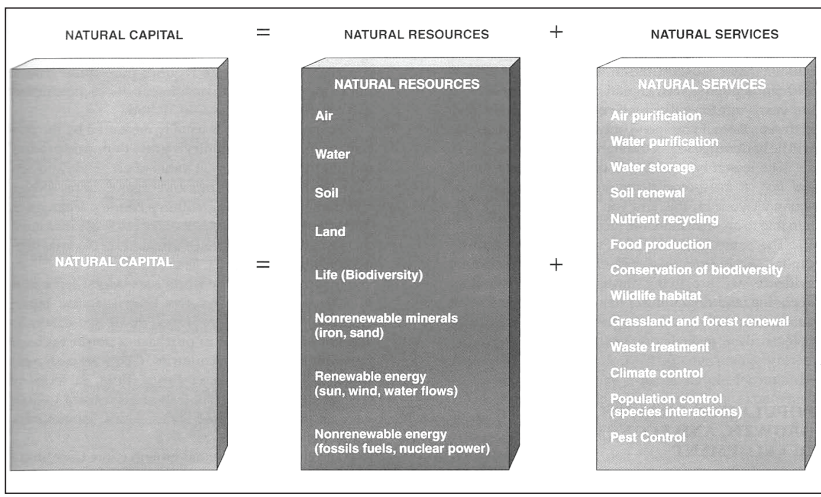
[7] K.H. Deal, *Wildlife and Natural Resource Management* (3rd Ed.), New York 2011.

2. Renewable and non-renewable natural resources

Natural resources can be divided into two categories, renewable and non-renewable. Resources in the non-renewable category are mineral resources, such as iron, copper, lead, uranium, aluminium, and fossil fuel such as oil, coal, and natural gas. Although we may have an ample supply of these non-renewable resources for many years to come, they are finite. A non-renewable resource is one which, once the available supply has been used, it cannot be replenished.

Conversely, renewable resources are those which with proper management and care, can be utilized indefinitely. Forests, wildlife, water, and soil are renewable natural resources. With proper management, absent of abuse, renewable resources are here to stay. This paper shall focus only on renewable natural resources.

Figure 1. Natural capital: Natural resources (centre) and natural services (right) that supports and sustain the earth's life and economics



Source: Miller, J.R., 2007, p. 9

2.1. The importance of natural resources

Natural resources as indicated in Figure 1, are items found in or on the earth that are of use to humans as fuel, food, shelter, or a source of wealth. Some common natural resources are oil, coal, water, mineral resources, arable land, wildlife, and forest resources. Our existence depends on these resources. In addition to the above, there is vast social and economic value of biodiversity such as attenuating floods, providing clean water of a drinking quality standard, facilitating the pollination of important agricultural crops to support food security and providing primary sources of food like fish from the wild.

2.2. The role of natural resources in development

People are drawn to a country by its abundant natural resources. Land is the most precious natural resource. Land should never be allowed to be in the hand of one person or group of people but to the well-articulated system of management backed by legal framework, where everybody concerned can make decision in a transparent way as to who shall own the land. The same mechanism can be used to take back the land to the society. Natural resources played a vital role in the development of USA[8].

According to Deal[9] the tremendous abundance of wildlife in North America was another factor in the development of the United States of America. About 80 percent of Tanzanians depend on land for their daily life; they also depend on forest with which to build shelter, fuel for cooking and warming their shelter. We must conserve and protect all our natural resources, both renewable and non-renewable for future generation of East Africa.

[8] K.H. Deal, *Wildlife and Natural Resource Management*..., op. cit.
[9] Ibidem.

3. Conservation of natural resources

Conserving natural resources is very essential today, bearing in mind the phenomenon of climate change being observed on Earth due to pollution. There are many ways that one can deploy in conserving natural resources through natural services as depicted in Figure 1. One of the popular methods is to replace natural resources with the alternatives which are friendly to climate. Currently the alternatives to natural resources can be counted using fingers of one hand, but hopefully future generations may develop alternatives to many of the resources we currently use. For the foreseeable future we shall have no viable substitutes for most of the natural resources we use today. Oil, natural gas, coal, water, wind, and sunrays will remain our main sources of energy.

Forest will continue to produce a major portion of our building materials, and soil will grow our crops for many years to come. Therefore, it is in our own interest to conserve existing natural resources, work to develop effective substitutes, and continue to look for ways to renew natural resources.

3.1. Soil conservation

Erosion is the most serious threat to our soil. Erosion is a natural process that occurs continuously to most soils, but abuse of the soil, by not leaving any grass or crop cover can greatly accelerate soil erosion. Erosion comes in three main forms[10]; traffic erosion, water erosion, and wind erosion. Traffic erosion is mainly associated with unpaved roads which are earth and gravel roads. Also water and wind assist further the erosion of these roads once its surface have been abraded and wearied off by traffic movements.

[10] R.R. Mwaipungu, *The formulation and application of a gravel loss model in management of gravel roads in Iringa region, Tanzania*, Durban 2015.

Water erosion occurs in two ways from water runoff and from raindrops striking the earth. Each rain drop strikes the earth at 32 to 40 km/h. If it strikes bare earth, it tears up the soil on impact. However, this form is not the most destructive type of water erosion. Water flows along the path of least resistance, which is downhill. As water runs off, it gathers speed, picking up soil particles as it does. If there are no plants and plant roots to slow this process, the damage done by the runoff can be significant. Wind erosion is caused when the wind picks up soils particles and moves them from their original location.

Erosion is very damaging to the productivity of the soil. It removes valuable top soil, thus making it more difficult for the farmer to produce a bountiful harvest if any. Providing training to encourage and enhance effective soil management techniques to farmers will help to reduce the adverse effects of physical soil erosion in East Africa. On the other hand, unpaved road surfacing material erosion are mainly associated with, limited funds set aside for construction, poor quality of finished work, poor materials selection, and lack of timely and appropriate maintenance. People in the locality where these roads pass should be part of this road maintenance management system.

According to Deal[11], USA has a soil bank and a conservation reserve program which assist farmers to set aside for 10 years marginal farmland, by so doing they have created millions of acre of wildlife habitat. Minimizing soil erosion also greatly increases the quality of our water supply.

3.2. Forest conservation

Forests are vital to our continued prosperity and to the well-being of hundreds of species of wildlife. We must manage them

[11] K.H. Deal, *Wildlife and Natural Resource Management*..., op. cit.

very carefully. Great progress has been made in forest conservation in the past few decades in Tanzania. Forest products, of which wood is the most obvious, are used to produce a large variety of items that we use every day. However, wood products may not be so obvious. Wood that has been mechanically or chemically altered is referred to as converted wood. Converted wood products include paper, wood fibber, charcoal, plastics, and explosives just to mention a few.

Furthermore, forests are wildlife habitat. Habitat destruction is the single greatest threat facing wildlife today and for the foreseeable future. Habitat destruction results from variety of human activities, including construction, farming, mining and timber harvesting. All are related to human encroachment on wildlife habitat. We must accelerate proper forest management efforts if we are to have the forest products and wildlife we will need for the future[12].

3.3. Wildlife conservation

Wildlife is constantly losing the fight for habitat, which is needed for their survival. Wilson[13] is of the opinion that various species are disappearing at an accelerating rate through human action, primarily habitat destruction, but also pollution and the introduction of exotic species into residual natural environments. Table 1 lists 12 principal threats facing national parks in Tanzania. In the list you can note that poaching of wild animals and uncontrolled bush fires are leading the list. Wild life management techniques of the future will likely to be based on minimizing the effects of human encroachment on wildlife habitat. This can be easily noted at Mikumi, where a TANZAM Highway crosses the Mikumi National

[12] Ibidem.

[13] E.O. Wilson, *The diversity of life*, Cambridge, USA, 1992.

Park. Effort to relocate the road hitherto has been futile. Stewart[14] asserts that inappropriately locating development results in the loss of important ecosystem and communities often end up paying for the long term costs of losing these important ecological assets. The challenge still being faced by Tanzanian conservationists is to minimize the potential conflict between biodiversity and different forms of land use. One among many solutions to this challenge is to have a bioregional plan, as the one currently employed in South Africa[15], which provides clear priorities and guidelines for all decisions that impact on biodiversity, including land use planning, environmental assessment and authorisations, and natural resources management. What is currently the norm in Tanzania is that local people can start mining operation in a locality without proper authorisation.

Stewart[16] acknowledges that bioregional plans assist local governments in spatially identifying priority sensitive areas. Wilson[17] warned that fifth or more of the species of plants and animals could vanish or be doomed to early extinction by the year 2020 unless better efforts are made to save them. I am still doubtful if serious enough action has been taken from what we are witnessing due to climatic changes. As a country we should start thinking seriously of using roof tops in urban areas for farming, the exercise which is already in advance stage in European countries. By so doing, we will save a lot of rural farming areas for wildlife habitat. The future of wildlife management is the management of wildlife populations within the available habitat.

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[14] W. Stewart, *Harvesting a City's natural wealth*, „Institute of Municipal Engineering of Southern Africa", 40(2015), no. 10, pp. 103–105.

[15] Ibidem.

[16] Ibidem.

[17] E.O. Wilson, *The diversity of life*..., op. cit.

Table 1. The principal threats facing Tanzania's National Parks

S/No	National Parks	PA	FI	TI	PP	BU	IS	WA	DI	SO	GR	TR	HU	Total
1	Rubondo	v	v	v				v						4
2	Serengeti	v							v					2
3	Ngorongoro*	v								v				2
4	Manyara	v	v				v	v						4
5	Tarangire	v				v	v						v	4
6	Arusha	v	v	v		v	v							5
7	Kilimanjaro					v								2
8	Mkomazi	v				v					v			3
9	Amani					v	v							2
10	Saadani	v				v								2
11	Mikumi	v		v		v						v		4
12	Selous**	v	v	v		v								4
13	Udzungwa	v		v										2
14	Ruaha	V				v		v	v					4
15	Kitulo				v					v				2
16	Katavi	V				v							v	3
17	Mahale													-
18	Gombe	v	v	v		v	v		v					6
Total Frequency		14	5	6	1	11	5	3	3	3	1	1	2	

The twelve (12) principal threats facing the eighteen (18) Tanzania's nature reserves, namely: poaching of animals (PA), illegal fishing (FI), illegal timber cutting (TI), poaching of plants (PP), uncontrolled bushfires (BU), closing of the migration routes and the isolation of the park (IS), disturbance in the water ecosystem (WA), infectious diseases spreading in from the surrounding countryside (DI), devastation of the soil caused by tourism or some other human activity (SO), illegal grazing (GR), increased mortality among wild animals caused by traffic (TR), and legal sports hunting for trophies (HU)

Source: Marttila, 2011; * Conservation area, ** Game reserve

3.4. Water conservation

Water is a natural resource without which all living organisms cannot survive. With approximately 70 percent of the earth covered by water, it might seem that a lack of water would not

be a problem. Unfortunately, 97 percent of the water on Earth is salt water, located in oceans and seas. Approximately 3 percent is fresh water, more than half of which is frozen in glaciers, and ice caps. Without expensive desalination being done, the water located in the oceans and seas cannot be used as drinking water as it contains too much salt. Of the 3 percent fresh water on Earth, less than 2 percent is available for human use.

Water was for many years taken for granted, wasted, and abused. We pollute rivers, streams and lakes by pumping untreated waste into them. Industries, agriculture, domestic users, fish and wildlife are all major users of water. It is high time now construction industries used grey water, water which is treated after being taken from sewers so as to save water for human and wild life usage.

4. The characteristics of management and deployment of natural capital for sustainable economic development of Tanzanian

It is common knowledge that the success or failure of any sustainable economic development policies depends on the quality of leadership. When the quality of leadership is right then capacity, know-how or skills follow. Corruption, self-enrichment and nepotism are some of the undesirable acts that prevail when leadership and accountability are absent. East African leaders fall short of their promise when they vie for public office to fight for the people and promote good governance[18]. They use public offices to exploit natural resources for personal enrichments. One incidence happened in Tanzania, not long ago, in which we witnessed the shipment of wild animals with forged documents, and in day light

[18] J.O. Borariniwa, *Good governance and economic development*..., op. cit.

at one of our international airport. Not only that, but also part of national parks areas are being sold for hunting to foreign nationals under dubious deals.

Borariniwa[19] stresses that for the nation to gain economically via natural resources, and these resources to be sustainable there must exist good governance, the rule of law, transparency, and accountability. It is not only to politicians that the EA people should look to nurture these values, but also to a functional public service that is alive to East Africa's challenges, committed to ethics, efficiency and effectiveness in public sector and alive to the needs of those living on the margins of society.

5. The role of mass education in achieving sustainable economic development by exploiting natural resources

Sustainability or durability is the ability of earth's various systems, including human cultural systems and economies, to survive and adapt to changing environmental conditions indefinitely. The second step toward sustainability is to recognize that many human activities degrade natural capital by using normally renewable resources such as forests faster that nature can renew them. A key variable is the rate at which we are transforming parts of the earth to meet our needs and wants.

Exponential increases in both the human population and our resources consumption have degraded the air, water, soil and species in the natural systems that support our lives and economies. If kept up, such actions can threaten the long-term sustainability of our societies. Sustainable economic development among other things requires a focus on preserving natural

[19] Ibidem.

capital – the natural resources and natural services that support all life and economies[20].

It is hoped that with knowledge, people will be able to understand their role in safeguarding the natural resources of Tanzania. Vibrant and educated EA society will be able to lead fuller, richer, and more fruitful lives[21]. According to Zanden[22], appropriate mass education addressing specific economic issues affecting the society in question will offer them the opportunity to improve their conditions by assisting them to achieve self-identity, freedom, and self-fulfilment.

6. Conclusion

This paper has drawn attention to the challenges facing the deployment of EA region natural capital for sustainable economic development: lack of visionary leadership, corruption, self-enrichment and nepotism. To make matter worse, most local residents pay lesser role by not raising their voices against authorities mismanaging their natural capital. The paper has articulated areas of natural resources which need utmost conservation, namely soil, forest, wildlife and water. Measure appropriate to tackle the challenges of preserving the just mentioned natural resources has been explained, albeit briefly. Furthermore, the paper pointed out the need to raise the awareness of the mass through appropriate education which addresses specific economic issues affecting their society. The authors hope that this method will offer them the opportunity to improve their life conditions by assisting them to achieve self-identity, freedom, and self-fulfilment.

[20] G.T. Miller jr., *Living in the Environment*..., op. cit.

[21] J.W. Santrock, *A Tropical approach to life-span development* (2nd Ed.), New York 2005.

[22] J.W.V. Zanden, *Human Development* (3rd Ed.), New York 1985.

REFERENCES

Borariniwa J.O., *Good governance and economic development: The challenges of democratic sustainability in Nigeria*, „African Journal of Governance and Development", 2(2013), no. 2, pp. 4–17.

Deal K.H., *Wildlife and Natural Resource Management* (3rd Ed.), New York 2011.

Kilindo A.A.L., *Enhancing financial inclusion for poverty eradication: Which way for Tanzania?*, „Tanzania Journal of Population Studies and Development. Demographic Training Unit University of Dar es Salaam", 16(2009), no. 2, pp. 21–41.

Marttila O., *The Great Savanna, The natural parks of Tanzania and other key conservation area*, Tampere 2011.

Miller jr. G.T., *Living in the Environment* (15th Ed.), Pacific Grove 2007.

Mwaipungu R.R., *The formulation and application of a gravel loss model in management of gravel roads in Iringa region, Tanzania*, Durban 2015.

Santrock J.W., *A Tropical approach to life-span development* (2nd Ed.), New York 2005.

Stewart W., *Harvesting a City's natural wealth*, „Institute of Municipal Engineering of Southern Africa", 40(2015), no. 10, pp. 103–105.

Wilson E.O., *The diversity of life*, Cambridge, USA, 1992.

Zanden J.W.V., *Human Development* (3rd Ed.), New York 1985.

Chapter 10.

JERZY GILAROWSKI

TAZARA AND TOURISM DEVELOPMENT IN THE SOUTHERN CIRCUIT

ABSTRACT

Tanzania is endowed with natural, cultural and man-made tourism attractions in all its parts, but in the vision of the Ministry of Natural Resources and Tourism there are two areas (apart from Northern Circuit) of priority tourism development – Coastal Zone and Southern Circuit[1]. The aim of this paper is to present the Tanzania-Zambia Railway (TAZARA) as a way of tourism development from the coast through Southern Highlands up to Mbeya region. I will present my vision of a new tourist programme, which in my opinion, after being implemented, would be absolutely successful, and which might bring another thousands of tourists to Tanzania, and which might make Tanzania to be known for international tourists not only because of Serengeti, Ngorongoro or Kilimanjaro, but also because of the countless tourist attractions of Southern Circuit.

Key words: Southern Circuit, Tanzania-Zambia Railway, tourism industry, development.

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[1] The United Republic of Tanzania, Ministry of Natural Resources and Tourism, 2002, *Tourism Master Plan, Strategy&Actions, Final Summary Updates*.

1. Introduction

Tourism is a rapidly growing sector in Tanzanian economy. Tourist arrivals broke the 1 million-barrier for the first time in 2012 when the number of foreign visitors surged by 24 per cent[2]. Data from the Ministry of Natural Resources and Tourism show that tourist arrivals rose by 12,9 per cent to reach nearly 1,3 million in 2016 from around 1,1 million tourists in 2015[3]. According to Tanzania Tourist Board (TTB), the number of tourists visiting the country is expected to reach 2 million in 2017. Most of the visitors came from Britain, Germany, the United States and Italy. Since 2015 the expenses of visitors bring about 2 billion US$ annually[4]. The sector contributes 17,5 per cent to Tanzania's Gross Domestic Product, and 25 per cent to foreign currency earnings[5]. International tourism is largely concentrated in the Northern Circuit, which stretches from Lake Victoria in the west to Tanga in the east, comprises such internationally known attractions as Mt. Kilimanjaro, Serengeti National Park, Ngorongoro Conservation Area, Tarangire and Lake Manyara National parks. These attractions have constituted the backbone of national tourism for many years, but now they are becoming overcrowded and the limits of acceptable use are being reached. Because of that the new areas of tourism exploration and new products must be developed if the tourism industry is still to grow. One of these areas is so called Southern Circuit, which extends from Selous Game Reserve in the

[2] Daily News, 03.01.2017, *Tanzania: Tourist Arrivals Increased By 10 Per Cent in 2016*, Dar es Salaam.

[3] The Citizen, 28 September 2017, *Tanzania: Ndulu: This is how to grow the economy*, Dar es Salaam.

[4] UNWTO, *Tourism Highlights*, 2016, http://www.e-unwto.org/doi/pdf/10.18111/9789284418145.

[5] The Citizen, op. cit.

east, through so called Southern Highlands, up to Panda Hills in the west of the country.

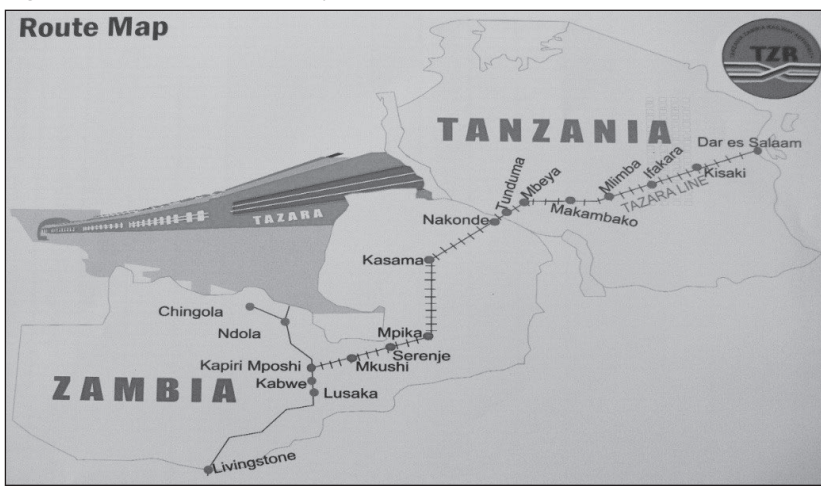
2. TAZARA – Train and walk. Characteristics of the product

There are countless tourism attractions within the Southern Circuit, which may successfully compete with famous already in the World – Northern Circuit of Tanzania. However, in my opinion, to develop tourism industry in this area, Tanzania should concentrate on those destinations which are unique, typical for the South, and do not occur in the North. It is not generally the question of convincing tourists to come to Southern, instead of Northern Circuit, but rather the question of extension of the length of tourists' stay in Tanzania, by preparing new products, which will be offering visits in Southern Circuit. Because of limited funds the government cannot invest in all places which are interesting, at least in the beginning. In this paper I present the outline of a new product, which has a great chance to be successful, and which I preliminary named as "TAZARA – train and walk". If the governmental plans of the revitalization of the Tanzania-Zambia Railway take place, tourism industry will profit enormously, because the railway goes through, or in a near distance to the Selous Game Reserve, Mikumi National Park, and Southern Highlands. Southern Highlands extend from Udzungwa Mountains in the East, through Mufindi Highlands, Highlands of Kilolo, Kipengere Range, Poroto Mountains, Mbeya Range, up to Panda Hills. TAZARA gives a great opportunity of tourism development within the Southern Circuit because nowadays there is no railway within a Northern Circuit, and generally speaking there are not so many opportunities of making a scenic journey by train in Africa.

Some of the world's most beautiful destinations are also home to the most scenic train rides, where journeys are ranging from a few

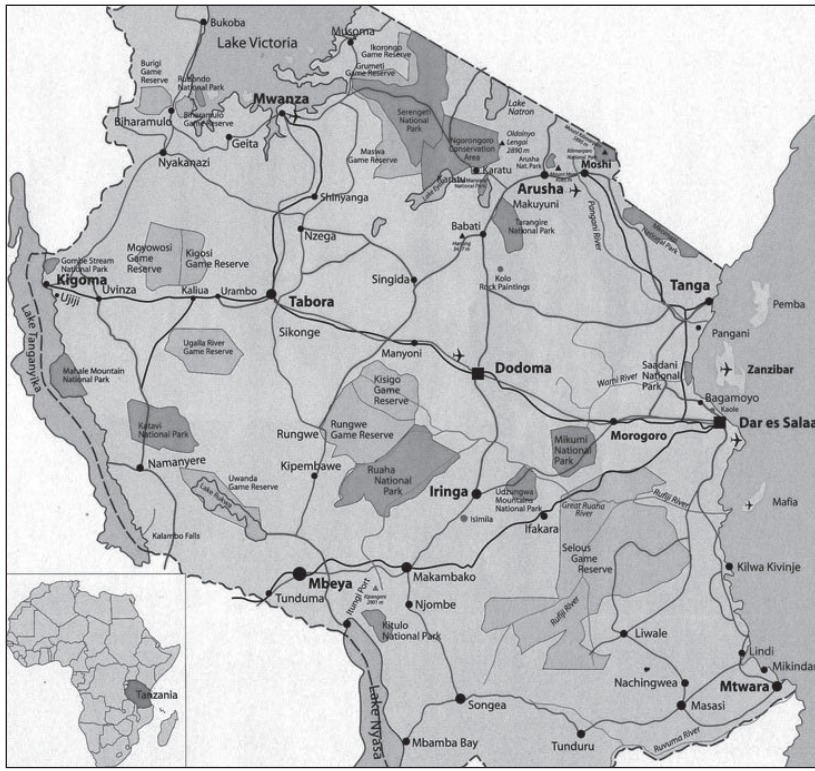
hours to more than a week. The most famous journeys are: Glacier Express in Switzerland, Durango & Silverton Narrow Gauge Railroad in Colorado (USA), Hiram Bingham Orient-Express from Cusco to Machu Picchu (Peru), Rocky Mountaineer from Banff to Vancouver (Canada), The Grand Canyon Railway (Arizona/USA), Maharajas Express (India), The Ghan from Adelaide to Darwin (Australia). In Africa there are only few places which offer Scenic train travels, among them the most known is Blue Train (the luxury train between Pretoria and Cape Town in South Africa). This journey is renowned in the World and included in many tour-packages, which are sold by travel agencies in Europe, USA or in Canada. Tanzania, due to TAZARA Railway, has an enormous opportunity to create a unique, not only at African, but at World scale, product. The journey from the coast through Southern Highlands (with many stops for doing different activities) may last one or two weeks (according to different versions), and the journey by Blue Train lasts only 27 hours.

Figure 1. The TAZARA Railway



Source: http://www.railwaypro.com/wp/plans-unveiled-to-revamp-tazara-railway-line/

Figure 2. The course of the TAZARA in relation to Tanzania's geography, national parks and game reserves



Source: https://www.google.com/search?q=tanzania+national+parks+map&client=firefox-b-ab&tbm=isch&imgil=jogQTIqbSJVdyM%253A%253BCn0YuBOHHEYcBM%253Bhttp%25253A%25252F%25252Fontheworldmap.com%25252Ftanzania%25252Ftanzania-national-parks-map.html&source=iu&pf=m&fir=jogQTIqbSJVdyM%253A%252CCn0YuBOHHEYcBM%252C_&usg=__jKVf11yhTC6Tdq2NrTf2tONPYGA%3D&ved=0ahUKEwiwlK3Pm8XWAhWEDMAKHfzBDOgQyjcIPw&ei=PoXLWbD9N4SZgAb8g7PADg&biw=1024&bih=659#imgrc=DTUIOv9NX7qk-M

The TAZARA Railway, also called the Uhuru Railway or the Tanzam Railway, is a railroad in East Africa linking the port of Dar es Salaam in Tanzania with the town of Kapiri Mposhi in Zambia's Central Province. The single-track railway is 1,860 km long and is operated by the Tanzania-Zambia Railway Authority.

Unfortunately, nowadays it is in a state of near-collapse. Annual traffic was only 88,000 metric tons in fiscal year 2015, less than 2% of the railway's design capacity of 5 million tons per year. Fortunately, as I have mentioned before, the plans of its revitalization recently revived.

First two stops will be done in famous Selous Game Reserve and, maybe less famous but also beautiful Mikumi National Park[6], where participants will be offered typical safari by four-wheelcars. Because later TAZARA goes through mountains (Southern Highlands) I propose to combine travel by train and mountain walking/climbing. Train, rented only for tourists, gives opportunity to shift from place to place (mostly during the night). Tourists will sleep in sleeping compartments, having meals in dining carriage. During the days walking/climbing activities will be carried out, and at mid-days the lunch-packets will be served.

Within Southern Highlands the following areas will be visited: Udzungwa National Park, including Sanje Falls and Kihansi Toad Project; Udzungwa Scarp Nature Reserve, Mufindi Highlands, including tea plantations and golf club; Kitulo National Park; Mount Rungwe Nature Forest Reserve, Ngozi Lake, and Panda Hills with famous Mbozi meteorite. All that areas are located very near railway stations of TAZARA line. The proposed railway stations to make stops are: Fuga Halt or Matambwe station (Selous National Park, and Mikumi National Park), Mang'ula (Udzungwa National Park), Tongora or Chita station (Udzungwa Scarp Nature Reserve), Makungu (Mufindi Highlands), Chimala (Kitulo National Park), Uyole (Mount Rungwe Nature Forest Reserve and Ngozi Lake), Mbozi (Mbozi meteorite).

To develop this project several crucial investments have to be made. The most important are:

[6] Those two parks are not located within the Southern Highlands.



Photo 1. Dining carriage (http://www.zanzibarmagic.com/tanzania%20trains.html)

– purchase of proper rail-carriages or adaptation of existing ones;
– redecoration of railway stations (including toilets and showers – part of them should be used only by tourists, not by travellers);
– improvement of the roads between stations and entrances to the visited areas;
– preparation of hiking trails: strengthening of the paths against erosion, preparation of informative banners along the trails, building of shelters and panoramic view sites.

The *Train and walk journey* leads through 6 administrative regions of Tanzania: Dar es Salaam, Pwani, Morogoro, Iringa, Njombe and Mbeya. The implementation of the product needs strict cooperation of all of them and coordination of all actions by Tanzanian government.

3. The basic information about visited places

Selous Game Reserve

The Selous Game Reserve is one of the largest faunal reserves of the world. It was named after Englishman Sir Frederick Selous,

a famous big game hunter and conservationist, who died at Beho Beho in this territory in 1917 while fighting against the Germans during World War I. The Selous was designated a UNESCO World Heritage Site in 1982 due to the diversity of its wildlife and undisturbed nature. The reserve covers a total area of 50,000 km^2 and has additional buffer zones. Within the reserve no permanent human habitation or permanent structures are permitted. Every (human) entry and exit is carefully controlled by the Wildlife Division of the Tanzanian Ministry of Natural Resources and Tourism. Among the typical animals of the Reserve there are: African bush elephants, black rhinos, hippopotamus, lions, East African wild dogs, Cape buffaloes, Masai giraffes, Plains zebras, and crocodiles[7].

Mikumi National Park

The Mikumi National Park was established in 1964. It covers an area of 3,230 km^2. It is the fourth largest Park in the country. The Mikumi is bordered to the south with the Selous Game Reserve, and together the two areas form a unique ecosystem.

The landscape of Mikumi is often compared to that of the Serengeti. The road Dar es Salaam – Mbeya, that crosses the park, divides it into two areas with partially distinct environments. The vegetation of the Northern part consists of savannah dotted with acacia, baobab, tamarinds and some rare palm. The southeast part of the park is less rich in wildlife.

The fauna includes many species characteristic of the African savannah. The park contains a subspecies of giraffe that biologists consider the link between the Maasai giraffe and the reticulated or Somali giraffe. Other animals in the park are elephants, lions, zebras, impala, eland, kudu, black antelope, baboons, wildebeests

[7] https://en.wikipedia.org/wiki/Selous_Game_Reserve.

and buffaloes. More than 400 different species of birds also inhabit the park[8].

Udzungwa National Park.

Udzungwa Mountains National Park is a park with a size of 1,990 km^2. The principal types of vegetation within the national park include tropical rainforest, mountain forest, miombo woodland, grassland and steppe. There is a vertical height range of 250–2,576 meters (the peak of Lohomero), which incorporates the Udzungwa Mountains part of the Eastern Arc Mountains. There are more than 400 bird species, 2500 plant species (25% of which are endemics) and 6 primate species (five of which are endemic). Among them is Iringa red colobus and Sanje crested mangabey.

Tourism in the Udzungwa Mountains National Park revolves around hiking and trekking, as the park has no roads and is accessible only on foot. The hiking trails range in difficulty from the short one-hour Sonjo trek to the extremely challenging 6-day camping trek the Lumemo Trail. The most common walk is the Sanje Waterfalls trail which takes approximately four hours to complete and allows the visitor access to the stunning 170 m waterfall and includes swimming in the waterfall plunge pools as part of the activity"[9].

Within Udzungwa Mountain the Kihansi Gorge is located, where the endemic Kihansi spray toad is living. A tiny toad of just two centimetres in length. Once considered to be extinct in the wild, the Kihansi spray toad has been the subject of intensive conservation measures and has now been successfully reintroduced to the wild.

[8] https://en.wikipedia.org/wiki/Mikumi_National_Park.

[9] https://en.wikipedia.org/wiki/Udzungwa_Mountains_National_Park.



Photo 2. Sanje Falls (Jerzy Gilarowski)

Udzungwa Scarp Nature Reserve

Udzungwa Scarp Nature Reserve (formerly Udzungwa Scarp Forest Reserve) is one of the largest (200 km^2) and biologically-richest in the Eastern Arc Mountains. The elevation ranges from 250 up to 2100 m above sea level. The outstanding biodiversity importance of USNR has been well documented, especially for vertebrate species[10]. A recent updated analysis conducted for the candidature of selected Eastern Arc forests to the UNESCO's World Heritage Site indicated that USNR has the highest number (37) of threatened vertebrates in the Eastern Arc, according to the 2009 IUCN Red List. The number of Eastern Arc-endemic vertebrates is the second highest (31) of any Eastern Arc forest.

[10] F. Rovero, M. Menegon, *Uzungwa Scarp, an outstanding Eastern Arc forest: biological value and urgent need for protection. Tanzanian Wildlife Research Institute. Proceedings of the 5 th Tanzania Wildlife Research Institute Scientific Conference*, 2005, pp. 183–187.

Mufindi Highlands

Mufindi Highlands is an area of beautiful tea plantations, evergreen forests, lakes, rivers. It offers a real sense of colonial rural Africa. A very broad range of activities may be done there including walking, hiking, horse-riding, fly-fishing, golf-playing, spending time around the farms and having interactions with the local communities. One of the biggest attractions may be 18 holes golf course in Mufindi Golf Club.

Kitulo National Park

Kitulo National Park is a protected area of montane grassland on the Kitulo Plateau in the southern highlands of Tanzania. The park is at an elevation of 2,600 meters and covers an area of 413 square kilometers, lying partly in Mbeya Region and mostly in Njombe Region. Protection of the Kitulo Plateau's unique flora was proposed in response to the growing international trade in orchid tubers and increased hunting and logging activities in the surrounding forests. The park was formally gazetted in 2005. Locals refer to the Kitulo Plateau as "Bustani ya Mungu" ("The Garden of God"), while botanists have referred to it as the "Serengeti of Flowers"[11].

Mount Rungwe Nature Forest Reserve

Mount Rungwe Nature Forest Reserve is a tropical montane forest with unique species composition, structure and biodiversity. The reserve is an important conservation area in Tanzania as well as having great value even at global level. The main vegetation types of the reserve are lower montane forest, upper montane forest, bushed grassland, bamboo belt, and heath. Mount Rungwe Nature Forest Reserve conserves the residual tropical montane forest and its endemic and endangered biodiversity. The Reserve

[11] https://en.wikipedia.org/wiki/Kitulo_National_Park.

hosts two of the world's twenty five rarest primates – the Kipunji (*Rungwecebus kipunji*) and the Rungwe galago[12]. The mountain is the catchment for key rivers which flow into Lake Nyasa. On the lower slopes of Rungwe mountain there is an arable land that can produce: paddy, coffee, tea, pyrethrum, cocoa, pineapples, tobacco, bananas, tomatoes, onions, Irish potatoes, wheat, sunflowers, groundnuts, millet, beans, sorghum, cassava, vegetables and non-traditional agricultural crops such as fresh fruits, vegetables, flowers and herbal plants.

Ngozi Lake

Lake Ngozi is located near Tukuyu, a small town in the highland of Rungwe District. Ngozi is a Holocene caldera which was formed around 12,000 years ago. The flooded crater is 2.5 km long and 1.6 km wide making it the second largest crater-lake in Africa[13]. The walls of the caldera are forested, with the exception of segments scoured by landslides and high cliffs that inhibit access to the water. The inner caldera is forested *with Maesa lanceolata*, *Albizia gummifera* and *Hagenia abyssinica*. The lake does not undergo large scale fluctuations in lake level, with only minor differences between the dry and rainy seasons. The lake has fish and the water is a deep emerald green colour. The local people use a very steep path to go down to the lake shore to catch fish. Air temperatures above the lake are around 18 °C with only minor seasonal variations.

Mbozi meteorite

Mbozi meteorite is one of the largest meteorites in the world. Its weight is estimated at 25 metric tons. It is around 3m long

[12] http://www.nature-reserves.go.tz/fnr/rungwe.

[13] http://www.tanzania-experience.com/blog/ngozi-crater-second-largest-crater-lake/.



Photo 3. Ngozi Lake
(http://www.tanzania-experience.com/blog/ngozi-crater-second-largest-crater-lake/)

and 1m tall. Although the site was only discovered by outsiders in 1930, it had been known to locals for centuries, but not reported because of various associated taboos. Like most meteorites, the one at Mbozi is composed primarily of iron (90%), with about 8% nickel and traces of phosphorous and other elements. It was declared a protected monument by the government in 1967 and is now under the jurisdiction of the Department of Antiquities. The meteorite's dark colour is due to its high iron content, while its burnished look comes from the melting and other heating that occurred as the meteorite hurtled through the atmosphere towards earth. At the distance of about 30 kilometres from the meteorite tourists may see other two attractions: Pongo la popo (cave of bats) and maji ya moto (hot-water springs).

4. Summary

As I already wrote, the implementation of the *TAZARA – Train and walk* product needs the strict cooperation of those administrative regions of Tanzania, through which the railway is passing, and the coordination of all actions by Tanzanian government. However, the prerequisite is the modernization of the Tanzania-Zambia Railway and the whole associated infrastructure. Due to the numerous tourist attractions occurring along the railway, and according to the different likings of tourists, the tour operators may prepare and implement various tourist, thematic programs. The common feature of all of them is that they might involve local communities and a huge portion of benefit might go to them. Community participation in tourism can take various forms depending on the local types of tourism resources and social circumstances, and often these forms will overlap. The most prevalent types of community participation would be:

– Village tourism, with tourists visiting villages on one day tours (or staying overnight in local accommodation), eating local cuisine and experiencing village life and cultural traditions.
– Ecotourism, where local communities exist in or nearby the ecotourism area (national park, game or nature reserve). These communities provide services related to the ecotourism activities. Often ecotourism and village tourism are combined with the tourists experiencing both the natural environment and local cultural patterns of the villages.
– Rural tourism, with tourists experiencing farming activities, and often engaging in local recreation activities such as hiking and fishing.
– Arts and crafts tourism, with tourists visiting villages that specialize in the production of particular crafts such as wood carving and textile making, or organize dance, music and drama performances.

REFERENCES

Daily News, 03.01.2017, *Tourist arrivals increased by 10 per cent in 2016*, Tanzania, Dar es Salaam.

Rovero F., Menegon M., *Udzungwa Scarp, an outstanding Eastern Arc forest: biological value and urgent need for protection. Tanzanian Wildlife Research Institute. Proceedings of the 5th Tanzania Wildlife Research Institute Scientific Conference 2005*, pp. 183–187.

The Citizen, 28.09.2017, *Ndulu: This is how to grow the economy*, Tanzania, Dar es Salaam.

UNWTO, *Tourism Highlights*, 2016, http://www.e-unwto.org/doi/pdf/10.18111/9789284418145.

http://tazarasite.com/wp-content/uploads/2014/11/Route_Map12.png.

https://en.wikipedia.org/wiki/TAZARA_Railway.

https://en.wikipedia.org/wiki/Selous_Game_Reserve.

https://en.wikipedia.org/wiki/Mikumi_National_Park.

https://en.wikipedia.org/wiki/Udzungwa_Mountains_National_Park.

https://en.wikipedia.org/wiki/Kitulo_National_Park.

http://www.nature-reserves.go.tz/fnr/rungwe.

http://www.tanzania-experience.com/blog/ngozi-crater-second-largest-crater-lake/.

Chapter 11.

CHAKUPEWA JOSEPH
EVARISTO HAULLE

THE INFLUENCE OF TOURISM ON THE GROWTH OF ENTREPRENEURSHIP IN SOUTHERN CIRCUIT OF TANZANIA
Challenges and the way forward

ABSTRACT

Tourism is regarded as a crucial sector in fostering economic growth, the creation of employment to both developed and developing countries of which Tanzania is not exceptional. While most parts of the country are said to be endowed with tourist attractions, not all parts of the country are benefiting from the sector at equal footing. The Southern Circuit, for example, has not reaped the most from the sector contrary to the northern zone. As a result, development of entrepreneurship that relies on tourist activities is far felt in the southern zone. With the use of secondary data, this paper argues that the Southern Circuit which is endowed with fascinating tourist attraction if fully harnessed will result into the growth of tourist entrepreneurs. The paper sketches several challenges that have impinged growth of tourist entrepreneurs in the Southern Circuit to include, poor infrastructure and poor marketing strategy of the tourist amenities, and limited entrepreneurial skill to run the tourism sector. Other challenges are: limited government support to improve the tourism in the southern zone as well as limited diversification of the tourism industry beyond wildlife so as to attract more tourists and entrepreneurs in the sector. Still, the Southern Circuit holds a great future for growth of tourism industry which

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will catalyse the growth of entrepreneurship. Thus, attempts to improve entrepreneurship through tourism industry should be made possible by undertaking training to the entrepreneurs, improve infrastructure and emphasis on diversifying the tourism industry to include cultural tourism which will attract more entrepreneurs in the sector.

1. Introduction

Most of the countries in the world run their economies and their people dependent on tourism for their livelihood. This is because there is a widely held view that tourism, if well harnessed, can successfully be used as a tool for economic development[1]. As Dieke[2] put it many developing countries regard tourism as an important and integral part of their economic development strategies. WTTC[3] conducted a research on travel and tourism business and found that travel and tourism subsidised USD 7.2 trillion to the world GDP, which is 9.8% of global GDP. The sector generated 284 million jobs or 9.1% of total employment in the world. It is anticipated that by 2026, the sector will have generated 370 million employment

[1] N. Luvanga, J. Shitundu, *The role of tourism in poverty alleviation in Tanzania*, Dar es Salaam 2003; J. Mitchell, C. Ashley, *Tourism and poverty reduction: Pathways to prosperity*, London 2010; D. Peaty, *Kilimanjaro tourism and what it means for local porters and for the local environment*, „Journal of Ritsumeikan Social Sciences and Humanities", 4(2012), pp. 1–11; J. Kweka, O. Morrissey, A. Blake, *The Economic Potential of Tourism in Tanzania*, „Journal of International Development", 15(2003), pp. 335–351, published online in Wiley InterScience (www.interscience.wiley.com), DOI: 10.1002/jid.990; W. Anderson, *Cultural tourism and Poverty Alleviation in Rural Kilimanjaro*, „Journal of Tourism and Cultural Change", 13(2015), no. 3, pp. 208–224.

[2] P.U.C. Dieke, *Tourism in Africa's Economic Development: Policy Implications*, „Management Decision", 4(2003), no. 3.

[3] WTTC, *Economic Impact Analysis. Annual Update Summary the Economic Impact of Travel&Tourism*, 2016, retrieved from: https://www.wttc.org/research/economic-research/economic impact-analysis.

opportunities in total globally which is equivalent to 11.1% of all employments[4]. In East Africa, tourism is continuing to regain the highest impetus to the extent of becoming one of the largest and fastest growing sectors in the region (WTO, 2012). Tanzania is one of the fastest growing tourist destinations in Africa. It is enjoying a healthy contribution of about 17% of GDP and 25% of foreign exchange from tourism. Tourism development has remained strong and accounts for more than 14% of the Tanzania's Gross Domestic Product (GDP) and is expected to grow by more than 5% a year in real terms through 2020[5]. According to Qorro (2017), Tanzania has overtaken neighbours like Kenya to become the East African region's tourist hub in both tourist arrivals and earnings from the key subsectors. Tanzania received a total of 1,284,279 tourists in 2016, a 12% increase from the 1,137,182 tourists who arrived in 2015 and at least 400,000 more tourist than Kenya for the same year. On the other hand, the Bank of Tanzania (BoT) statistics revealed that the country earning from tourism rose by 11% in 2016 to $2.23 billion as a direct result of the increase in a number of tourist arrival, from $2.01 billion in 2015. On the other hand, the Bank of Tanzania (BoT) revealed that the country earning from tourism rose by 11% (from $2.01 billion in 2015to $2.23 billion in 2016) as a direct result of the increase in a number of tourist arrival.

Such tremendous increase of tourists is due to, among other things, existing of the highest endowment of various tourist attractions in the country ranging from natural resources that form a mainstay of tourist attractions with almost a third of the land areas being located close to national parks and other kinds of conservations[6].

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[4] Ibidem.

[5] M.M. Okello, *Economic Contribution, Challenges and Way Forward for Wildlife-Based Tourism Industry in Eastern African Countries*, „Journal of Tourism Hospitality", 3(2014), pp. 122, doi: 10.4172/2167-0269.1000122.

[6] J. Kweka, O. Morrissey, A. Blake, *The Economic Potential of Tourism*..., op. cit.

The growth of tourist sector, apart from directly contributing to the government through paid fees, demands inputs of different services from other sectors of economy hence emerging of individuals and other small, medium and large enterprises to serve tourists once they are in the host country. As a result of the on-going activities of feeding tourist demands, entrepreneurship that depends on the tourist sector to thrive emerged. According to Nongsiej and Somipam[7], tourist activities foster entrepreneurship activities in a number of ways especially through the construction of hotels, creation and improvement of cultural tourism, increase of sports and games activities, improvement of transport activities, etc. While tourist activities which fosterdevelopment of entrepreneurship activities are appreciated, there are some parts of Tanzania where despite endowment of tourist attractions, still entrepreneurship activities are very low. This is to say people living adjacent to the most tourist centres have not yet benefited much through the initiation of different projects which are mostly needed by the tourists. The most affected region in this aspect is the Southern Circuit of Tanzania comprising Iringa, Njombe, Mbeya, Katavi, Songwe, Ruvuma, and Rukwa regions.

The Southern Circuit has several tourist centres including Mikumi, Katavi, Kitulo, and Ruaha national parks, several game reserves, historical and archaeological sites of which have not attracted much entrance of tourist such growth of entrepreneurship being fuelled by tourism impinges. This is contrary to other regions where the entrance of tourism is in such high abundance that entrepreneurship activities that are fuelled by tourism are flourishing. According to Kweka[8], tourism activities are largely

[7] P. Nongsiej, S.R. Somipam, *The Role of Entrepreneurship in Tourism Industry: An Overview. Paper Presented in a seminar on Entrepreneurial Opportunities for Educated Youth in Global Bus*, Pondicherry University 2017.

[8] J. Kweka, O. Morrissey, A. Blake, *The Economic Potential of Tourism*..., op. cit.

concentrated in the Northern Wildlife Area (NWA), the city of Dar es Salaam and the historic isle of Zanzibar. Above all, according to the UNWTO[9] about 72% of the Tanzania's total revenue from tourists comes from Kilimanjaro and the Northern Safari Circuit (Serengeti, Ngorongoro, Manyara and Tarangire) which attract about 300,000 tourists a year.

It is against that background that this paper is written which among others aims at delineating how undertaking of tourism in the Southern Circuit, if fully harnessed, will lead to the growth of entrepreneurship in the region. Apart from introduction section, the paper is composed of the following sections: "The state of tourism in Tanzania with focus from the Southern Circuit of Tanzania" and followed by "The role of tourism in the growth of entrepreneurship in the southern part of Tanzania". Another remaining section touches on the challenges faced by the entrepreneurs who rely on the tourist industry whereas the next section addresses necessary strategies that should be employed to improve the tourist industry and entrepreneurship altogether in the southern zone. The last section concludes the entire work by emphasizing much what needs to be undertaken to improve the sector for the success of entrepreneurship in the Southern Circuit which relies much on the tourism sector.

2. The state of tourism in Tanzania with focus from Southern Circuit of Tanzania

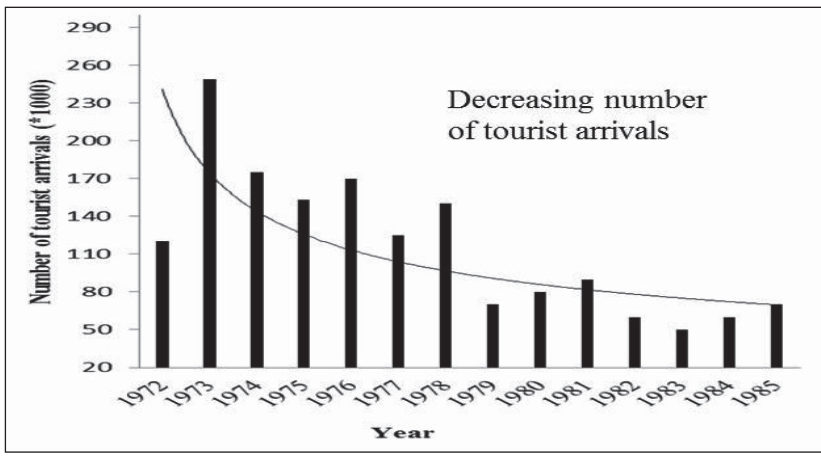
The overalltourist industry in Tanzania can be categorized into two major phases i.e. pre-liberation period and after the introduction of liberalization policy. During the pre-liberalization era where socialism policy under the Arusha declaration was under the reign,

[9] UNWTO, *Manual on Tourism and Poverty Alleviation. World Tourist Organization*, Madrid 2010.

the tourist industry was solely run by the government with no individual given room to operate the sector. Wade [et al.][10] put it that despite the modest investment in the sector tourism increased within the country during the 1960s and 1970s. This was mainly due to the growing tourist industry within the bordering Kenya. The closure of the boundary of Tanzania and Kenya, the collapse of East African Community and the emergency of economic crisis in the world resulted into the dropping down of the number of tourists and the length of stay in the country. Figure 1 shows the situation of the tourist arrivals from 1972 to 1985.

The figure revealed clearly that it was in 1973 when tourist arrivals boomed, whereas in 1983 received the lowest number of tourists in the country. The trend of tourism in 1970s was spearheaded by the

Figure 1. Trends in tourist arrivals between 1972 and 1985



Data source: D. Wade, B.C. Mwesiga, P.F.J. Eagles, *A history and market analysis of tourism in Tanzania*, „Tourism and Management", 22(2001), pp. 93–101; H. Kilungu, P. Munishi, R. Leemans, B. Amelung, *Wildlife Safari Tourist Destinations in Tanzania: Experiences from Colonial to Post Colonial Era*, „International Journal of Current Research and Academic Review", 2(2014), no. 6, pp. 240–259

[10] D. Wade, B.C. Mwesiga, P.F.J. Eagles, *A history and market analysis of tourism in Tanzania*, „Tourism and Management", 22(2001), pp. 93–101.

existing friendliness between Tanzania and Kenya where the border was free whereas the practised tourism was said to be an advantage of Kenyan tourism industry. On the other hand the diminishing of tourist arrivals in the 1980s was fuelled by the deepening of the economic crisis that affected the East African country and the entire continent.

The late 1980s witnessed a tremendous increase of tourist arrivals in the country following the introduction of Structural Adjustment Programme. According to Chambua[11], Kulindwa[12], and Ranja[13], these new liberalization policies together with the removal of trade restriction forced the developing countries to open up their economies for import from developed world. It was during this period that massive privatization of state-owned tourism assets was implemented and so the sector was left on the hands of individuals and private enterprises. The government played the role of overseeing and regulating the sector through the Ministry of Natural Resources and Tourism. These changes led to the increase of tourists year after year. Figure 2 shows the trend of tourism from 2000 to 2012.

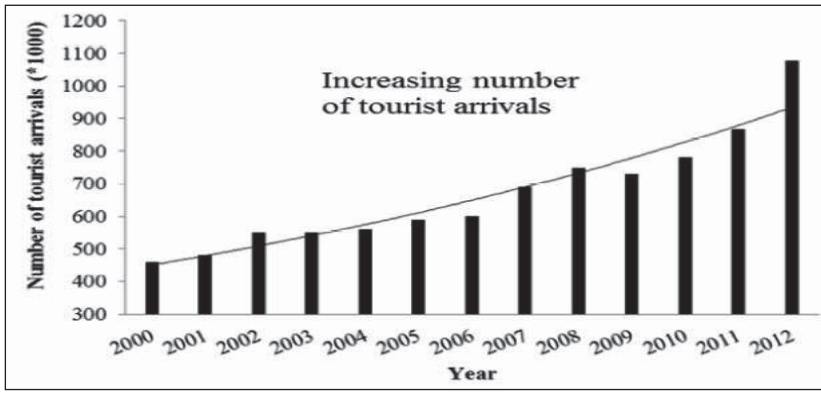
Figure 2 reveals the trend of tourist growth from 2000 to 2012 which suggests that there has been a tremendous increase of tourist arrivals in Tanzania every year. Such increase of tourist arrival has been going higher that in 2015 Tanzania received a total of 1,137,182 before increasing by 12% in 2016 to reach a total of 1,284,279. Such increase of tourists goes hand in hand with its contribution to the economic development of the country whereby revenue from the tourist has been increasing year after year gaining

[11] G. Chambua, *Tourism and Development in Tanzania: Myths and Realities. Paper presented at the 4th IIPT African Conference „Building Strategic Alliance for Sustainable Development, Peace and Reconciliation on the African Continent"*, 2007.

[12] K. Kulindwa, H. Sosovelo, O. Mashindano, *Tourism Growth for Sustainable Development in Tanzania*, Dar es Salaam 2001.

[13] T. Ranja, *Development of National Entrepreneurship in the East African Tourism Industry*, Dar es Salaam 2003.

Figure. 2 Trends in tourist's arrival between 2000 and 2012



Data source: UNWTO, 2011; Tairo, 2013

2 USD billion in 2016 against 1.9 USD in 2015 which contributed to 17.5% to Tanzania GDP and 25% of foreign currency (URT, 2016). Moreover, the sector has produced direct and indirect employment in which in 2016 alone total of 500,000 were directly employed in the tourist sector whereas 1,000,000 were self-employed. This is to state that all who were self-employed ventured into the tourism entrepreneurship (URT, 2016). The question, however, maybe that is the whole country benefiting equally to the growing number of tourism? Are all areas in Tanzania that are endowed with tourist attractions favouring thegrowthof entrepreneurship activities? These andother kinds of analyses are well addressed in the following sections starting with addressing the existing inextricable relationship between tourism and entrepreneurship.

3. Relationship between Tourism and Entrepreneurship: A Conceptual Model

It is evident that there is a relationship between tourism and entrepreneurship but this relationship is not causal-effect relation-

ship; rather the two sectors are intricately linked. Any country that has registered highest performance of tourism has, in the same way,witnessed thegrowth of entrepreneurship. This is to say, there is a greater correlation of the two sectors such that separating them might risk the other. Shaw and William (1998) assert that tourism and entrepreneurship are branded as indefinable and hard to disentangle as there seems to be a converse relationship between the effect of entrepreneurship on tourism and vice versa. Khan& Krisnamurthy[14] believe strongly that a well-endowed tourism industry would never evolve successfully without tourism entrepreneurs. It is from such understanding that today researchers and academicians and tourist practitioners have coined tourism and entrepreneurship as "tourism entrepreneurship". According to Khanka (1999) tourism entrepreneurship refers to the activities of the major groups of stakeholders in the tourist sector primarily designed for the effective and profitable interactions of demand for and supply of tourism products at the same time ensuring competitive professionalism and gainful of social status. In simple terms, it embraces all sorts of activities involved in creation and operation of legal tourism enterprises. Entrepreneurship tourism is run by individuals, small, medium and large enterprises who run different activities that are demanded by the tourists. According to Jakanathan [et al.][15] enterprises that relate with the tourist industry are widespread depending on the nature of the country and the attractions available, namely travel & tour operators, hotels, motels, guest houses, travel tour agencies guiding services, traditional cuisines, restaurants, cafe, etc.

[14] F.R. Khan, J. Krishnamurthy, *Future proofing of tourism entrepreneurship in Oman: challenges and prospects*, „Journal of Work-Applied Management", 8(2016), no. 1, pp.79–94, https://doi.org/10.1108/JWAM-06-2016-0008.

[15] K.N. Jakanathan, K.R. Mehta, V. Muthukumar, K. Siva, *Tourism entrepreneurship*, 2009, http://www.scribd.com/doc/20995282/Tourism-Entrepreneurship#scribd.

The tourism industry has numerous areas which need individual, small, medium and large enterprise to run the sector. The growth of entrepreneurship being spearheaded by tourism and vice versa is well articulated by Jakanath [et al.][16] who argued that the entire gamut of travel and trade activities seems to have combined adventure with the element of tourism thereby offering exciting opportunities for entrepreneurs. Moreover, Koh and Hannet (2002) stated that a community's quantity and quality of supply of tourism entrepreneurs significantly determines the magnitude and form of its tourist's mantle because the tourism entrepreneur is the personal cause of tourism development.

4. Tourism and growth of entrepreneurship in Southern Circuit of Tanzania

The state of entrepreneurship that depends on the tourism industry in Tanzania follows the path that the history of Tanzania has passed since independence. During the early years of independence the government had one major activity of building the nation. When the government was struggling to build nationality spirit, very few resources were directed to building the economy. Moreover, soon after introducing socialism in the 1960s as its path to development, the government decided to own and manage the tourist industry through the Tanzania Tourist Cooperation (TTC). There was a belief at that time that development of tourism would not contribute to the Ujamaa policy of self-reliance, instead would, in fact, promote dependency upon the developed world[17]. Thus, the tourist industry witnessed little investment in the sector as very

[16] Ibidem.

[17] B. Freisen, Safari tourism to the Ngorongoro Conservation Area, Tanzania: Planning for future developments a survey into perceptions of tourists and the tourism industry, Unpublished MA Thesis, Nijmegen 1995.

few funds were directed toward the sector. Of interest is the fact that the government at that time discouraged private and foreign investment in the tourist industry[18]. As a result, the possibility of developing entrepreneurship in the tourist industry did not exist.

The tourist industry witnessed new changes of seeing private enterprises and individual entrepreneurs venturing into this lucrative sector in the late 1980s and early 1990 after the government had withdrawn from managing the sector following disbandment of Tanzania Tourist Cooperation (TTC) and the introduction of Tanzania Hotels and Investment Cooperation (TAHI), and the Tanzania Tourist Board (TTB). It is from this time that a good number of private enterprises, local and foreign, got her impetus. Again, individual entrepreneurs started seeing greater opportunity in the tourist industry. As tourists entered Tanzania, via different routes in good numbers, the regions, which received many tourists, enjoyed much higher growth of entrepreneurship activities than the regions with small number of tourists. In this aspect, the northern zone, comprising Arusha, Manyara and Kilimanjaro regions, has benefited much from attracting many tourists and so increased entrepreneurship activities[19]. However, other zones, though might not have benefitted much through development of entrepreneurship that is spearheaded by tourism, still enjoy the role that the tourism industry may offer to the entrepreneurship activities.

The Southern Circuit with the current level of tourism practices has led to thegrowth of investment in the hotel industry including motels, inn, camping that serves the accommodation need for tourists. Iringa and Mbeya are steadily increasing in the construction of hotels, motels, camping sites, restaurants, fast food and coffee food so as to satisfy tourists' needs. All such

[18] D. Wade, B.C. Mwesiga, P.F.J. Eagles, *A history and market analysis*..., op. cit.
[19] W. Anderson, *Cultural tourism and Poverty Alleviation*..., op. cit.

services demand well-trained staff with an entrepreneurial mind to run the hotel industry so as to satisfy the growing needs of tourists in the Southern zone. Studies show, for instance, that between 2000 and 2005 the accommodation establishment for Iringa and Mbeya increased by 46.9% compared to an average of 10% growth in previous years.

The entry of tourists in the Southern Circuit demands for reliable transport systems and so the need for a travel agency to offer transport opportunities for the tourist. In order to reach the tourist attraction destinations, people from the country of destination have the role to organize transport for tourist to and from the tourist attractions[20]. Running the tourist transporting system needs well-skilled personnel with an entrepreneurial spirit as opposed to the normal public transport system. Moreover, travel agencies which are tasked to coordinate transportation of the tourists in the southern zone formimportant entity in the tourist sector that needs to bear important entrepreneurial knowledge.

Apart from enjoying national parks with attractive flora and fauna, tourists are also moved with cultural opportunities including museums, art exhibitions and information services to fulfiltheir earmarked thirstfor visiting southern zone. The basis for the cultural exhibition is always provided by local entrepreneurs who among others combine their entrepreneurial knowledge and innovative skill to manufacture and design different cultural attires for the tourist to buy. Indeed, the cultural tourism has attracted many local entrepreneurs whose daily earning depends onmany arrivals and longer stay of tourists in the southern zone. Mbeya region, for instance, has fascinating scenery and vibrant local

[20] S. Samei, M. Akhoondzade, *The Role of Entrepreneurship in Tourism Industry Development*, „European Online Journal of Natural and Social Science", 2(2013), no. 3, pp. 1423–1430.

culture including the following: Ngozi crater lake, Matema Beach, 20 tonnelnickel-iron meteorite fall, Daraja la Mungu (Natural Bridge), mysterious and aloe inspiringkijungu (plunge pool), Uporoto, Kipengere and Livingstone mountain ranges, Usangu valley and Kalambo Falls at Zambia and Tanzania border[21]. In Iringa, apart from having Ruaha, the largest national park in Tanzania and the third large national parks in Africa, there are also Udzungwa and Kilombero Nature Reserve, the best historical sites like: Kalenga museum, Isimila stone ages, Igeleke Rock art and Gangilonga stone. Similarly in Njombe region there are Manda and Lupingu beaches along Lake Nyasa, Livingstone and Kipengere ranges and Kitulo National Parks (The Garden of Eden of flower). Cultural attractions in Njombe are Mganda and Kihoda Dance festivals in Ludewa, tea plantations in Lupembe, Njombe and Luponde as well as Nyumbanitu cultural site.

The entry of tourists in the southern zone needs to be provided with different services which attractlaunching of different business opportunities by the local communities. Such business opportunities include shopping, passport service as well as communication. Moreover, there is a need for financial services in the destination areas where tourists reside. This requires efficient availability of reliable banking system, insurance as well as bureau de change shops. These needs push for a greater need for entrepreneurship knowledge and mindset for the establishment and rendering such services in the Southern Circuit. Those who work in such institutions are also tasked to develop the entrepreneurial skill to run such service so as to satisfy the need of tourists.

This is to state that growth of tourism in the southern zone goes hand in hand with the growth of entrepreneurial skills as the more tourists need different reliable services the greater the need for high

[21] http://domestictourismsafaris.co.tz/mbeya-region/.

innovation in the sector which in the end attracts growth of entrepreneurship spirit. The southern zone, however, despite appreciating the need for entrepreneurship for the development of tourism still number of challenges are haunting the sector, both the tourist sector as well the entrepreneurship sector. Such challenges emanate from within and outside the sector as highlighted hereunder.

5. The tourism industry and the challenges of entrepreneurship in Southern Circuit of Tanzania

Observing the growth of entrepreneurship being spearheaded by the tourism in the Southern Circuit is worrisome. There is little effort that is directed towards assuring the residents in these regions that they can reap the most from the sector. In addition, the tourism sector in the Southern Circuit is least performing with more emphasis being placed on wildlife attraction. As a result,entrepreneur that is expected to grow following the suit of this sector is quite very little. Indeed, the challenges facing tourist sector to grow in the Southern Circuit are almost the same affecting growth of entrepreneurship in the same sector.

The region is not well connected with reliable infrastructure, especially roads and airways. Even railway through Tanzania Zambia Railway (TAZARA) and waterways are still not well developed and utilised. The question for poor infrastructure was also echoed by stating that about 41.2% of tourists who visited Tanzania in 2015/2016 expressed their concerns over poor conditions of roads and airport facilities[22]. It should be known that most of the tourists make use of roads and air as their major means of transport

[22] Xinhua, *Tanzania records surging tourist arrivals: report*, 2017, retrieved from: http://news.xinhuanet.com/english/2017-06/10/c_136355634.htm accessed on 16/10/2017.

to reach areas of destination. For instance, in 2000–2009 most of the international visitors used road and airways as their major means of transport compared to railway and sea as Figure 3 shows.

Figure 3. International Visitor Arrival by mode of Transport



Source: Ministry of Natural Resource and Tourism (2010)

In Southern Circuit airways and roads are not well developed. It is from this fact that Southern Circuit has not managed to attract tourists from Europe. Poor means of transport to easy tourist access to the Southern Circuit has not only affected the growth of tourist entrepreneurship but also the region has witnessed little growth of hotels – for example there is no five-star hotel (URT, 2015).

Thriving of entrepreneurship that depends on the growth of tourism will be made possible if well-trained personnel fully participates in the tourist sector. It has been revealed that in the northern zone, that is regarded as the best practice, still lackof skills to run the tourism sector is clearly identified which suggests that in the southern

zone the situation is worse. The study by Anderson[23] revealed that lack of awareness of how to invest in tourism, the lack of skills and qualification for working in the tourist industry were identified as a stumbling block to fully engage in the tourism industry. In the same study Anderson underscored the level of challenge for lacking skilled labour by quoting one respondent who argued that:

> „Our people lack traditional skills. If we could get experts to train us on how to create cultural product and perform some traditional dance, it would attract tourists to our village. Just imagine, currently, tourists travel 50km or more through our villages to watch things which can also be shown here".

Such excerpt suggests clearly that entrepreneurs who can run tourist activities need to have specialized skills as opposed to mere selling of finished products. The situation is worse in the Southern Circuit which does not even have public tourist college to train "the would be tourist entrepreneurs" like tour guides, tour operators who are hospitable enough to run the facilities. Even the present private tourist colleges in the southern zone are still at the infant stage to produce well-qualified staff to operate the sector[24]. Most of tourists personnel who are running the tourist activities in the Southern Circuit are drawn from northern and eastern part of Tanzania as they have relatively higher experience in running the sector. The southern part has no reliable tourist colleges and best hotel to undertake hands-on tourist training. As a result, there isa greater challenge for enabling environment for entrepreneurship to grow that depends on the tourist activities.

It is evident that since the beginning of privatisation, the tourist sector in Tanzania has not focussed enough on the Southern Circuit as true destination of the tourists. There is a problem of

[23] W. Anderson, *Cultural tourism and Poverty Alleviation*..., op. cit.

[24] D. Wade, B.C. Mwesiga, P.F.J. Eagles, *A history and market analysis*..., op. cit.

coordination between the government agencies that operate tourist activities on one side and the private sector, mainly entrepreneurs, in the southern zone. It is no wonder that the Ministry of Natural Resources and Tourism declared Iringa to be the southern hub of tourism and TTB decided to open up a zonal office in Mbeya. However, the same offices should be open in each region of the southern zone, because the entrepreneurs who wish to initiate any project have to go to Mbeya from Iringa, Ruvuma, Katavi or Rukwa.

Marketing and advertising of tourist attractions from the Southern Circuit are still limited. The use of websites, broadcasting and printing media were not widely used to raise the awareness to prospective tourists. Similarly, social media are also not fully utilised. Kiralova and Pavliceka[25] assert that the growing role of social media in tourism is undeniable. The leveraging off social media to the market destination has proven to be an excellent strategy. Indeed, the development of information and communication technologies through their mother channel "internet" has revolutionized the tourism business both as a source of information and as a sales journey. In the Southern Circuit magnitude of using social media is not well developed as a result of which most tourist attractions are less known to the potential international and local tourists. This has a far-reaching impact on the potential entrepreneurs who rely on the growth of tourism. To authenticate how social media are nowadays determinant driver of tourist, Nielsen[26] conducted a research through the Global Survey of Trust in Adverting and revealed among others that more than half (56%) of respondents

[25] A. Kiralova, A. Pavliceka, *Development of Social Media Strategies in Tourism Destination*, „Procedia-Social and Behavioral Science", 175(2015), pp. 358–366.

[26] Nielsen, *Earned Advertising Remains Most Credible among Consumers. Trust in Owned Advertising on the Rise*, 2013, retrieved from: http://www.nielsen.com/us/en/press-room/2013/nielsen--earned-advertising-remains-most-credible-among-consumer.html.

trusted consumer-consented email messages, 48% of respondents trusted ads in search engine results, online video ads and ads on social networks, 42% say they trust online banner ads. 45% of respondents in Nielsen's survey believed display ads on mobile phones were credible and 37% trusted text ads on mobile phones.

According to Nielsen, 55% of respondents said they were willing to take action at least sometimes based on social network ads, 52% based on online video ads, 50% based on online banner ads, 49% based on display ads on mobile devices, and 45% based on text ads on mobile phones. Countries/regions that do not make use of social media in advertising their attractions do not benefit from the basic objectives of social media which include the following: (1) creating/increasing awareness of the destination; (2) reaching global publicity; (3) encouraging visitors to plan their journey; (4) strengthening the destination image as a favourite destination; (5) targeting new/specific market; (6) increasing number of visitors; (7) creating buzz around the destination; (8) increasing the number of email subscribers; (9) increasing the number of Facebook fan base; (10) changing the position of destination in the mind of visitors; (11) bringing back the destination as a favourite one for visitors[27].

While the question of tourism encompasses a number of issues, Tanzania and Southern Circuit, in particular, have mainly confined the tourist activities in the wildlife industry. Little efforts have been made to widen the scope of tourism including cultural tourism. According to Anderson[28], cultural tourism is built on various cultural attractions and local people by which tourists are able to experience authentic cultures combined with nature, scenery, folklore, ceremonies, dances, rituals, tale, art, handcrafts and hospitality, giving a unique insight into the ways of life of the people. Such failure

[27] A. Kiralova, A. Pavliceka, *Development of Social Media Strategies*..., op. cit.
[28] W. Anderson, *Cultural tourism and Poverty Alleviation*..., op. cit.

to allow tourism in the Southern Circuit to be so much inclusive does not give a room for entrepreneurship to grow in the respective region. This is contrary to Kilimanjaro region where, according to Anderson, 37.8% of the respondents were involved in different forms of cultural tourism in their villages. The study attested that most men and women got money from exhibiting cultural products designed from their handicraft enterprises.

The Southern Circuit of Tanzania is greatly facing a tremendous increase of environmental degradation that aggravates climate changes. The Southern Circuit has witnessed the far-reaching impact of environmental degradation that has affected tourism through the Great Ruaha Basin[29] which is referred to as the Tanzanian ecological backbone[30]. The ecosystem services, that tourism depends upon, are threatened by climatic variability, land use mal-practices, cutting down trees and uncontrolled fire which is common in Iringa, Dodoma and Mbeya region. Over the past few years the Great Ruaha River has been delivering less and less water; the grass that was once plentiful is now scarce, leaving fauna in the Ruaha National Park hungry. Since 1994, the runoff of River Ruaha has been uncertain. The flow of river stops most of the summer times, the river turns into a series of ponds in the river course. The situation affects the aquatic life like hippos, crocodiles, fish and other organisms which may directly feed in the river and sustain life by using water from the Great Ruaha. This affects food chain, web and ecosystem at large. The great river

[29] The Great Ruaha River is a river in south-central Tanzania that flows through the Usangu wetlands and the Ruaha National Park east into the Rufiji River. Its basin catchment area is 83,970 square kilometres (32,421 sq mi). The Great Ruaha is about 475 km (300 mi.) long, its tributary basin has a catchment area of 68,000 km^2.

[30] O. Kiishweko, *Great Ruaha river that helps feed Tanzania under 'alarming stress'. The Guardian, Tuesday 15 January 2013*, retrieved from: https://www.theguardian.com/global-development/2013/jan/15/great-ruaha-river-tanzania-stress on 15/10/2016.

runoff has not only affected ecosystem resources in the river, but also affected agricultural production in the upper course of the river especially in Mbalali area. The situation also affected the production of the electricity in the dams located in the same river course like Mtera and Kidatu and Kihansi. Failure to produce enough electricity poses a challenge on establishing other entrepreneurial activities that can directly support tourism in the Southern Circuit. Limited availability of electricity causes poor services in hotels which host tourists, but also other tourist amenities cannot function properly, thus causing dissatisfaction of tourist services hence reducing the number of visitors and time of stay of specific visitors.

Wetland cultivation which is popularly known as vinyungu in Iringa and Njombe and madimba cultivation in Ruvuma has disturbed water catchments and thus loss of vegetation cover and degradation of water resources that could sustain the ecosystem and human life.

Also poaching is posing a challenge on the sustainability of tourism sector that in turn could enhance entrepreneurship. As it is evident that the tourist amenities in Tanzania are mainly related to natural resources and wildlife resources in particular, any jeopardy of such resources causes decline of tourism. Illegal hunting in our national parks and game controlled area caused loss of biodiversity and loss of key attractive resources. It is evident that to date there is no rhinoceroses in the Southern Tanzania Tourism Circuit since 1993 due to poaching. The number of elephants is tremendously declining because of illegal search of ivory. In this case, the food chain and food web are disturbed and thus ecological sustainability is questionable.

6. Improving tourism for the growth of entrepreneurship in southern highland: the way forward

The growth of tourism in the Southern Circuit has a greater potential to allow steady improvement of entrepreneurship that

relies on the tourist amenities. In fact, each sector depends on one another for its sustainability. However, preceded analysis has proven that development of entrepreneurship that relies on tourist activities faces several challenges to ascertain its headway. The same is true with the tourism industry in Southern Highlands which is also not exception. Despite all that hurdles for the two sectors still, there is greater hope to have the two sectors improved together if the following attempts are undertaken.

The first attempt to have the two sectors match its way is through deliberate undertaking training to all individual entrepreneurs in the Southern Circuit so that they may be able to properly handle the need of the tourist need. The needs for undertaking intensive training are in line with what Cooper [et al.][31] argued that the challenges facing the tourism industry will only be met successfully by a well-educated, well trained, bright, energetic, multilingual and entrepreneurial workforce which understand the nature of tourism and have a professional training. Serving the tourists needs the highest level of hospitality of which entrepreneurs in the southern zone are not used to, due to, among others, lack of training. The tourism is against what is known as *kidada* or *ndimgaya sida* in kihehe language, which implies that the service provider does not care, instead, it is up to the customer to take the service or not. This is a critical exemplary of limited customer care that hinders tourism so does entrepreneurship to flourish.

There is a need for the government to deliberately initiate a policy of attracting investment in the tourist sector in the southern zone since it seems to have been forgotten regardless of its abundance of tourist attractions. Such policy would cater, among others, the construction of the tourist colleges in the southern zone

[31] C. Cooper, J. Fletcher, D. Gilbert, R. Shepherd, S. Wan Will, *Tourism Principles and Practice*, New York 1998.

that will train tour guides, tour operators, hotel managers etc. The same policy will have to articulate and establish infrastructures that lead to the improved tourist destination.

The future growth of tourism in Tanzania is inextricably bound to the development of entrepreneurship which will unleash the sleeping giant of the tourist beauty of the Southern Circuit. This will be made possible if deliberate strategic promotion of the Circuit will be made known to the world over, hence the need for intensive marketing of immense wildlife resources of Selous Game Reserve, Mikumi, Ruaha, Kituro, Katavi and Udzungwa national parks. The need for strategic marketing of the Southern Circuit is well articulated by Yuju-Wang[32], who noted that the increasingly competitive tourism market has made the products marketing a very important factor in order to gain better destination patronage and to attract more consumption services and generate repeat business and loyalty. Esu and Ebitu[33] provided further benefit of investing on marketing of the destination like in the Sothern Circuit such as: (i) creation of awareness and interest in the destination and the attractions; (ii) differentiate the destination and its product offerings from competing destinations; and (iii) communicate the physical and psychological benefits of products packaged of the destination to the market. Other benefits for investing on marketing destination are: build and maintain the overall image and reputation of the destination; persuade tou ists to visit the destination and increase the length of stay in the destination; and assist the destination management to level out peaks and valleys result from the seasonality of demand.

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[32] B.A. Yuju-Wang, *Effects of integrated marketing communications (IMC) on visitors heritage destination selection*, „Journal of Quality Assurance in Hospitality and Tourism", 10(2007), pp. 132–144.

[33] B.B. Esu & E. Ebitu, *Promoting an emerging tourism destination*, „Global Journal of Management and Business Research", 10(2010), no. 1, pp. 21–28.

The growth of entrepreneurship that relies on tourism to thrive needs a special committee at the regional level and the entire Southern Circuit to oversee undertaking of tourism activities for its success to be witnessed. The committee, among others, will have a duty to plan short, medium and long-term working plan to ensure that each scheduled task to see tourism succeed in the respective region is accomplished. The committee should be tasked also with undertaking monitoring and evaluating of each scheduled task while reporting each hurdle they experience to be dealt with at the national level or regional level.

Improving infrastructure that will ease reaching the hard areas for making tourist in the Southern Circuit a success needs a special attention at the regional and national level. The infrastructure that is targeted here encompasses mainly economic infrastructure ranging from public work and transport, public utilities such as power, telecommunications, water, sanitation and sewage and solid waste collection and disposal[34]. The way through which success of tourism, as well as entrepreneurship that relies on tourism, is affected has been addressed. Persistent of impassable roads to the destinations of the tourist, unreliable air transport in the regions do not offer the best opportunities for tourism and entrepreneurship to thrive in the region.

In order to develop tourism and have its impact on entrepreneurship, there is a need to encourage individuals, private sectors and government to actively engage in provision of tourist demands through improvement of Public Private Partnership. The friendly manner of interaction and investment the sectors will improve and the tricked down effect will be experienced.

Since tourism industry is largely depending on natural resources especially wildlife, there is a need to improve conservation of

[34] World Bank, *World Development Report 1994: Infrastructure For Development*, New York 1994.

natural resources. By doing so the natural attractions will be enhanced and thus the tourists will continue to be attracted and thus through demand driven approach individuals will be encouraged to establish businesses that will serve the interests of the tourists. In the same way, the conservation will be meaningful, especially when there would be very high participation of the community members in conservation of the resources. In so doing, the poaching will be reduced at great extent.

Land use plan is also key if the Southern Circuit needs to be competitive in tourism while enhancing entrepreneurship. Emphasis in land use plan will help reducing the encroachment of reserved areas but also help to maintain other resources that would be identified as tourist amenities. This is because without land use plan, some of the attractions will not be identified and thus they would be put at risk of extinction.

There is also a need of improving marketing strategy. There are a lot of avenues that are not fully utilised in marketing the tourist attractions found in the Southern Highlands of Tanzania. These ways included the use of websites, social media, radios and televisions and trade fares. All these have the power of improving tourism hence entrepreneurship.

7. Conclusion

Tourism and entrepreneurships are intricately linked. The importance of entrepreneurship to the growth of the tourism industry in the Southern Circuit is indisputable. This is far cemented by Koh and Halten[35], who claimed that it is only when tourism

[35] K.Y. Koh, T.S. Halten, *The Tourism Entrepreneur: The Overlooked Player in Tourism Development Studies*, „International Journal of Hospitality and Tourism Administration", 3(2014), no. 1, pp. 37–41.

entrepreneurs exist, a society's environment, landform, flora and fauna, historical artefacts and cultural heritage enclaves become tourist resources which can be renovated and transformed into tourist attractions and destination. Such view indicates clearly that the future of tourism entrepreneurship in the tourist sector is guaranteed given the global prediction that from 2010 to 2030 it is expected that the tourist industry will grow by an average of 3.3% with about 1.8 billion tourist record[36]. Indeed, Tanzania and Southern Circuit of the country will have its fair share of the anticipated global tourism if existing challenges that affect the growth of tourist entrepreneur and the tourism industry, in general, will be addressed. Among the unearthed challenges are: poor infrastructure, lack of training, poor coordination between the government and private sector, poor marketing and advertising as well as failure to incorporate cultural tourism in the industry. It is high time that deliberate efforts were made by individual, private and public sector to improve both the tourism industry as well as entrepreneurship that will steer the development of tourism. It needs to be understood that all employment that is harnessed from the tourism industry comes from the effort of the entrepreneurs. Thus, for entrepreneurs to run their task in the southern zone very well it is necessary to undergo constant training, increase marketing strategy for the Southern Circuit to be known of its potential to tourism, the formation of a special committee that will monitor undertaking of the tourism activities and that of the entrepreneurs. Moreover, the improvement of infrastructure in the southern zone so as to ease transportation of tourists as well as smoothen entrepreneurial activities that are targeted to cater the tourism industry.

[36] UNWTO, *Tourism Highlights 2014 edition*, retrieved from: http://www.e-unwto.org/doi/pdf/10.18111/9789284416226 accessed on 16/10/2017.

REFERENCES

Anderson W., *Cultural tourism and Poverty Alleviation in Rural Kilimanjaro*, „Journal of Tourism and Cultural Change", 13(2015), no. 3, pp. 208–224.

Anderson W., *Leakages in the tourism systems: Case of Zanzibar*, „Tourism Review", 2013, no. 68(1), pp. 62–76.

Anderson W., *Botswana*, „Journal of Tourism and Cultural Change", 2013, no. 2(3), pp. 163–185.

Chambua G., *Tourism and Development in Tanzania: Myths and Realities. Paper presented at the 4th IIPT African Conference „Building Strategic Alliance for Sustainable Development, Peace and Reconciliation on the African Continent"*, 2007.

Cooper C., Fletcher J., Gilbert D., Shepherd R., Wanwill S., *Tourism Principles and Practice*, New York 1998.

Esu B.B. & Ebitu E., *Promoting an emerging tourism destination*, „Global Journal of Management and Business Research", 10(2010), no. 1, pp. 21–28.

Freisen B., Safari tourism to the Ngorongoro Conservation Area, Tanzania: Planning for future developments a survey into perceptions of tourists and the tourism industry, Unpublished MA Thesis, Nijmegen 1995.

Jakanathan K.N., Mehta K.R. Muthukumar V., Siva K., *Tourism entrepreneurship*, 2009, retrieved from: http://www.scribd.com/doc/20995282/Tourism-Entrepreneurship#scribd.

Kazuzuru B., *History, Performance and Challenges of Tourism Industry in Tanzania*, „International Journal of Business and Social Science", 5(2014), no. 11.

Khan F.R., Krishnamurthy J., *Future proofing of tourism entrepreneurship in Oman: challenges and prospects*, „Journal of Work-Applied Management", 8(2016), no. 1, pp.79–94, https://doi.org/10.1108/JWAM-06-2016-0008.

Kiishweko O., *Great Ruaha river that helps feed Tanzania under 'alarming stress'. The Guardian, Tuesday 15 January 2013*, retrieved from:

https://www.theguardian.com/global-development/2013/jan/15/great-ruaha-river-tanzania-stress on 15/10/2016.

Kilungu H., Munishi P., Leemans R., Amelung B., *Wildlife Safari Tourist Destinations in Tanzania: Experiences from Colonial to Post Colonial Era*, „International Journal of Current Research and Academic Review", 2(2014), no. 6, pp. 240–259.

Kiralova A., Pavliceka A., *Development of Social Media Strategies in Tourism Destination*, „Procedia-Social and Behavioral Science", 175(2015), pp. 358–366.

Koh K.Y., Halten T.S., *The Tourism Entrepreneur: The Overlooked Player in Tourism Development Studies*, „International Journal of Hospitality and Tourism Administration", 3(2014), no 1, pp. 37–41.

Kulindwa K., Sosovelo H., Mashindano O., *Tourism Growth for Sustainable Development in Tanzania*, Dar es Salaam 2001.

Kweka J., Morrissey O., Blake A., *The Economic Potential of Tourism in Tanzania*, „Journal of International Development", 15(2003), pp. 335–351, published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/jid.990.

Luvanga N., Shitundu J., *The role of tourism in poverty alleviation in Tanzania*, Dar es Salaam 2003.

Mitchell J., Ashley C., *Tourism and poverty reduction: Pathways to prosperity*, London 2010.

Nielsen, *Earned Advertising Remains Most Credible among Consumers. Trust in Owned Advertising on the Rise, 2013*, retrieved from: http://www.nielsen.com/us/en/press-room/2013/nielsen--earned-advertising-remains-most-credible-among-consumer.html.

Nongsiej P., Somipam S.R., *The Role of Entrepreneurship in Tourism Industry: An Overview. Paper Presented in a seminar on Entrepreneurial Opportunities for Educated Youth in Global Bus*, Pondicherry University 2017.

Okello M.M., *Economic Contribution, Challenges and Way Forward for Wildlife-Based Tourism Industry in Eastern African Countries*, „Jour-

nal of Tourism Hospitality", 3(2014), pp. 122, doi: 10.4172/2167-0269.1000122.

Peaty D., *Kilimanjaro tourism and what it means for local porters and for the local environment*, „Journal of Ritsumeikan Social Sciences and Humanities", 4(2012), pp. 1–11.

Ranja T., *Development of National Entrepreneurship in the East African Tourism Industry*, Dar es Salaam 2003.

Samei S., Akhoondzade M., *The Role of Entrepreneurship in Tourism Industry Development*, „European Online Journal of Natural and Social Science", 2(2013), no. 3, pp. 1423–1430.

Shemsanga C., Omambia A.N., Gu Y., *The Cost of Climate in Tanzania: Impacts and Adaptations*, „Journal of American Science", 2010, no. 6(3).

Tanzania National Parks, *Annual Report 2004/2005*, Arusha 2005.

UNWTO, *Manual on Tourism and Poverty Alleviation. World Tourist Organization*, Madrid 2010.

UNWTO, Tourism Highlights 2014 edition, retrieved from: http://www.e-unwto.org/doi/pdf/10.18111/9789284416226 accessed on 16/10/2017.

Wade D., Mwesiga B.C., Eagles P.F.J., *A history and market analysis of tourism in Tanzania*, „Tourism and Management", 22(2001), pp. 93–101.

World Bank, *World Development Report 1994: Infrastructure For Development*, New York 1994.

WTTC, *Economic Impact Analysis. Annual Update Summary the Economic Impact of Travel&Tourism*, 2016, retrieved from: https://www.wttc.org/research/economic-research/economic impact-analysis.

Xinhua, *Tanzania records surging tourist arrivals: report, 2017*, retrieved from: http://news.xinhuanet.com/english/2017-06/10/c_136355634.htm accessed on 16/10/2017.

Yuju-Wang B.A., *Effects of integrated marketing communications (IMC) on visitors heritage destination selection*, „Journal of Quality Assurance in Hospitality and Tourism", 10(2007), pp. 132–144.

Chapter 12.

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GROUNDWATER SITUATION IN TANZANIA
Experiences from Mbarali District in Mbeya Region

ABSTRACT

This chapter examines groundwater situation in selected villages in rural areas of Mbarali District where drinking water infrastructures for domestic use are poor and or lacking. The study adopted sequential exploratory research design to collect quantitative and qualitative data. The sample size, randomly selected, was 90 groundwater users and 50% were women. Descriptive statistics, one way Analysis of Variance (ANOVA), correlation analysis and independent T-test were used to analyze quantitative data while qualitative data were subjected to content analysis. The results show that 66.7% of the respondents depend on the groundwater (deep wells) for domestic use. This was influenced by the perception that groundwater was clean or was the only source available. The mean distance from a household to a groundwater source was 249.50 metres. The variation, in terms of distance from households to the groundwater source between the villages, was significant at 5%. In addition, the relationship between socio-economic characteristics of the household heads and the amount of groundwater used was generally weak. The socio-economic characteristics involved were household heads' education level, household size, household annual income and distance from home to the groundwater source. The study concludes that groundwater was critical and dependable in supporting households' livelihoods. It is therefore pertinent, at a policy level, to enhance groundwater infrastructure

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development at the local level so long as surface water is dwindling. In addition, the question of groundwater governance in terms of groundwater quality, institutional structures and legal and policy issues worth an investigation to ensure sustainability of the groundwater resources.

Key words: Groundwater, accessibility, usage, challenges, Mbarali, Mbeya, Tanzania.

1. Introduction

In recent years, it has been acknowledged that a considerable proportion of the human population in the world is using groundwater resource for different purposes including domestic uses and irrigation. This trend is influenced by many factors. For instance, in developing countries like Tanzania, the increasing trend is influenced by, among other factors, diminishing of surface water because of changes in rainfall amount and its patterns, population growth and increasing economic development. Nevertheless, the interactions between groundwater resource and the society especially in rural Tanzania where infrastructures for domestic use including drinking water are poor and or lacking is not explored sufficiently. The importance of groundwater resource is acknowledged in many countries in the world. For instance, Garduño[1] reports that 97% of the accessible freshwater in the world is groundwater resource. About 2 billion people in the world depend on groundwater resource for domestic use, industrial development and irrigation. This indicates that groundwater is one of the critical natural resources for peoples' livelihoods and for development in general.

[1] H. Garduño, S. Romani, B. Sengupta, A. Tuinhof, R. Davis, *India groundwater governance case study*, Washington DC 2011, http://documents.worldbank.org/curated/en/758081468169178804/India-Groundwater-governance-case-study, visited 23 March 2017.

Groundwater is defined as freshwater from rain or melting ice and snow that soaks into the soil and is stored in the tiny spaces between rocks and particles of the soil. As such groundwater is not isolated with surface hydrological system, but interacts with each other across a variety of physiographic andclimatic landscapes[2]. Normally, people use deep wells, drilled shallow wells or dug wells to access groundwater resource. A deep well refers to the constructed well by either cable tool or rotary-drilling machines. It can be drilled even more than 300 metres deep. The space around the casing must be sealed with grouting material of neat cement to prevent contamination by water draining from the surface downward around the outside of the casing. On the other hand, drilled shallow well is constructed by drilling a pipe into soft ground, such as gravel or thick sand. A perforated pipe or screen is attached at the end of the pipe to allow water to flow into the well as well as to filter out sediment[3].

According to Wijnen [at el.][4], 70% of the population in the Southern African Development Community (SADC) depends on groundwater resource for various uses including agriculture, urban development, rural livelihood, livestock and safe drinking water supply systems. One of the factors that necessitate groundwater use

[2] Z. Yang, Y. Zhou, S. Uhlenbrook, *Multi-method approach to quantify groundwater/surface water-interactions in the semi-arid Hailiutu River basin, northwest China*, „Hydrogeology Journal", 22(2014), pp. 527–554; D. Bhatt, R.K. Mall, *Surface Water Resources, Climate Change and Simulation Modelling*, „Aquatic Procedia", 4(2015), pp. 730–738.

[3] S. Collins, *Hand-dug Shallow Well, SKAT, Swiss Centre for Development Cooperation in Technology and Management*, St Gallen 2000; A. van der Wal, *Understanding Groundwater and Wells in Manual Drilling: Instruction Handbook for Manual Drilling Teams on Hydro-Geology for Well Drilling, Well Installation and Well Development*, „PRACTICA Foundation", 3(2010), pp. 1–4.

[4] M. Wijnen, A. Benedicte, H. Bradley, C. Ward, P. Huntjens, *Managing the Invisible- Understanding and Improving Groundwater Governance*, Thematic Paper No. 11. Groundwater Governance, A Global Framework for Action. GEF, World Bank, UNESCO-IHP, FAO and IAH, 2012.

is the dwindling of surface water particularly in semi-arid and arid areas. Literature reveals that the diminishing of surface water is accelerated by a number of factors including decreasing and changes in rainfall patterns, increasing multi-sectors demands, degradation of water catchments due to increase population, over abstraction, poor land use practices, urbanization and industrial development[5].

In Tanzania, groundwater use accounts for over 25% of the water supply for domestic use, livestock, agriculture and sustaining ecosystems[6]. Despite the fact that Tanzania is not mentioned as one of the water stressed countries, it has high rainfall variability suggesting decreasing amount of surface water in some areas. In some regions, semi-arid areas are affected by frequent drought. For instance, in the Southern Highlands the average annual rainfall is over 1 200 mm while in semi-arid areas including Mbarali District the mean annual rainfall is less than 600 mm[7]. Climate variability and change are mentioned to be the main causes of the rain shortage in arid and semi-arid areas[8]. The aridity situation

[5] J.J. Kashaigili, *Assessment of groundwater availability and its current and potential use and impacts in Tanzania. Report Prepared for the International Water Management Institute*, 2010; URT, Water Sector Status Report. Ministry of Water, Dar es Salaam 2012, [http://www.Water_ Sector_ Status_ Report-_Submitted_17-092012.pdf], site visited on16th February 2017.

[6] Water Resource Group, *Tanzania: Hydro-economic overview initial – analysis*, 2014, http://www.2030WRG_TANZANIA (USED).pdf, site visited on 12 April 2017.

[7] M. Van Camp, I.C. Mjemah, N. Al Farrah, K. Walraevens, *Modeling approaches and strategies for data-scarce aquifers: example of the Dar es Salaam aquifer in Tanzania*, „Hydrogeology Journal", 21(2013), no. 2, pp. 341–356; Water Resource Group, *Tanzania: Hydro-economic overview initial*..., op. cit.; W.C. Kayombo, *Assessing Meteorological Data for Reference Evapotranspiration – in Kyela and Mbarali District*, „Journal of Environment and Earth Science", 6(2016), no. 4, pp. 1–7.

[8] J.J. Kashaigili, *Assessment of groundwater availability*..., op. cit.; URT, *Water Sector Status Report*..., op. cit.; M.Y. Mkonda, *Assessment of Water Shortage and its Implications to Gender Role in Semi-arid Areas in Mvumi Ward, Dodoma in Tanzania*, „Arts Social Science Journal", 6(2015), pp. 142, doi: 10.4172/2151-6200.1000142.

in Mbarali District accelerates people to depend on groundwater source to support their livelihoods[9].

Although literatures acknowledge the importance of groundwater in supporting peoples' livelihoods, little is known about groundwater situation in terms of types of groundwater sources, availability of groundwater, and challenges related with groundwater resource. Understanding the situation of groundwater in Mbarali District remains vital since it informs various groundwater stakeholders on the existing interaction between the resource and the local community. It also reflects the magnitude of the local community dependency on groundwater resource in enhancing their livelihoods. This chapter is guided by the following research questions: What types of groundwater source exist in the study area and what are the challenges associated with groundwater sources? How far are the households from the groundwater source? What influences access to and or use of groundwater apart from using other water sources? The answers to these questions provide comprehensive knowledge about the interaction between the groundwater resource and community in the study area. This chapter is organized into four sections. Section one introduces the chapter and uncovers the research puzzle. Section two presents the methodology used while section three is devoted to results and discussion. Conclusions and recommendations are presented in section four.

2. Study area

This study was conducted in Mbarali District, Mbeya Region. The central part of Mbarali District is located at latitude 8° 51'

[9] J.J. Kashaigili, *Assessment of groundwater availability*..., op. cit.; K.G. Villholth, C. Tottrup, M. Stendel, A. Maherry, *Integrated mapping of groundwater drought risk in the Southern African Development Community (SADC) Region*, „Hydrogeology Journal", 21(2013), no. 4, pp. 863–885.

South, longitude: 33° 51' East. The altitude ranges from 1 000 to 1 800 meters above sea level[10]. The minimum temperature is 19°C (June–July) while the maximum is 35°C (August to December)[11]. The district covers an area of 16 632 square kilometres and has a population of 300 517. Administratively, the district is divided into 20 wards with a total of 99 villages[12]. The main soil characteristics in Mbarali District are dark grey and prismatic cracking clays. The water sources including groundwater laid in the Great Ruaha River Catchment, which is one of the four sub-basins of the Rufiji River Basin. The mean annual rainfall is 600 mm which falls between December and April and hence the District is vulnerable to water scarcity[13].

3. Methodology

The study employed sequential exploratory research design with two phases. The first phase involved collection and analysis of qualitative data, and the results of this phase were used to refine questionnaire for the second phase. The second phase involved collection of quantitative data through household survey using a structured questionnaire. Focus Group Discussions (FGDs) and key informant interviews guided by checklist of items were used to collect qualitative data.

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[10] R. Kangalawe, S. Mwakalila, P. Masolwa, *Climate Change Impacts, Local Knowledge and Coping Strategies in the Great Ruaha River Catchment Area, Tanzania*, „Natural Resources Journal", 2(2011), pp. 212–223.

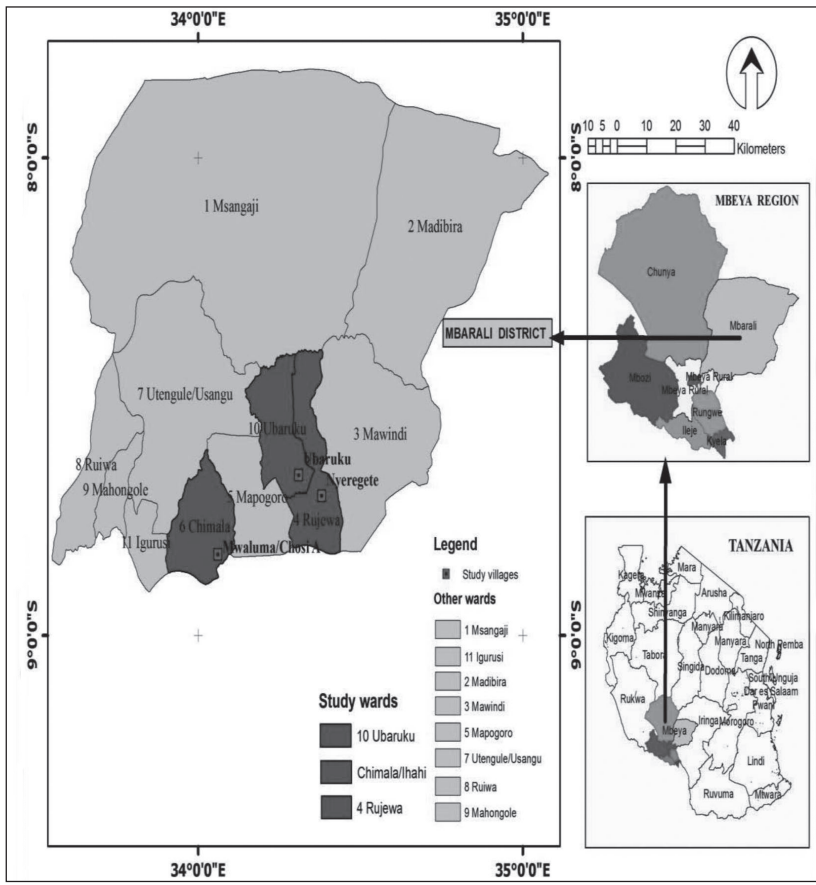
[11] Ibidem.

[12] URT-National Bureau of Statistics, *Basic Demographic and Socio-Economic Profile Report Tanzania Mainland*, 2014, http://www.TANZANIA_ MAINLAND_SOCIO_ECONOMIC_PROFIL_sw.pdf, site visited on 11 March 2017.

[13] W.C. Kayombo, *Assessing Meteorological Data*..., op. cit.; A. Sirima, *Social and Economic Impacts of Ruaha National Park Expansion*, „Open Journal of Social Sciences", 4(2016), pp. 1–11.

The study population encompassed groundwater users in the study sites. The sampling procedures involved purposive selection of three villages based on various criteria including accessibility and use of groundwater by household, groundwater degree of dependence, public use, degree of collective action arrangements in managing and use of groundwater. The villages were Nyeregete, Ubaruku and Mwaluma from Rujewa, Ubaruku and Ihahi wards respectively (Figure 1).

Figure 1. Location map of Mbarali district



The selected villages constitute an area for the Groundwater Futures in Sub-Saharan Africa (Grofutures) Project whereas this study is a part of the project. The Grofutures Project is a four years research project (2015–2018) funded by the United Kingdom (UK) government. The overall aim of the Grofutures is to develop scientific basis and participatory management processes by which groundwater resources can be used sustainably for poverty alleviation in Sub-Saharan Africa. This study contributes knowledge to the specific objective of constructing a set of plausible and stakeholder-informed groundwater development pathways. In each village 30 respondents were randomly selected making a sample size of 90 respondents. This sample size is appropriate because it allows statistical analysis leading to the reasonable conclusions[14].

One Focus Group Discussion was conducted in each village making a total of three FGDs. In order to get different experiences and perceptions on groundwater, sex and age were the criteria used to select FGDs participants. Each FGD comprised 8–12 participants. The proportion of women FGDs participants ranged from 5 to 7 in each group. Women were involved in FGDs because they are responsible to collect water for domestic uses. The information gathered during FGDs captured groundwater usage, type of groundwater sources, groundwater availability, factors that influence the household to access groundwater source, other water sources accessed by the households, socio economic activities and challenges of using groundwater sources. The Village Executive Officers (VEOs) from each village and the chairperson and secretary of Ubaruku Mpakani (UBAMPA) were involved as the key informants. UBAMPA is a Community Water Supply Organization (COWSO) that serves at Ubaruku and Mpakani villages.

[14] K.D. Bailey, *Methods of Social Research*, 4th Edn., New York 1994.

The key informant interviews were conducted to obtain information about the number of groundwater sources in the villages and the intervention supporters of the constructed groundwater sources. The key informants were selected based on the fact that they were well informed and responsible for keeping all information related to groundwater facilities in a village. In addition, household survey guided by a questionnaire was used to collect quantitative data on demographic characteristics and the situation of groundwater in the selected villages. The situation of groundwater included groundwater usage, types of groundwater source, factors that influenced the households to access groundwater source, other sources of water accessed by the households, distance from a household to the groundwater source and estimated amount of water used at the household per day per capita.

4. Data analysis

Content analysis was used to analyze qualitative data by summarizing field data based on objectives of the study. The quantitative data were analyzed by using Statistical Package for Social Sciences (SPSS) by computing descriptive statistics to obtain means and percentage distribution of the responses. To determine the normality of data, the Sharpiro-Wilk test was used and it showed no significant ($P > 0.05$) difference between the normal curve and the curve of the amount of water used at the household per day and distance of a household to the groundwater source. This implies that the population from which the data were collected was normally distributed.

Therefore, one way Analysis of Variance (ANOVA) was used to test differences of the amount of water used at a household level per day and distance from the groundwater source to a household between the villages. The Post hoc particularly Tukey's Honestly Significant Difference (HSD) was used for multiple comparisons. The test is

designed to make all pair wise comparisons while maintaining the experiment wise error rate at the pre-established level. In addition, the Independent T-test was used to compare the amount of water used at a household level reported by men and women respondents. This test is useful tocompare mean difference on continuous variables for two different groups if the data are normally distributed[15].

The analysis also involved running correlation analysis whereby Pearson correlation coefficient was computed to determine whether there was any relationship between the estimated amount of groundwater in litres used at a household per day and respondents characteristics including years of schooling, household size, annual income, number of years a household resided in the village, and distance from home to the groundwater source in metres. The Pearson correlation coefficient (r) is a measure of the strength of a relationship between two continuous variables. The value of r normally ranges between -1 and 1[16]. The strength of the relationship can be categorized into three groups. If r ranges from 0.10 to 0.29 the relationship is said to be weak whereas if r ranges from 0.30 to 0.49 the relationship is said to be moderate. In addition, a strong relationship exists when r ranges from 0.50 to 1.0 whereas a perfect relationship exists if r is either -1 or 1[17].

5. Results and discussion

5.1. Respondents' characteristics

Table 1 presents respondents' characteristics. The results showed that half (50%) of the respondents were females. The results also

[15] J.F. Pallant, *SPSS survival manual: Step-by-step guide to data analysis using SPSS for windows*, third edition, England 2007.

[16] N. Fenton, M. Neil, *Risk Assessment and Decision Analysis with Bayesian Networks*, 2012.

[17] J.F. Pallant, *SPSS survival manual...*, op. cit.

show that 58.9% and 33.3% of the respondents were household heads and spouses respectively. The rest were the grown-up other household members. The analysis also shows that 62.2% of the respondents depended on farming activities as their main source of income followed by 18.9% who depended on small scale businesses. This implies that majority of the respondents were smallholder farmers. Most of the United Republic of Tanzania reports indicate that more than 70% of the Tanzania work force depends on agricultural sector for the livelihoods[18].

Table 1. Respondents' characteristics (n=90)

Sex	**Nyeregete**	**Ubaruku**	**Mwaluma**	**Total**
Male	15(50)	15(50)	15(50)	45(50)
Female	15(50)	15(50)	15(50)	45(50)
Relationship to the Household head				
Head of Household	22(73.3)	16(53.3)	15(50)	53(58.9)
Spouse	7(23.3)	8(26.7)	15(50)	30(33.3)
Another Male Household member	0(0.0)	3(10)	0(0.0)	3(3.3)
Another Female Household member	1(3.3)	3(10.0)	0(0.0)	4(4.4)
Main source of income				
Farming	20(66.7)	20(66.7)	16(53.3)	56(62.2)
Livestock keeping	1(3.3)	2(6.7)	1(3.3)	4(4.4)
Small scale business	6(20.0)	7(23.3)	4(13.3)	17(18.9)
Casual labour	0(0.0)	0(0.0)	2(6.7)	2(2.2)
Salary	3(10.0)	1(3.3)	7(23.3)	11(12.2)

Note: Numbers in brackets are percentages

Table 2 presents respondents' response on other sources of income apart from what is considered as a main source. The results

[18] E.T. Lwoga, C. Stilwell, P. Ngulube, *Access and Use of Agricultural Information and Knowledge in Tanzania*, „Library Review", 60(2011), no 5, pp. 383–395.

show that 37.8% of the respondents reported livestock keeping. The rest reported farming, casual labour, remittance and small scale business as their households' supplementary sources of income. Livestock keeping and crop production as sub sectors are the leading households' other sources of income. This implies that majority depended on farming and or livestock keeping in supporting their livelihoods. These results are in line with literature which indicates that about 35% of the households in Tanzania are engaged both in crop production and livestock keeping[19].

Table 2. Other sources of income (n=90)

Source of income of the household	Nyeregete	Ubaruku	Mwaluma	Total
Farming	5(16.7)	5(16.7)	9(30)	19(21.1)
Livestock keeping	10(33.3)	13(43.3)	11(36.6)	34(37.7)
Casual labour wages	9(30)	3(10)	5(16.7)	17(18.9)
Remittances	3(10)	1(3.3)	2(6.7)	6(6.7)
Small scale business	3(10)	5(10)	0(0)	8(8.9)
None	0(0)	3(10)	3(10)	6(6.7)
Total	**30(100.0)**	**30(100.0)**	**30(100.0)**	**90(100.0)**

Note: Numbers in brackets are percentages

Table 3 shows the respondents' marital status and education levels. The findings show that 72.2% of respondents were married. Out of married couples, 55.4% were male. This indicates that the married males outnumbered the married females. With regard to the respondents' education level, 53.3% of the respondents held primary education. This implies the majority had acquired basic

[19] E. Engida, P. Guthiga and J. Karugia, *The Role of Livestock in the Tanzanian Economy: Policy Analysis Using a Dynamic Computable General Equilibrium Model for Tanzania*, in: 2015 Conference, August 9–14, Milan, Italy (No. 212039). International Association of Agricultural Economists, 2015.

education. Education is a major means of providing individuals with opportunity to achieve their full potential. This involves the ability of acquiring knowledge, skills, values and attitudes needed for various social and economic roles, as well as for their all-around personal development[20]. Thus, low education level may constrain development at the household level.

Table 3. Respondents' marital status and education level (n=90)

Marital status	**Male**	**Female**	**Total**
Married	36(80.0)	29(64.4)	65(72.2)
Single	4(8.9)	2(4.4)	6(6.7)
Divorced	1(2.2)	5(11.1)	6(6.7)
Widowed/widower	4(8.9)	9(20.0)	13(14.4)
Education level			
Non-formal education	10(22.2)	8(17.8)	18(20.0)
Primary education	26(57.7)	22(48.9)	48(53.3)
Secondary	3(6.7)	12(26.7)	15(16.7)
Tertiary education	3(6.7)	2(4.4)	5(5.6)
Higher Learning education	3(6.7)	1(2.2)	4(4.4)

Note: Numbers in brackets are percentages

Table 4 shows respondents' age, household size, total number of years a household resided in the village and household annual income. The results show that the mean age of the respondents was 43 years. This implies that majority of the respondents were young adults who are potential workforce on households' socio-economic development. Furthermore, the findings show that the mean number of persons per household was 5.9. This number is

[20] URT, *Education in a Global Era: Challenges to Equity, Opportunity for Diversity. Paper presented at the Fourteenth Conference of Commonwealth Education Ministers (14 CCEM) Halifax, Nova Scotia, Canada, 27–30 November*, 2000.

above 4.9 persons reported at the national level[21]. With regard to the total number of years in which respondents resided in the village; the results show that the mean number was 18.4 years. This implies that respondents had enough experience with regard to water resource in the villages. The results also show that the mean annual income of household was Tanzania Shillings (TZS) 3 074 500, equivalent to TZS 256 208 per month per household. This amount is higher than the mean income at a national level. Literature shows that the mean household income is TZS 146,000 per month per household in Tanzania[22]. The higher household income in the study area can be associated with potential socio-economic activities including paddy production that are undertaken in the Usangu plain including Mbarali District.

Table 4. Descriptive statistics on respondents' characteristics (n=90)

Category	Minimum	Maximum	Mean	Std. Deviation
Age of the respondent	22	72	43.2	12.1
Number of people in the household	2	11	5.9	1.8
Number of years the household heads resided in a village	3	50	18.4	10.9
Annual household income	350 000	15 000 000	3 074 500	3 177 319

5.2. Groundwater sources and its challenges

Table 5 presents types of groundwater sources reported by the respondents. The results indicate that 66.7% of the respondents used deep groundwater wells. The rest used drilled shallow wells.

[21] United Nations World Food Programme and World Bank, *Comprehensive Food Security and Vulnerability Analysis (CFSVA), Tanzania, 2012*, 2013, [http://www.UN-WorldFood-ProgrammeandWorldBank2013.pdf], site visited on 28/04/2017.

[22] URT, *National Baseline Survey Report for Micro, Small, and Medium Enterprises in Tanzania*, 2012, [MSME-National-Baseline-Survey-Report.pdf], site visited on 16/3/2017.

Table 5. Groundwater sources used (n=90)

Type of groundwater source	Nyeregete	Ubaruku	Mwaluma	Total
Deep well	0(0.0)	30(100)	30(100)	60(66.7)
Drilled Shallow well	30(100)	0(0.0)	0(0.0)	30(33.3)
Total	**30(100)**	**30(100)**	**30(100)**	**90(100)**

Note: Numbers in brackets are percentages

These results deviate from the 2012 Population and Housing Census (PHC) report, which show that dug wells are the main source of water in rural areas in Tanzania. About 25% of households in rural areas depend on unprotected water dug wells[23]. Possibly, this difference can be related with lack of groundwater intervention support in most rural areas. The key informants reported that all groundwater sources in the study area were financed by the international donors via the Tanzania government as an initiative to support local governments as well as the entire community to improve water services for domestic uses. For instance, the constructed deep and drilled wells at Ubaruku, Mwaluma and Nyeregete villages were constructed by local government at the district level with financial support from World Bank (WB), United Nations Children's Fund (UNICEF) and Danish International Development Agency (DANIDA) water programme. This connotes that there was no direct internal initiative established by community to enhance groundwater interventions. Dependence on external support jeopardizes sustainability of the groundwater sources. Apart from deep and drilled wells, direct observation and Focus Group Discussion (FGDs) revealed several dug wells owned by individual

[23] URT, *Mbarali District Council Strategic Plan 2013/14–2017/18*; Prime Minister's Office Regional Administration and Local Government, 2014, [http://www.mbaralidc.go.tz/storage/app/uploads/public/58d/10/58d101fccce7f653574057.pdf] site visited on 27/6/2017.

households. Even though, they were used communally. In addition, FGDs at Nyeregete and Ubaruku villages reported that: "People tend to construct wells around their houses for various purposes such as livestock use, brick making, domestic use and small scale irrigation". This indicates that apart from deep and drilled wells, dug shallow wells were commonly used by the respondents for various socio-economic activities.

By definition, hand dug wells are wells excavated and lined by human labour, usually by entering the well with a variety of hand tools. They may be as small as 80 cm diameter, and can range in depth from about five metres deep, to deep wells over 20 metres deep[24]. The key informants reported that the average depth of deep wells and drilled shallow wells were 85 and 8 metres respectively. FGDs, also reported that both deep and drilled shallow wells provided enough water throughout a year. „---all the time our well provides a lot of water. Therefore people can access water at any time except when they are in maintenance need" (FGD at Nyeregete village).

The use of groundwater has various advantages such as accessibility to water source in terms of distance, cleanness and adequacy of groundwater resource. However, during the Focus Group Discussions it was reported that groundwater use had a number of challenges. One of them is lack of knowledge on how and where to construct dug wells at a household level. „We use our own indigenous knowledge to dig wells around our homes to satisfy our household water needs but most of us know nothing about location. For instance, most of dug well users in this village are not well informed about the proper distance from pit latrines to the groundwater sources" (FGD at Nyeregete). Literature recommends that the bottom of pit latrines should be at least 2 m

[24] S. Collins, *Hand-dug Shallow Well...*, op. cit.

above groundwater level, and a minimum horizontal distance of 30 m between a pit latrines and dug well. This recommendation aims to limit exposure to microbial contamination[25].

Another challenge is poor wells protection. Through direct observation in all villages, the study found most of the dug wells were not and/or were poorly protected. Although this challenge is well known by the village authorities there was no seriousness in managing it. „Those dug wells are constructed by the households themselves for their own uses. Thus it is their responsibility to ensure that wells are well protected. I sometimes remind them to do it but most of them are not protecting those wells properly" (Source: key informant at Nyeregete). Although Water Resource Management Act (WRMA) no 11and 12 of 2009 directs that all groundwater sources have to be protected[26] the reality is the reverse. As such, groundwater sources can endanger household members.

In addition, uncertainty on groundwater safety for human consumption was also mentioned as a challenge. Even if the resource is perceived by the groundwater users as cleaner than surface water, FGDs reported groundwater from dug and drilled shallow wells were not treated. „We thank God that we have a lot of water from our groundwater sources. But to what extent the resource is safe for our health remains a mystery. We do not treat our drilled shallow wells or dug wells" (said by key informant in Nyeregete). According to the Secretary of COWSO it was reported that groundwater sample from the deep well is taken by UBAMPA once per year to the regional laboratory to test whether the resource is still healthy for human consumption. However, the UBAMPA had no say about

[25] R.A. Fenner, P.M. Guthrie, E. Piano, *Process selection for sanitation systems and wastewater treatment in refugee camps during disaster-relief situations*, „Water and Environment Journal", 21(2007), no. 4, pp. 252–264.

[26] URT, *Water Resource Management Act no 11*, Dar es Salaam 2009.

status of dug wells owned by individual households. "Water from this source is treated every month to ensure safety to all groundwater users. We know that if the source is not protected as well as if the resource is not treated it can lead to health problems. But we have no access to enforce water sources protection and water resource treatment to dug wells that are normally constructed and controlled by individuals' households" (Key informant at Ubaruku village). Generally, the findings related on dug wells indicate that the situation of dug wells in terms of protection and hygiene was not well known by the villages' authorities. Thus, there is a possibility of the groundwater users using these sources to get diseases such as typhoid and cholera.

Other water sources reported by the respondents apart from groundwater wells are presented in Table 6. The results show that 34.4% did not report other water sources apart from groundwater source while 30% and nearly 29% of the respondents reported water from springs and canals respectively. Literature defines springs as a land to which water rises naturally from below the ground flows by gravity. Normally, it occurs where the water table is very near or meets land surface[27]. Canal is defined as the main ditch which is used to convey water from an intake built from a river. The conveyed water from the canal is led to paddy fields through field(s) ditches or furrow(s). Therefore, village dwellers around the canal tend to use it as other source of water for domestic uses.

Focus Group Discussions reported that most of people do not prefer using canals and springs sources because of pollution. Water

[27] S.M. Awadh, K.K. Ali, A.T. Alazzawi, *Geochemical exploration using surveys of spring water, hydrocarbon and gas seepage, and geobotany for-determining the surface extension of Abu-Jir Fault Zone in Iraq: A new way for determining geometrical shapes of computational simulation models*, „Journal of Geochemical Exploration", 124(2013), pp. 218–229.

pollution is mainly caused by socio-economic activities such as irrigation whereby mortars to pump water from springs or canals are used. Hence, water becomes contaminated since some fuel drops remain in the water. In addition, human behaviour such as bathing or dumping sold wastes also discourages the use of water from springs and canals for domestic uses particularly for drinking. „---sometimes when we fetch water we see a lot of things such as plastic materials, tarnished clothes, faeces just few metres in or around water sources. I think such a situation also accelerates the use of groundwater at the households." (Source: FGDs in Mwaluma village). However, it should be noted that groundwater like surface water is also prone to pollutants. Thus, to deviate from using surface water to groundwater because of pollution created by the resource users themselves, it is likely to shift the problem from the visible to the invisible resource.

Table 6. Other water sources reported by the respondents in percentages (n=90)

Source of water	Nyeregete	Ubaruku	Mwaluma	Total
Canal	0(0.0)	26(86.7)	0(0.0)	26(28.9)
Water spring	0(0.0)	0(0.0)	27(90.0)	27(30)
Rainwater collection	0(0.0)	3(10.0)	3(10.0)	6(6.7)
None	30(100.0)	1(3.3)	0(0.0)	31(34.4)
Total	**30(100)**	**30(100)**	**30(100)**	**90(100)**

Note: Numbers in brackets are percentages

5.3. Distance to the groundwater source

Table 7 presents approximate distance from home to the groundwater sources in metres. The results show that the overall mean distance from a household to a groundwater source was 249.50 metres with a standard deviation of 174.4 metres. This indicates that groundwater resource in the study area was

accessible. The National Water Policy (NAWAPO) of 2002 defines water as accessible when one water point serves 250 persons within a distance of 400 meters and users spend no more than 30 minutes for a round trip[28].

Although the national policy suggests a walkable distance to a water source, the reality is not the case. Literature shows that about 50% of households in arid areas obtain water service at the distance of more than 3 000 metres from their home[29]. This implies that groundwater resource has an advantage of being nearly accessed from home. Using ANOVA, the results of this study show that the distance from home to a water source between the villages was significant at 0.1%.

Table 7. Approximate distance from home to water source in meters (n=90)

Village Names	N	Mean	Std. Deviation	F	P-value
Ubaruku	30	174.83	120.32		
Nyeregete	30	227.00	156.14	9.036	0.00
Mwaluma	30	346.46	196.08		
Total	**90**	**249.50**	**174.42**		

Table 8 shows that there was a significant difference in terms of distance in metres from household to the groundwater source between Ubaruku and Mwaluma villages at 1% level of significance. This means that households in Ubaruku village were closer to groundwater source than the households in Mwaluma village. There was also a significant difference between Mwaluma and

[28] URT, Ministry of Water, *National Water Policy*, Dar es Salaam 2002; C.G.v Mandara, R. Lammeren, A. Niehof, *Assessing Water Service Coverage by Placeholders: Social Media Simulation, 7th RWSN Forum „Water for Everyone" 29 Nov – 02 Dec 2016*, Abidjan, Côte d'Ivoire.

[29] M.Y. Mkonda, *Assessment of Water Shortage...*, op. cit.

Nyeregete villages at 5% level of significance. These differences are largely associated by the total number of groundwater points within the villages. For instance, during key informant interviews, it was reported that there were 23 groundwater points in Ubaruku while Nyeregete and Mwaluma had 3 and 1 respectively. This is justified by a mean of distance from home to groundwater source at Mwaluma, Nyeregete and Ubaruku villages (Table 7) in relation to a total number of groundwater points. Thus, proper water points' distribution in a given population is important for improving water accessibility. By definition, water point is a place whereby people get access of water service[30]. In this study, water point refers to a place whereby the households in the villages obtained groundwater from either deep or drill shallow well.

Table 8. Compared mean difference on the approximate distance from home to the groundwater sources (n=90)

Compared village		Mean Difference	Std. Error	P-value	95% Confidence Interval	
					Lower Bound	Upper Bound
Ubaruku	Nyeregete	–52.167	41.448	0.422	–151.00	46.67
	Mwaluma	–171.833*	41.448	0.000	–270.67	–73.00
Nyeregete	Ubaruku	52.167	41.448	0.422	–46.67	151.00
	Mwaluma	–119.667**	41.448	0.013	–218.50	–20.83
Mwaluma	Ubaruku	171.833*	41.448	0.000	73.00	270.67
	Nyeregete	119.667**	41.448	0.013	20.83	218.50

*. Significant at 0.1%; **Significant at 5%.

5.4. Reasons for accessing and using groundwater

Table 9 shows the reasons that influenced access to groundwater resource apart from other sources. The results show that 40% of

[30] URT, Ministry of Water, *National Water Policy*..., op. cit.

the respondents used groundwater because they perceived it to be clean. Other reasons include: it is the only source of water available and near walking distance to groundwater source. This is in line with the qualitative results. For instance, FGDs reported that majority of the people in Ubaruku village used groundwater source than canal water source because groundwater was considered clean while people from Nyeregete village reported that groundwater was the only source available. With regard to the situation of water availability in Nyeregete, one of the key informants reported that „----I thank God for groundwater availability at Nyeregete village. I sometimes ask myself, what would happen in our village if we should have no groundwater resource? Perhaps many people could migrate to other villages to sustain their livelihoods". This implies that the availability of groundwater contributes in supporting peoples' livelihoods.

Table 9. Factors influencing access to and use of groundwater source (n=90)

Reasons	Male	Female	Total
Near walking distance to groundwater source	8(17.8)	6(13.3)	14(15.5)
Adequate groundwater source	2(4.4)	4(8.9)	6(6.7)
Affordability to groundwater charges	2(4.4)	6(13.3)	8(8.9)
Is the only source available	14(31.1)	12(26.7)	26(28.9)
Groundwater is clean and safe	19(42.2)	17(37.8)	36(40.0)
Total	**45(100)**	**45(100)**	**90(100)**

Note: Numbers in brackets are percentages

5.5. Groundwater use at a household level

Table 10 shows the overall amount of groundwater used per day at the household level. The results showed that the overall mean of the amount of water used at the household per day was 221 litres. This is equivalent to 41 litres per person per day in the study

villages. This is relatively high compared to the minimum amount of 20 litres per person per day as suggested at the national level (URT, 2015). The difference can be associated by the accessibility in terms of distance from the household to the water source and its adequacy in the study villages. However, this amount of water is low compared to the United Nations (UN) recommendations on the water poverty line suggesting that a sufficient amount of water is at least 50 to 100 litres per person per day obtained from a safe source[31]. Reflecting that the amount of water used at the households' level in the study villages did not meet the requirement of the UN. Nevertheless, the results also show that the amount of groundwater used per person per day at Nyeregete village met the UN recommendations. Likely, the types of socio economic activities that used groundwater in Nyeregete led to high amount of groundwater used per day per person than other villages.

Table 10. Amount of groundwater used per household per day in litres (n= 90)

Village	**N**	**Mean**	**Std. Deviation**	**F**	**P. Value**
Nyeregete	30	261.00	105.02		
Ubaruku	30	236.00	96.22	8.966	0.00
Mwaluma	30	166.00	63.65		
Total	**90**	**221.00**	**97.80**		
Amount of water used per person per day					
Nyeregete	30	49.97	37.39	1.249	0.292
Ubaruku	30	40.09	19.99		
Mwaluma	30	39.95	24.02		
Total	**90**	**43.34**	**28.22**		

[31] United Nations World Food Programme and World Bank, *Comprehensive Food Security...*, op. cit.; I.S. Akoteyon, *Pattern of household access to water supply in Sub-urban settlement in parts of Logos state, Nigeria*, „Malaysian Journal of Society and Space", 12(2016), pp. 93–106.

The results also show that there was a significant difference in terms of the amount of water used at a household per day in Nyeregete and Ubaruku villages at 0.1% level of confidence. Furthermore, findings indicate that there was a significant difference between Mwaluma and Ubaruku villages at the 1% level of significance.

The difference can be attributed to a number of factors including availability of other water sources. For instance, in this study, 100% of the households in Nyeregete village used groundwater because it was the only water source available. The amount of water reported at a household in Nyeregete village was higher than the amount reported at a household level in Ubaruku and Mwaluma villages respectively (Table 11). Possibly, this variation is caused by differences in economic activities that were using groundwater resource. Through FGDs in Nyeregete village, it was reported that smallholder farmers were watering gardens using groundwater. However, in Mwaluma and Ubaruku, smallholder farmers were not using groundwater to water their gardens because of the belief that groundwater is hard water, which is unsuitable for plants growth including fruits. This perception has to be technically verified.

The results also show that there was a significant difference in terms of the amount of water used per person per day at Nyeregete and Mwaluma villages at 0.1% level of confidence. Similarly, there was a significant difference on the amount of water used per person per day at Ubaruku and Mwaluma villages at 0.1%. Since these significant differences are in line with the significant differences on the amount of water used at the household per day between villages, it implies that the factors that influence the amount of water used at the household per day are likely to influence the amount of water used per person per day too.

Table 11. Multiple comparisons on the amount of groundwater used per household per day in liters (n=90)

Compared villages		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Nyeregete	Ubaruku	95.000*	23.258	0.000	39.54	150.46
	Mwaluma	25.000	23.258	0.532	–30.46	80.46
Ubaruku	Nyeregete	–95.000*	23.258	0.000	–150.46	–39.54
	Mwaluma	–70.000**	23.258	0.009	–125.46	–14.54
Mwaluma	Nyeregete	–25.000	23.258	0.532	–80.46	30.46
	Ubaruku	70.000**	23.258	0.009	14.54	125.46
Different amount of groundwater used per person per day in litres						
Nyeregete	Ubaruku	13.48987	6.30429	0.088	10.0127	40.0776
	Mwaluma	25.04517*	6.30429	0.000*	–1.5426	28.5223
Ubaruku	Nyeregete	–11.55529	6.30429	0.165	–40.0776	–10.0127
	Mwaluma	–25.04517*	6.30429	0.000*	–26.5877	3.4772
Mwaluma	Nyeregete	11.55529	6.30429	0.165	–28.5223	1.5426
	Ubaruku	–13.48987	6.30429	0.088	–3.4772	26.5877

* Significant at the 0.1% ; ** Significant at 1%

Table 12 shows responses of male and female on the amount of water in litres used per day at a household. The results indicate that there was no significant difference between male and female responses in reporting the amount of water used at the household level per day ($P > 0.05$).This can be associated by various factors including the nature of activities. For instance, the experience from the study area shows that at the household both male and female engage in brick making, watering garden and animals. These activities consume a lot more water than the amount used for cooking, bathing and washing. Even though, female respondents can be more familiar than male on the amount of water used for cooking and washing. This is because; these activities are mainly undertaken by female at a household level.

Table 12. Male and female responses on the amount of water in litres used at a household per day (n=90)

Groups compared	N	Mean	Std. Deviation	P-Value
Male	45	223.11	103.415	0.426
Female	45	218.89	92.986	

Table 13 presents directions and strengths of the relationship between the amount of water used in litres per day per household and respondents education level, household size, number of years the household resided in the village, household annual income and the distance from home to groundwater sources. The results show a positive relationship between the estimated amount of water used in litres/day per household and the household size, household annual income and the number of years the household resided in the village. This implies that as the household size, the number of years the household residing in the village and the household annual income increase, the amount of groundwater used in the household per day also increases.

Table 13. Relationship between amount of water used at a household per day and households' characteristics

	Education level	HH Size	Years the HH resided in the village	HH annual income	Distance from home to a water source
Pearson Correlation	-.334	.010	.104	.064	-.034
Sig. (2-tailed)	.001*	.923	.330	.547	.748
N	90	90	90	90	90

*Significant at 0.1%

The positive relationship between the amount of water used at the household per day and the household annual income connotes that the amount of water used at the household per day increases with mean annual income. This was associated with two things:

affordability of paying water charges, which was TZS 25 per bucket and engagement on various socio economic activities that used water resource. This implies that households with low income use the available water carefully so as to serve their money for other expenditures. On the other hand, households with high income will maximize the use of water and are likely to be involved in various socio-economic activities like animal keeping, home gardening, brick making among others as they can afford to pay for the water charges.

The results also show negative relationship between the estimated amount of water used per day at a household and education level and the distance from home to the groundwater source in metres. This indicates that as the education level of the household head and the distance from the household to the groundwater sources increase, the amount of groundwater used per day decreases. In relation to the education level this can be explained with the level of awareness on the value of water and the knowledge on proper amount of water to be extracted from groundwater source. Formal education can guide water users on where, when, why and how to use water resource. The decreasing amount of water used at the household per day in relation to the distance from home to groundwater sources is obvious, explained by different reasons including serving the time that should be spent by households to collect water. Literature shows that in some parts of arid and semi-arid areas in Tanzania people spend about 3 to 6 hours to collect water for domestic use[32]. This reduces time for other socio-economic activities at a household level and therefore can negatively affect development.

The results also show that there was a significant relationship between the amount of water used in litres/household per day and the respondents' education level 5%. The strength of the relationship between the estimated amount of water and number of years

[32] M.Y. Mkonda, *Assessment of Water Shortage*..., op. cit.

the household resided in the village and the household annual income was weak. This can be associated by various reasons including the nature of socio economic activities that households are doing. Although 62.2% of the respondents depended on farming activities as their main source of income, yet the results indicate that groundwater resource is less utilized compared to the number of years the household resided in the village. The weak relationship between the amount of groundwater used per household per day and the household annual income can be associated by the established water regulations. For instance, in Ubaruku village there was a regulation of water fee that consequently involved the household income while in Nyeregete and Mwaluma there was no water fee regulation. Thus, all groundwater users' households from Nyeregete and Mwaluma regardless of their income statuses were not limited by their income to use groundwater resource. In addition, there was a moderate relationship between estimated amount of water used per day at a household and years of schooling of the respondents. The results are in line with the respondents' education level whereas the majority acquired basic education.

5. Conclusions and recommendations

The main objective of this study was to examine groundwater situation in selected villages in rural areas of Mbarali District where there is increasing groundwater use for domestic purpose. Based on the results and discussion the study concludes that both deep wells and shallow wells are potential groundwater sources in supporting household livelihoods. However, its potentiality is threatened by lack of awareness of groundwater users particularly on dug wells proper construction, protection and groundwater treatment for human consumption. Furthermore, the study found that groundwater in the study area is accessible in terms of distance from the households to the

water sources. Lastly, the study concludes that the majority depends on groundwater sources because they do not have an alternative.

Based on the conclusions the study recommends that different water stakeholders including local government should put more effort in addressing the challenges that exist in the interaction process between groundwater and the groundwater users. Based on the captured groundwater related challenges, the study recommends further studies on groundwater governance to determine whether the resource is effectively managed via its current water structures and institutions. Knowing the status of groundwater governance will help to determine the sustainability of the invisible groundwater resource. Lastly, the study recommends that groundwater users should continue protecting its sources in order to make them sustainable.

REFERENCES

Akoteyon I.S., *Pattern of household access to water supply in Sub-urban settlement in parts of Logos state, Nigeria*, „Malaysian Journal of Society and Space", 12(2016), pp. 93–106.

Awadh S.M., Ali K.K., Alazzawi A.T., *Geochemical exploration using surveys of spring water, hydrocarbon and gas seepage, and geobotany for-determining the surface extension of Abu-Jir Fault Zone in Iraq: A new way for determining geometrical shapes of computational simulation models*, „Journal of Geochemical Exploration", 124(2013), pp. 218–229.

Babbie, E. *Practice of Social Research. Oxford University Press, Cape Town*, Southern Africa, 2007.

Bailey K.D., *Methods of Social Research*, 4th Edn., New York 1994.

Bhatt D., Mall R.K., *Surface Water Resources, Climate Change and Simulation Modelling*, „Aquatic Procedia", 4(2015), pp. 730–738.

Collins S., *Hand-dug Shallow Well, SKAT*, Swiss Centre for Development Cooperation in Technology and Management, St Gallen 2000.

Creswell J.W. *Research Design: Qualitative and Mixed Methods approaches*, (2ed), California Sage Publication Inc. 2014.

Engida E., Guthiga P. and Karugia J., *The Role of Livestock in the Tanzanian Economy: Policy Analysis Using a Dynamic Computable General Equilibrium Model for Tanzania*, in: 2015 Conference, August 9–14, Milan, Italy (No. 212039). International Association of Agricultural Economists, 2015.

Fenner R.A., Guthrie P.M., Piano E., *Process selection for sanitation systems and wastewater treatment in refugee camps during disaster-relief situations*, „Water and Environment Journal", 21(2007), no. 4, pp. 252–264.

Fenton N., Neil M., *Risk Assessment and Decision Analysis with Bayesian Networks*, 2012.

Garduño H., Romani S., Sengupta B., Tuinhof A., Davis R., *India groundwater governance case study*, Washington DC 2011, http://documents.worldbank.org/curated/en/758081468169178804/India-Groundwater-governance-case-study, visited 23 March 2017.

Kabote S.J., John P., *Water Governance in Tanzania: Performance of Governance Structures and Institutions*, „World Journal of Social Sciences and Humanities", 2017, 3(1), pp. 15-20.

Kambuku D., Assessment of Conjunctive Use of Small Earth Dams and Boreholes for Sustainable Rural Livelihoods In; Semi-Arid Area: Case of Lilongwe West Rural Groundwater Project Area, Malawi. Dissertation for the award of MSc in Integrated Water Resources Management Degree at University of Zimbabwe, Harare, Zimbabwe 2009.

Kangalawe R., Mwakalila S., Masolwa P., *Climate Change Impacts, Local Knowledge and Coping Strategies in the Great Ruaha River Catchment Area, Tanzania*, „Natural Resources Journal", 2(2011), pp. 212–223.

Kashaigili J.J., *Assessment of groundwater availability and its current and potential use and impacts in Tanzania. Report Prepared for the International Water Management Institute*, 2010.

Kayombo W.C., *Assessing Meteorological Data for Reference Evapotranspiration – in Kyela and Mbarali District*, „Journal of Environment and Earth Science", 6(2016), no. 4, pp. 1–7.

Lwoga E.T., Stilwell C., Ngulube P., *Access and Use of Agricultural Information and Knowledge in Tanzania*, „Library Review", 60(2011), no. 5, pp. 383–395.

Mandara C.G., Lammeren R., Niehof A., *Assessing Water Service Coverage by Placeholders: Social Media Simulation, 7th RWSN Forum „Water for Everyone" 29 Nov – 02 Dec 2016*, Abidjan, Côte d'Ivoire.

Mkonda M.Y., *Assessment of Water Shortage and its Implications to Gender Role in Semi-arid Areas in Mvumi Ward, Dodoma in Tanzania*, „Arts Social Science Journal", 6(2015), pp. 142, doi: 10.4172/2151-6200.1000142.

Ndibalema V. G., Qolli N. S., Maganga, S.S., *Effect of elephant browsing on selected species of Acacia along the great Ruaha River in Ruaha National Park, Tanzania*, „Ethiopian Journal of Environmental Studies and Management", 2014, 7(2), s. 124-133.

Pallant J.F., *SPSS survival manual: Step-by-step guide to data analysis using SPSS for windows*, third edition, England 2007.

Pavelic P., Giordano M., Keraita B., Ramesh V., Rao T., *Groundwater – availability and use in Sub-Saharan Africa*, 2012. Available at: [http:www.cg iar.org/Publications/Books/PDF/groundwater_availabilility_and_use_in-subsaharan_africa_a_review_of_15_countries.pdf] site visited on 23/6/2016.

Sirima A., *Social and Economic Impacts of Ruaha National Park Expansion*, „Open Journal of Social Sciences", 4(2016), pp. 1–11.

United Nations World Food Programme and World Bank, *Comprehensive Food Security and Vulnerability Analysis (CFSVA), Tanzania, 2012*, 2013, [http://www.UN-WorldFood-ProgrammeandWorldBank2013.pdf], site visited on 28/04/2017.

URT, *Education in a Global Era: Challenges to Equity, Opportunity for Diversity. Paper presented at the Fourteenth Conference of Commonwealth Education Ministers (14 CCEM) Halifax, Nova Scotia, Canada, 27–30 November*, 2000.

URT, *Water Resource Management Act no 11*, Dar es Salaam 2009.

URT, *National Baseline Survey Report for Micro, Small, and Medium Enterprises in Tanzania*, 2012, [MSME-National-Baseline-Survey-Report.pdf], site visited on 16/3/2017.

URT, *Water Sector Status Report. Ministry of Water, Dar es Salaam 2012*, [http://www.Water_ Sector_ Status_ Report-_Submitted_17-092012.pdf], site visited on16th February 2017.

URT, Mbarali District Council Strategic Plan 2013/14–2017/18; Prime Minister's Office Regional Administration and Local Government, 2014, [http://www.mbaralidc.go.tz/storage/app/uploads/public/58d/10/58d101fccce7f653574057.pdf] site visited on 27/6/2017.

URT, Ministry of Water, *National Water Policy*, Dar es Salaam 2002.

URT-National Bureau of Statistics, *Basic Demographic and Socio-Economic Profile Report Tanzania Mainland*, 2014, http://www.TANZANIA_MAINLAND_SOCIO_ECONOMIC_PROFIL_sw.pdf, site visited on 11 March 2017.

Van Camp M., Mjemah I.C., Al Farrah N., Walraevens K., *Modeling approaches and strategies for data-scarce aquifers: example of the Dar es Salaam aquifer in Tanzania*, „Hydrogeology Journal", 21(2013), no. 2, pp. 341–356.

Van der Wal A., *Understanding Groundwater and Wells in Manual Drilling: Instruction Handbook for Manual Drilling Teams on Hydro-Geology for Well Drilling, Well Installation and Well Development*, „PRACTICA Foundation", 3(2010), pp. 1–4.

Villholth K.G., Tottrup C., Stendel M., Maherry A., *Integrated mapping of groundwater drought risk in the Southern African Development Community (SADC) Region*, „Hydrogeology Journal", 21(2013), no. 4, pp. 863–885.

Water Resource Group, *Tanzania: Hydro-economic overview initial – analysis*, 2014, http://www.2030WRG_TANZANIA (USED).pdf, site visited on 12 April 2017.

Wijnen M., Benedicte A., Bradley H., Ward C., Huntjens P., *Managing the Invisible - Understanding and Improving Groundwater Governance*,

Thematic Paper No. 11. Groundwater Governance, A Global Framework for Action. GEF, World Bank, UNESCO-IHP, FAO and IAH, 2012.

Yang Z., Zhou Y., Uhlenbrook S., *Multi-method approach to quantify groundwater/surface water-interactions in the semi-arid Hailiutu River basin, northwest China*, „Hydrogeology Journal", 22(2014), pp. 527–54.

