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TITLE: SUSTAINABLE BIO-FUELS PRODUCTION: AN INSTITUITIONAL ANALYSIS OF BIO-FUELS INDUSTRY IN TANZANIA.THE CASE OF RUFIJI RIVER BASIN.

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Dedication

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Acronyms

B-O-T	Build, Operate and Transfer
BTF	Bio-fuels Task Force
EU	European Union
FAO	Food and Agricultural Organization
GHG	Green House Gases
GoT	Government of Tanzania
GTZ	German Technical Cooperation (Deutsche Gesellschaft für Technische Zusammenarbeit)
IEA	International energy agency
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resource Management
KAKUTE	Kampuni ya Kusambaza Tecknolojia
LEAT	Lawyer´s Environmental Action Team
MAFC	Ministry of Agriculture, Food security and Cooperation
MCT	Ministry of Communication and Transport
MDGs	Millennium Development Goals
MEM	Ministry of Energy and Minerals
MHa	Millions of Hectares
MNR	Ministry of Tourism and Natural resources
NEMC	National Environmental Management Council
NGO	Non-Governmental Organization
NLP	National Land Policy
NSGRP	National Strategy for Growth and Reduction of Poverty
REA	Rural Energy Agency
REF	Rural Energy Fund
RSB	Roundtable on Sustainable Biofuels
SEK	Swedish kronor
SEKAB	Swedish Ethanol Chemistry AB
SUA	Sokoine University of Agriculture
TaTEDO	Tanzania Traditional Energy Development and Environment
TBPA	Tanzanian Biofuels Producer Association
TIC	Tanzania Investment Centre
TOE	Tonne Oil Equivalent
UDSM	University of Dar es Salaam
UN	United Nation
URT	United Republic of Tanzania
USD	United States Dollar
VIC	Village Information Centers
WWF	World Wide Fund for Nature

Preface

This study has been prepared by Eng. Rajabu Hamisi Mohamed. This is the paper produced in the second academic year to fulfill master studies in IWRM-SLU. The study seeks to establish baseline information on the major sustainable development issues involved in bio-fuels production. This paper examines and reviews current issues and challenges for bio-fuels in lower Rufiji River basin. In this context I used the reflexive governance and roundtable approach as a tool for analyzing institutional framework with clear division of roles and responsibilities that can regulate main actors of bio-fuels cultivation, processing and marketing. Unfortunately, the communication or simply the lack of clear access to information among the many institutions contributing to, or benefiting on biofuels is often limited to the rural smallholders. It proposes ways to improve the institution involved in bio-fuels industry. Moreover, I believe that understanding the land and water resources rights, laws, policies and regulations of the true roles of bio-fuel industry and their sustainable management requires a comprehensive view of this complex subject. Therefore, there is need of analyzing bio-fuels institutions in order to stimulate cooperation initiations between actors, innovations and ideas to tackle these challenges associated to access of water and land ownership. In case bio-fuels industry has to be sustainably regulated will offer opportunities for smallholder farmers, producers, processors and investors as well. This study would not have been possible without the extraordinary commitment of the academics staff, donors or development partners, political leaders, flex-fuels vendors and local bio-fuels consumers who contributed their knowledge, creativity, time, and enthusiasm during discussion.

Abstract

Bio-fuels production are important alternatives to fossil fuel, but bio-fuels are also associated with risks of displacing rural communities during the process of acquiring land, disturbing hydrological cycle- water scarcity, biodiversity loss, limit animal migration, displacement of native plant species, and ,hence, potential land use conflicts. Tanzania is well known as a blessed country endowed with numerous and diverse land and water resources in the form of rivers, lakes, wetlands and aquifers. In addition, Tanzania appear to have several comparative advantages of growing bio-fuels due to conducive climatic conditions, political stability, geographic location favour bio-fuels exporting, attractive investment policy, availability of labour force (skilled, semi skilled and unskilled) from rural population. However, Tanzanians are worried with the rapidly mushrooming of more than 40 investors as registered by MEM seeing them as competitors in as far as their natural resources are concerned as they target the vast area of fertile land, with best access to water. Despite, the emergent challenges of bio-fuels production have been reported but bio-fuels productions in Tanzania could potentially contribute to agricultural/rural development, reduction of oil imports, improving rural energy security, creation of new industries and technologies, reduction of GHG emissions – opportunities for CDM. This study is analyzing how the institution aspects of bio-fuels industry in Tanzania can contribute to sustainable rural smallholder's development by exploring the inter-relation of both formal and informal institutions. The study deployed both qualitative approach through focus group discussions and interviews that accomplished through use of facilitation methods and tools. Institutional improvements in the emergent issues of food security, energy provision, environmental protection, socio-economic, and macro-economic aspects were examined using reflexive governance and round table approach methodology. Furthermore, this paper describes bio-fuels initiatives, institutions perspectives and marketing policy for sustainable bio-fuel production in Tanzania, with the lower Rufiji River Basin as a case study. It was concluded from this paper that URT has to strengthen weak legislative laws, reviewing investors approach, protecting the endangered land rights of poor local people, and, hence empowering them by transforming ownership of bio-fuel industry through sustainable bio-fuel technologies, reflexive governance and roundtable on sustainable bio-fuels that ensure win-win situations.This study is establishing action plan which is meant for bio-fuels regulating institution as a needed change for Tanzania sustainable bio-fuels industry.

Key words: Sustainable Development, Institution, Bio-fuels, Land, Water resource, Energy

1. INTRODUCTION

Bio-fuels have emerged as important alternatives for providing energy in many forms such as electricity, heat, solids, gaseous, and liquid fuels[1]. Like other renewable energy, bio-fuels can make valuable contributions to agriculture, rural development, mitigation of climate change, increasing energy security, reducing fossil fuels[2] consumption. The liquid bio-fuels have become a top policy agenda in G8+5 countries, excluding Russia by proposing the use of energy from renewable sources in the transportation sector due to soaring world fossil fuel prices and climate change. For instance, on 23 January 2008, the EU Commission presented a proposal for a renewable energy directive which supports the promotion of bio-fuel use. It sets 31 March 2010 as a deadline for EU member states to submit their respective National Action Plans (NAPs) for renewable energy. The EU is targeting on at least 10% consumption of bio-fuels in the transport sectors out of overall 20% targets of renewable energy consumption including wind, hydro and solar by 2020[3].

According to IEA latest oil market report project that ``oil prices strengthened by six-month high with benchmark crudes reaching $58-$60/ barrel by early May, 2009´´. The fossil fuel prices will continue to be high through 2030 in the range of $48-$62/ barrel as projected by IEA[4].This factor influences most developing nations to seek for energy alternatives. In addition to this, unstable and unpredictable oil prices are further complicating and damaging the economic planning of many poor countries including Tanzania since the oil imports consume a lot of foreign exchange earnings.

In Tanzania, bio-fuels production is highly anticipated as essential option that could potentially contribute to Agricultural/rural development–creation of new jobs and income opportunities, reduction of oil imports–foreign exchange savings, improving energy security, creation of new industries, reduction of GHG emissions – opportunities for CDM and carbon trading, reduction of air pollution (Lead, SO_2, CO) and improving vehicle performance[5]. The

[1]Henry Lee, William C. Clark and Charan Devereaux, ``Bio-fuels and sustainable development: An executive session on the grand challenges of sustainability transition´´, San Servolo Island, Venice, 19-20th May, 2008

[2]Johnson, F.X., and Roman, M. ``Bio-fuels Sustainability Criteria´´, *Relevant issues to the proposed Directive on the promotion of the use of energy from renewable sources, {COM (2008) 30 final}*, Consolidated study (IP/A/ ENVI/IC/2008-051) (IP/A/ ENVI/IC/2008-052, June, 2008, pp.5-7.

[3]EU renewable energy policy,``Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources´´, updated January 2009, Cited on May 2009 at http://www.euractiv.com/en/energy/eu-renewable-energy-policy/article-117536.

[4] International Energy Agency ,Oil market report, May, 2009.Cited May 31, 2009 at http://omrpublic.iea.org

[5]German Technical Cooperation (GTZ), Liquid Bio-fuels for Transportation in Tanzania: Potential and Implications for Sustainable Agriculture and Energy in the 21st Century, BMELV, August 2005, pp.5-6.

implementation of the Tanzanian rural energy master plan is a case that focuses on expansion of rural electrification schemes, development of renewable energy as alternative sources to fossil fuel[6]. The bio-fuel industry is emerging as a focus issue which meets energy demands at the local and international levels. By 2015 sustainability target of MDGs is meeting food and energy demands, as well as environmental, socio-economic, and macro-economic aspects. Therefore, Tanzania is revising its bio-fuels promotion strategies to sustainable bio-fuels production by switching off from fossil fuels dependency to environmentally friendly fuels as described in the Tanzania Development Vision (Vision 2025).

The bio-fuels industry in Tanzania lacks a transparent institutional framework with clear division of roles and responsibility that can regulate main actors of bio-fuels industry in cultivation, processing and Marketing. The bio-fuels industry is faced with a myriad challenges ranging from illegal, unreported and unregulated activities, to budget constraints; thus jeopardizing the process to attain food and energy security, and improved livelihood of the local people. The recent emergent issues of Tanzania bio-fuels development are largely contributed by institutions fragmentation of available policies and legislations which seems to have different regulating objectives.

The recent findings of bio-fuel studies in Tanzania have raised marked diversification of stakeholders' perception of growing large scale bio-fuel[7]. The arguments are focusing on how the bio-fuels industry, individually and collectively are either promoting or alleviating rural poverty. Since majority of rural smallholders of Tanzania are lacking knowledge and understanding of land rights and laws that are coupled with inadequate compensation of their land[8]. Bio-fuels industry in Tanzania is creating arguments which are also bringing rise of vigorous and strong polarized debates from the North to the South. Regarding the great complexities of the issues, as well as considerable scientific and multiplicity of stakeholders' interest involved in the bio-fuels production. Tanzanians are worried with rapidly mushrooming of more than 30 large-scale bio-fuel investors targeting the vast area of fertile land, with best access to water, prime natural vegetations such as Miombo woodland, riverrine forests, wetlands and coastal forests with a huge potential of mangroves growth.

[6]Charles Jumbe, Frederick Msiska & Lewis Mhango, ``Report on National Policies on Biofuels Sector Development in Sub-Saharan Africa´´.Number 6—Policy Development, December 2007, pp.3-7.
[7] [7]Food and Agriculture Organization of the United Nations, *The State of Food and Agriculture*,(Electronic Publishing Policy and Support Branch, Communication Division, FAO, Rome), 2008, pp.5-17.
[8]Study team, Feasibility of large-scale bio-fuel production in Tanzania, Study report, April 2009

Tanzania as one of the sub-Saharan countries is promoting sustainable bio-fuels production based on 62,000 km^2 present water resources and land use designation of 44.4Mha potentials for Agriculture, 10.8Mha allocated for crops production while 39Mha not potential for agriculture activities[9]. In March 2006, BTF identified sites suitable for bio-fuels production mostly located adjacent to; Rufiji River basin (Rufiji, Kilwa and Usangu plains), Wami River basin (Masaki plain, Kilosa and Bagamoyo), Luiche-Malagarasi River Basin, Ruvuma River basin (Mahuranga-Mtwara), Ruipa, Ikongo-North West Tanzania, East of Lake Victoria (Mara region) and internal drainage basin like Hanang[10]. The identified sites targeted by investors for bio-fuels production are already under rural institutions that used for their own livelihood[11]. Still the foreigner investors are increasing pressure on the central GoT for access to these lands for large scale bio-fuels production. Majority of bio-fuel projects in Tanzania are headed by foreign investors largely stimulated by policies in Western countries (USA and EU) and Asian (India, China, Malaysia) countries based on their expected positives contribution to climate change mitigation, energy security and Agricultural development to least developing countries.

Recently, donors and development partners are showing interests of shifting their emphasis to support rural smallholder bio-fuels initiatives on the village land[12] by promoting local people to engage in bio-fuels production through the use of new governance structures and roundtable approach[13]. The roundtable approach on sustainable bio-fuel production seems to increase cooperation between stakeholders such as government sectors, district, local, NGOs and foreign investors. The effort aims to extend peer community in dealing with bio-fuels production dilemmas towards raising productivity of water resources and land use. Globally, the use of bio-fuels for energy supply is projected to rise in the coming decades. The current UNDP report predicts that the global production of bio-fuels is expected to increase in the next four years by 170 percent due to increase demands for liquid bio-fuels[14]. This will be accompanied by both large-scale and growers' scheme production of energy crops.New areas will be opened up for growing energy crops.

[9]African Biodiversity Network (ABN), Agro fuels in Africa-The impacts on land, food and forests, July 2007.pp.
[10]Abdallah Mkindi, The socio-economic and environmental impacts of bio-fuels industry in Tanzania, LVRC on Holloway Road, London, July 2007.
[11]African Biodiversity Network (ABN), Agro fuels in Africa-The impacts on land, food and forests, July 2007.
[12]Kjell Havnevik, Africa in Search of Alternatives: Forests Returned to Village Management in Northern Tanzania-Natural resources under New Rulers, The Nordic Africa Institute, and Annual Report 2008.
[13] Energy center, ``The roundtable on sustainable biofuels:Ensuring that bio-fuels delivers on their promise of sustainability´´ cited on June ,2009 at http://energy center .epfl.ch/Bio-fuels
[14]UN-Energy, Sustainable Energy: A Framework for Decision-Makers.2007,pp.5,cited on 12 may 2009 at http://esa.un.org/un-energy/pdf/susdev.Biofuels.FAO.pdf

2. RESEARCH DESIGN

2.1. Aim of study

The overall aim of this study is to investigate the institutional aspects of Tanzania bio-fuel production in relation to rural sustainability targets. The objective of the study is to understand the institutional complexities related to bio-fuels in relation to issues of food security, energy provision, environmental protection, socio-economic, and macro-economic aspects. Specific focus of the study is to look at major institution issues of;

- Details of assessing the current representation in the bio-fuels regulatory institution.
- Reviewing the functions and outlining the findings of reform of the weak existing policies, legal, and regulatory institutional frameworks and standards.
- Enforcing land and water resources allocation, land rights, adequate land compensation and technical support to smallholders liquid bio-fuels processing for value adding.
- Strengthening information accessibility, reporting, training and expanding inventory of land and water resources.
- Establishment of bio-fuels roundtable and reflective governance linked to better land and water resource management practices.
- Encouraging intercropping and crop rotations with bio-fuels crops for maintaining food security.
- Increasing incentive and tax exemption for large scale bio-fuel production to degraded land and emphasis to second bio-fuels generation.

2.2 Study methodology

The study employed both qualitative and quantitative approaches through focus group discussions and interviews. The key informants for group discussion were selected based on their detailed understanding, first-hand experience and their roles in the local and international institutions concerned on the issue of Tanzania or global bio-fuel development, water and land use management, and policy development. Others were selected based on equal representation of academics, donors or development partners, political leaders, flex-fuels vendors and local bio-fuels consumers. The discussions also aim to encourage informants' active participation through the use of facilitation methods and tools that helps to extract information as to how formal and informal institution is responsible for resources utilisation.

The semi-structured questions were used to collect data from students in Uppsala and irrigation engineer, bio-fuels experts, and bioenergy researchers' network in Tanzania. The questionnaires were designed to clarify the perceptions and practices of smallholder bioenergy production with regards to their responsible institution (Appendix 1).

The helpfully secondary data deployed in this study were mainly from various bio-fuel reports of the study area obtained from SIDA-help desk, The Nordic Africa Institute, Stockholm University, and Swedish University of Agricultural Sciences library, European Union renewable energy website and the URT website. The others were obtained from seminars and workshops which I actively participated in bio-fuels development, natural resources and on political science-power structures (Appendix 2).

2.2 Scope and limitations of the study

2.2.1 Scope of Study

The study is mainly focusing on sugar cane production as a major bio-fuel crop that can alleviate poverty in Tanzania. Sugar cane is expected to meet large demands of ethanol on the international market. This study analyzes how the institution aspects of bio-fuels industry in Tanzania can contribute to rural smallholder's development by exploring the inter-relations of both formal and informal institutions. For instance, promote both effective indigenous, legal laws and regulations for monitoring and coordinating modern investment initiatives. This provide incentives, modern farming technology for maximizing water and land productivity (example ,promising bio-fuels investment plans of SEKAB including Out-growers block farming and others) and hence increase profits and livelihood..

However, a recent study by the WWF-Sweden in Rufiji district experiences several challenges on land tenure policies that are connected to current bio-fuels developments to village land. For example, About 11000 village assemblies in Tanzania are still regulating and holding 70% of the land, 28% reserved (forests/wildlife) and 2% general land (title).The current land approaches is due long process for land access largely contributed by central GoT top-down ruling systems which give much authority to commissioner of land who is informed by the President to provide land to TIC for promoting investments[15]. On other hand, the

[15] Kjell Havnevik,``Rufiji district, Tanzania – historical and current contexts for bio-fuel investments´´, World Wide Fund for Nature in Sweden and the Swedish interdisciplinary research network on livelihoods and natural resource governance in Africa workshop on *Aspects of SEKAB's plans for large scale bio-fuel production in Tanzania - focus on Rufiji District and the conditions for development and poverty reduction,* Stockholm, 20 May 2009.

approach is limiting the investors' access to land and disempowered indigenous institutions to decide on land resources allocation for adequate resource access and fair benefits sharing.

In addition, the existing water resource management legislation as an amendment Act No.10 of 1981 explains also bureaucracy of institution decision making due to establishment of two advisory levels of boards, the central water boards and basin water boards. The authority for granting water rights start with the principal water officer and then descend to the basin water officers,example,RUBADA, followed by customary water rights. The water use processing results into a barrier because of failure to deliver on time the necessary hydrological data to local smallholders.This creates risks to smallholders as they do not know their water usage rights and time for planning intensive irrigation.

Within the context of broader basin water resources and land tenure threats, the current efforts of URT in finding sustainable guidelines for bio-fuels development is requested to acts as an important centerpiece for bio-fuels development between actors. The guidelines have to save hard currency, bringing social responsibility, commoditization, biological diversity, conservation; carbon trading and carbon sink for climate change mitigation. The matter is how do local smallholders involved in formulation of these guidelines? In addition, the integrated water resources and land use governance for commercial bio-fuels production has to be clearly stated by reducing serious water and land competitions by taking concerns of the main attributers: uncoordinated developments and water allocation, and less water flows data.

The study seeks to establish both qualitative and quantitative baseline information on the major sustainable development issues involved in the globally polarized debates of bio-fuels cultivation, processing and marketing. The study is categorized into 7 sections: Section 2 analyses regulatory and institutional framework. Section 3 discusses reflexive governance as mechanism for a sustainable transforming village land and water resources. Section 4 is about land and water issues in Rufiji River basin. Section 5 analyses the interrelationship between food and energy. Section 6 analyses the strengths and challenges of bio-fuels production in Tanzania. The last section, finally, analyses bio-fuels development–institutional in Tanzania.

2.2.2 Limitations of the study

The major limitations of the research study is its broad inter-disciplinary nature that involves ecological, economic, social and institutional aspects of bio-fuel production that encompasses local, national and global actors. In addition, I have not had the opportunity to explore the reality on the ground through field observation and interviews with bio-fuel stakeholders in Tanzania. Instead most of the information of the study was acquired from people who are working on bio-fuel industry. The intervention of the study observes weak interdependence between institutions and regulations because the available policies and legislation in reference seek to regulate and coordinate agriculture, land, environment, natural resources management (water, marine parks, fisheries, forests and wildlife), local government authorities and investment. Therefore, due to institution fragmentations, it was difficult to access information related to bio-fuels legislations because the roles and responsibilities of the key bio-fuels multiple actors are determined by different legislations. This increases the legitimacy of the bio-fuels industry because of the lack of transparency institution framework that coordinates multiple actors and activities of bio-fuels operations which promise sustainable development to local people. I hope the measures and ideas introduced in this research study could be refined and made more robust for later studies.

2.3 Definitions, Concepts, Terminology

Bio-fuel; is a renewable energy produced from all types of organic materials such as wood, charcoal, energy crops, agricultural and forestry wastes, and organic manure.
The study is focusing on two types of engine combustion liquid bio-fuels generation.
(i) First generation: Bioethanol and Biodiesel, which account for more than 90 per cent of world bio-fuel for transport usage.
(ii) Second generation: Cellulosic fuel, which are estimated to become competitive at the earliest 2020.

Liquid Bio-fuel; is defined as a liquid fuels produced from renewable resources such as plants biomass, vegetable oils, treated municipal and industrial waste for use in combustion engines directly or blended. This is often referred to as first generation bio-fuels which include only bioethanol and biodiesel.

Bioethanol; is an alcohol made from sugar or starch crops such as (cereals, plant tubers, sugar cane, sugar beets, or sometimes plant biomass, agro by-products) by fermenting into bioethanol and water. It can be used directly for engine combustion or blended with petrol. For example in Sweden E85 is a blend of 85% Ethanol and 15% pure petrol. Figure 1 shows the major process of bioethanol production (Figure 1 in Appendix 4).

Biodiesel is made from vegetable oils such as *Jatropha curcas*, sunflower, palm oil, rapeseed, castor beans, and coconut or from animal fats, tallow and waste cooking oil. The oil reacts with methanol under a catalyst to yield crude biodiesel and crude glycerin. The crude biodiesel undergo further process to produces biodiesel while the crude glycerin produces glycerin (Figure 2 in Appendix 4). A second generation of biodiesel technologies - the Fischer-Tropsch process - synthesizes diesel fuels from wood and straw to a gasification stage.

An institution is a rule of game in a society that encompasses formal and informal rules together with their enforcement mechanism. Basically, considering institutions as system of interrelated rules, beliefs, norms and organisation, each of which is man-made and nonphysical social factors[16].In addition, institutions acts as a human arrangement that form structures and mechanisms of social order for initiating or constraining cooperation while governing the behavior of a set of individuals. Institutions can be judicial bodies, political parties, and legislative and representative bodies' executive agencies, civil society and membership organizations, NGOs, law, money, commercial enterprises and corporations.

Formal institution; are legal systems and property rights which operate with objectives, roles and rules designed accordingly by reflecting the official declaration.

Informal institution; is a moral or ethical standard that describes different ways of clientelism, self-help, kinship and other customary norms. The major features of this are dynamism, bringing local legitimacy through face-to-face interaction, being unwritten, lacking public rationale, personalizing power over others, and typically self –enforcing.

Institutional analysis; is studies of how structures and mechanisms of social order and cooperation governing the behavior of two or more individuals, behave and function

[16] North 1990;Ostrom 1990;Knights 1992;Weingast 1996,``Institution definition used in economics, political sciences and sociology´´,pp.39

according to both empirical rules – informal rules-in-use and norms - and also theoretical rules - formal rules and law. This field deals with how individuals and groups construct institutions, how institutions function in practice, and the effects of institutions on society[17].

Reflexive governance is defined as: 'the organization (modulation) of recursive feedback relations between distributed steering activities'. Reflexive governance is regarded as strategic process involving five key elements ;(a) transdisciplinary knowledge production(b)experiments and adaptively strategies and institutions(c)anticipation of long-term systems effects of measures(d)interactive participatory goal formulation(e)interactive strategy development[18].Taking into account its process of decision-making which is usually based on the procedural requirement that allows the unintended result of past choice, creating and giving chances to those external factors, and governing activities are entangled in wider societal feedback loops.

Sustainable development; is defined as the use of pattern of water or land resources that meets the needs of the present without compromising the ability of future generations to meet their own needs[19].

Land tenure; is referred as a relationship, whether legally or customarily defined, among people, as individuals or groups, with respect to land and associated natural resources (water, forests, minerals, wildlife, etc.). Also, is regarded as a system which determine who can use what resources and for how long, and under what conditions. This includes rules of tenure which define how property rights in land are to be allocated, and alienated within a community.

2.4 Selection of a case study

Lower Rufiji River basin as a study site was selected based on empirical understanding and uniqueness of the basin as shown by recent studies[20] that the area is being vulnerable to adverse social and environmental impacts. The lower Rufiji River basin is one of the poorest

[17]FAO, understanding local institutions, http://www.fao.org/DOCREP/006/Y5084E/y5084e08.htm,Cited on 15 May 2009.
[18] Voß, J.-P. and Kemp, R. (2005) 'Sustainability and reflexive governance: Incorporating feedback into social problem solving.' Paper presented at International Human Dimensions Programme on Global Environmental Change (IHDP) Open Meeting. Bonn: 9-13 October
[19] United Nations. 1987."Report of the World Commission on Environment and Development." General Assembly Resolution 42/187, 11 December 1987. Retrieved: 2007-04-12.
[20] WWF for nature Tanzania Programme Office (WWF-TPO),``Bio-fuel Industry Study, Tanzania: An Assessment of the Current Situation´´, with support from WWF SWEDEN, March 2009

areas in Tanzania caused by ineffective resources management. However, the critical features of the selected study area are its resource endowment, complex agro-ecological systems, economic diversification and migration. The area is targeted by various foreign companies planning or started investments on natural gas, bio-fuels and hydropower. Some of the investors see that the natural resources in Rufiji district as poorly utilised or unused although there are many indigenous institutions and activities which are still going on there.

The study site is becoming more sensitive because the present investors' land and water resources approach and operations are claimed to; disturb rural smallholders' livelihood, contributing to climatic change via GHG emission, endanger mammals and birds, exploitation of ecosystem of important wetlands and Miombo woodland forests with high biodiversity value. These demand a holistic approach for long term sustainable management of water resources and land that will link social and economic development with protection of natural ecosystems. All of these factors influenced the choosing of this area as a case study so as to investigate information on a contemporary phenomenon of Rufiji River basin. The study is hoping to increase knowledge and understanding to villagers, bringing criteria's for resources benefit sharing, stimulating local policies and coordinating the exploitation of existing resources.

2.5 The study area.

Rufiji River Basin is a largest perennial river in Tanzania located in Rufiji District in the South of Coastal region. The Rufiji River basin covers an area of 177420 km^2 with a total population about 1,400,000 people[21] and drains the Southern Highland into Indian Ocean at a delta point of Mafia Island called Mafia Channel. Rufiji River basin includes four main rivers namely; the Great Ruaha River (83979km^2-principal tributary), Kilombero River (39990 km^2), Luwegu River (26300 km^2) and the Rufiji (lower part of main river-27160 km^2)[22].The maximum flows of Rufiji River Basin is up to 14,000 m^3/sec and minimum flows of about 50m^3/sec in the lower catchment. The basin water flow supports fisheries, domestic uses, biodiversity, meticulous wildlife, navigation, power generation, livestock keeping and intensive rain-fed and irrigated agriculture. Rufiji River Basin is a store for variety of

[21] URT, National Bureau of Statistics Tanzania, National population and housing Census, Coastal region 2002. Cited on 16 April 2009 on http://www.nbs.go.tz/indicators_2.htm
[22] URT, Ministry of Water and Irrigation, Rufiji Basin Water Board (RBWO), Details of the Rufiji Basin, 2009.

endangered species including 117 species of mammals, 10 birds' species, 2 amphibians and 25 plant species[23].

The study is focusing on lower Rufiji River which is mostly occupying 75% of Rufiji district. The Rufiji district is about 200 km (120 miles) southern of Dar es Salaam City with 202,001 populations including 104,266 female and 97,735 male in 18 wards[24]. However, more than 50,000 people are living in the delta including the Rufiji, Mafia and Kilwa Marine Ramsar Site. Rufiji district lies between latitudes 33º55' and 39º25' east, and longitudes 5º35' and 10º45' south. The assessment from several WWF-Sweden studies shows that Rufiji district is one of the highest levels of poverty in Tanzania[25]. The district ecological and agro-ecological zones have been demarcated by Selous game reserve, west valley, north and south hills, flood plains, inner delta and delta[26] (Figure 3). In Rufiji district there are 23 forests reserves some located few distance from villages of Mloka and Nyaminywili at the west valley of lower Rufiji River[27]. The ethnic group lives in Rufiji district are largely dominated by Ndengereko (who, according to oral tradition, are the original inhabitants of the area), other groups includes the Matumbi, Nyagatwa (concentrated in the delta area), Ngindo, Makonde and few Pogoro. The majority of the people are Muslims with few Christians and followers of traditional religions. In addition to local languages, Kiswahili is widely spoken; English is not commonly used in the area. The majority of the people in Rufiji District are subsistence farmers.

The weather in Rufiji district is hot throughout the year with two rainy seasons; short rains-Vuli (October to December) and long rains-Masika (February to May).The average precipitation per annum in the district is ranging between 800mm to 2000 mm. The north and south of lower Rufiji River before the inner delta there are two fertile floodplains; 20km wide with a flood peak around April strongly influenced by seasonal flow pattern. The two floodplains are potential areas for agriculture and are traditionally planted with rice, cassava, maize, peas, millets, sesame, coconut and cashew nuts. The southern flood plains had been granted to Turkish company for rice production though there is no any site developing till now and the local farmers are not allowed to cultivate in that area.

[23] The International Union for Conservation of Nature and Natural Resources (IUCN),2008
[24] URT, National Bureau of Statistics Tanzania, National population and housing Census, Coastal region ,2002.Cited on 16 April 2009 on http://www.nbs.go.tz/indicators_2.htm
[25] Peter Loberntz,Aspects of SEKAB's plans for large scale Bio-fuels production in Tanzania-Focus on Rufiji District and the conditions for development and poverty reduction,WWF seminar on Bio-fuels, Stockholm University,20 may 2009.
[26] Kjell J.Havenevik,TANZANIA:The limits to development from Above,(Nordic Africa Institute,1993),pp.65-80
[27] International Union for Conservation of Nature, 2008

The western valley of lower Rufiji River there are 4 out of 13 villages assemblies which have approved their land to SEKAB for sugar cane cultivation. These villages include Mloka, Nyaminywili, Kipugira and Kipo. In addition, the south flood plains of lower Rufiji River cover Nyamwage, Utunge and Tawi villages are in discussion with SEKAB for sugar production and others who have interests with these areas include VISTA-Indian Company (Jatropha production), Korean company and Turkish Company (rice production) and China Company for oils and gas mining. Recent studies are documenting on several water resources dilemmas and land use problems facing the Rufiji River basin because of large interests from foreign investors to introduce bio-fuels production in the basin. Water resources and land competitions are experienced between downstream and upstream due to increasing demands of village land from investors for bio-fuels production.

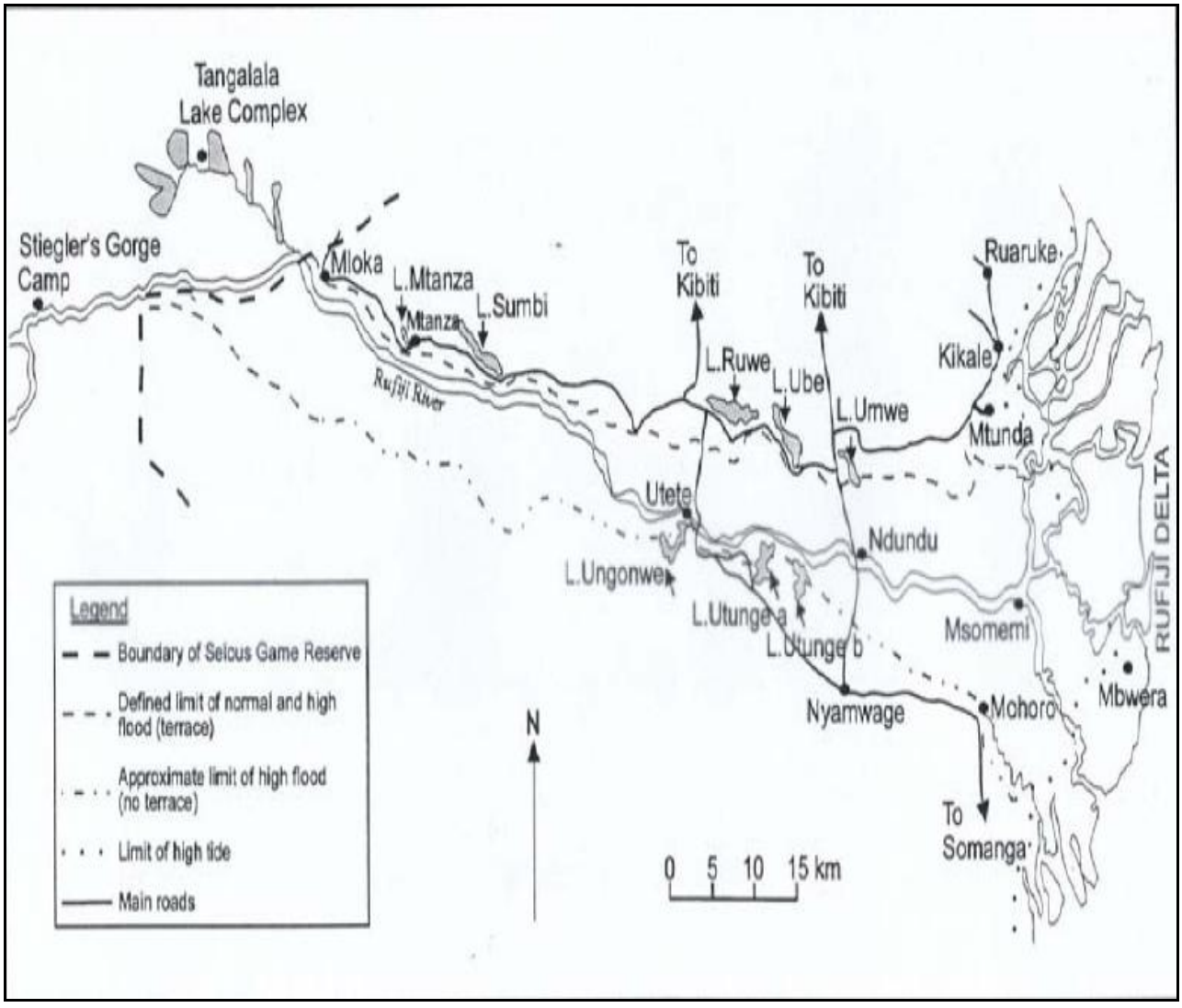


Figure 3 Rufiji River Basin Agro-Ecological Zone.

2.6 Methods and Tools

Mind mapping; is a technique of structuring an issue, it is different from other forms of note taking since it's not linear, you start in the middle of the paper and work your way out .

Multiple causes diagrams; are used to show why things happened and why they are as they are. The aim of it is to untangle the interconnected causes, identify how certain issues impact others and to identify possible points of intervention and which approaches would be more suitable.

Time line; this tool deployed to understand the different water resources and land tenure managements systems since colonial era to current periods which appear to be neo-colonial era to many developing countries .

Stakeholders Analysis; the method identifies key actors, and giving assessment of their interests, and what influences extent and direction affects of bio-fuels development riskiness and viability in Tanzania.

Force Field Analysis (FFA); used as a technique of visually, identifying and analyze both western countries and Tanzania driving and restraining forces of bio-fuels production in Rufiji River basin.

SWOT Analysis; the method has been used as a monitoring or evaluation tool by explaining (SWOT) -Strengths, Weakness, Opportunities and Threats of bio-fuels development in lower Rufiji River basin.

Bio-fuels logical frame work-Action plan

The study has proposed suggestions and intentions through logical framework (log frame) which are linked logically by showing the goals, purposes, outputs, indicators and essential activities in achieving sustainable bio –fuels development in lower Rufiji River Basin.

3. THEORETICAL FRAMEWORK

3.1 Regulatory and institutional frameworks for bio-fuels development in Tanzania

The importance of institutions are mostly perceived when institutions are resulting to entitlements, rights and enforcing incentive and disincentive in the rural community as an approach of shaping the rural living. Poverty is a major problem in Tanzania attributed by lack of sustainable rural energy supply. The energy availability is a critical issue that leads URT to promote investment in modern energy by increase access of energy services to rural smallholders'. The URT under (NSGRP-MKUKUTA) programme is strengthening its specific goals for reducing extreme poverty from 33.6% in 2007 to an estimated 18% of the population by the year 2010[28]. The objective of the programme is to ensure economic and social empowerment of the local poor by establishing an enabling environment for development, through investment in energy, transportation, communication and other economic, social and physical infrastructure.

Presently, the GoT under MEM has established or revised an institutional framework of NBTF, REA and REF that seems to be main institutions for promoting modern energy investments to poor rural people throughout a country. The three institutions are requested to increase access of energy services to rural people by handling well the diversity, management and coordination of several institutions. Their aims are to include renewable energy resources (bio-fuels, hydro, natural gas, coal, wind and solar) by taking into account the energy efficient and NEMC environmental sustainable criteria. The 2003 National Energy Policy has considered the necessity to have affordable and reliable energy supplies, enhance the development and utilization of renewable energy sources and technologies, promote energy efficiency and conservation in all sectors, reform the market for energy services and establish an appropriate institutional framework which facilitates investment, expansion of services, efficient pricing mechanisms and other financial incentives[29]. With regards to the objectives of the study, the discussion will focus on NBTF as one of energy agency in Tanzania.

[28] URT,General budget support annual review 2008 final report, MKUKUTA Implementation and presentation of detailed poverty analysis'', Cited on March 2009 at http://www.mof.go.tz/mofdocs/GBS/general%20budget%20support.pdf,pp.18

[29]URT,MINISTRY OF ENERGY AND MINERALS(MEM), Biomass Energy Situation in Tanzania, Cited April 2009 at http://www.tatedo.org/publications/reports/biomassenergy.pdf

3.1.1 Institutions for Tanzania bio-fuels development

The main driver for implementing bio-fuels policy in Tanzania is the Ministry of Energy and Minerals (MEM).Though there is an on-going debate in Tanzania about who is responsible for regulating and coordination bio-fuels production activities between MEM and MAFC. The MEM is strongly supporting that bio-fuels is under its supervision by defending that bio-fuels are energy issues. They are responsible to provide advices and recommendations for the elaboration of bio-fuels policies and regulations suitable for the Tanzanian bio-fuel framework conditions. At the same time MAFC argued that in order to ensure rural sustainable agriculture development, bio-fuels production has to be under its ministry. Since a well-developed agricultural extension network could facilitate promotion of bio-fuels activities such as improving end-use efficiency in agro-processing, as well as briquetting of agricultural residues.

Therefore, MEM continue to dominate by establish NBTF with the targets of facilitating strong co-operation and channeling information in the development of bio-fuels to various stakeholders including Government Bodies, Associations and Utilities, Bio-fuels producers and other stakeholders. The NBTF has been designed to be independent body from central government with agenda of being open, transparency, accountability, power sharing, reporting, information sharing and rule of statutory laws and customary rights. Table 1 below summarizes the essential NBTF members.

Table 1 Summary of the essential NBTF members.

Institution Category	Name of Institution
Government Bodies	❖ Ministry of Energy and Minerals (MEM) **(Lead actor)**
	❖ Ministry of Agriculture, Food Security and Cooperation (MAFC)
	❖ Ministry of Transport and Communication (MTC)
	❖ Ministry of Industries and Trade (MIT)
	❖ Vice President Office (VPO)
	❖ National Environment Management Council (NEMC)
	❖ Planning and Privatization Commission(PPC)
	❖ Tanzania Investment Centre (TIC)
	❖ Ministry of Regional Administration and Local Governments
	❖ Ministry of Finance (MoF)
	❖ Tanzania Revenue Authority (TRA)
Associations and Utilities	❖ Energy and Water Utility Regulatory Authority (EWURA)
	❖ Tanzania Petroleum Development Cooperation (TPDC)
	❖ Tanzania Association of Oil Marketing Companies (TAOMC)
	❖ Sugar Board of Tanzania(SBT)
	❖ Tanzania Sugarcane Growers Association (TASGA)
Bio-fuels producers and other stakeholders	❖ Kilombero Sugar Company
	❖ Mtibwa Sugar Estates
	❖ Kagera Sugar Limited
	❖ KAKUTE
	❖ FELISA
	❖ SEKAB
	❖ TaTEDO
Religious institution	❖ CARITAS
	❖ ELCT-SUDERETA

Source: Developed from GTZ, August 2005

3.1.2 Institutions as entitlement and right approach on bio-fuel production

The main advantages so far focus on how bio-fuels actors access, use and benefit from different components of the environment, and how an extended entitlements approach, coupled with an analysis of institutions help to conceptualize these processes. In fact, entitlements can be explained as those sets of alternatives commodity bundles that a person can command in a society using the totality of water rights, land titles, rights based

approaches and opportunities that poor local people face[30]. But a key set of advantages concerning the ways in which the NBTF in turn, shaped and transformed through people's interactions. Other benefits resources entitlements happen when bio-fuels institutions appear to drive rules which un problematically governed people's behavior and maintained social order. This can comprise parts that interlocked functionally to fulfill society's needs and maintain an equilibrium e.g. water quantity and quality for daily uses, irrigation. Specifically, taking into account the key elements of the entitlement and rights approach that offer opportunity for the involvement of both historical and traditionally rights and responsibilities of the social actors.

Also an institution as entitlements can help to reduce Rambo or hegemony situation among water users in Rufiji River by provision of responsibilities. For example upstream water users have to produce hydroelectricity for downstream uses and downstream riparian has to produce bio-fuel and food for feeding upstream. Since, the water sector is real complex; rights should act as instruments for the empowerment of community by asking for their flexibility to the overlapping systems of rights and responsibilities alongside customary law rights.

3.1.3 Institutions enforce incentives and disincentives in bio-fuel development

Many institutions use incentives and disincentives in water and land resources management purposely to keep out society in different decisions which have direct effects to them. Others are for bureaucratic and market force matter while the rest are for changing gradually the social life through water subsidies, fines, taxes, standards and technology standards on water. The value of institutions to fit and not fit in the society depends on the static and dynamic dimensions of these institutions as objects of choice. Generally the static dimension of institution occurs when acts as human devised constraints that shape human interaction by providing bureaucratic, market force, less awareness raising by disseminating less information, less insecure and less sustainable laws and rules that facilitate human interaction and social life.

[30]Melissa Leach, Robin Mearns and Ian Scoones, Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management. Institute of Development Studies, Brighton, UK, World Development Vol. 27, No. 2, 1999, pp. 225-247

A dynamic outlook of biofuel institution occurs when it involves stakeholders without undermining their endogenous character, ownership and responsibilities to facilitate more commitment, trust, transparent and depoliticizing by appreciating the contextual factors and local knowledge.That could enhance to improve awareness and communication and cooperation/relationships between actors and local sharing understanding. Therefore, there are needs to enhance networking and involving different stakeholders as a key asset to promote institutional change. Institutional reform processes should asks for facilitator and people who look beyond technical and/or sectoral boundaries that can open eye for the process itself, including the interaction and power play between different stakeholders.

3.2 Reflexive Governance as a Mechanism of Transforming Village Land and Water Resources

In Tanzania, land and water resources are main tools for promoting rural livelihood and economic empowering. There are proliferations of institutions in lower Rufiji River basin with both formal and informal legislation. The process of decision making on water and land resources utilization has been asked to consider the interests of local by involving different pieces of statutory legislation, customary laws and ethnic groups. Reflexive governance appear to be affordable governing process that has emerged from the concept of modernization theory which collectively allows multi-perspectives of different actors and factors (endogenous and exogenous) with different knowledge, power, role and authorities over water and land resources. In order to bring these interfaces into bio-fuels viewpoints, we propose an analytical framework for conceptualizing reflexive governance in context [31].The main device of ensuring reflexivity governance is democracy circulation. Democracy creates a room for debate on land and water resources issues occur; where citizens, stakeholders, government officials and NGOs come together to consider issues for collective decision making.

Therefore, the idea behind reflexive governance is about dual functions of systemic feedback and conscientious self introspection that are arising from intended and unintended outcomes. Actually, reflexive governance for sustainable development used to explore strategic experiments, policies, and programs that may help move the society through an era

[31] Hendriks, C. M. (2004) 'Public deliberation and interest organizations: A study of responses to lay citizen engagement in public policy.' Ph. D. Thesis. Canberra: The Australian National University.

of uncertainty. Therefore the governance style has showed several strengths that increases the learning action across the different actors. The process of decision making is recommended to consider the needs, constraints to participation, ability to participate, different benefits of participation as it can be identified between men and women while planning for any bio-fuels intervention.

Some of the customary laws are usually not easy to be noticed unless there are resources scarcity and competitions. However, the central government believes that the only leading law is statutory law[32]. Before discussing the details of how the transformation of village land and water resources has to be structured for promising sustainable bio-fuel production in Tanzania. It is much better to discuss the land and water issues of bio-fuels production in Rufiji River basin.

3.3 Land and water Issues of Bio-fuels production in Rufiji River Basin

Bio-fuels production requests a vast land entailing exploitation of natural vegetation, water resources abstraction and huge labour force. Sugar cane is a bio-fuel crop grown on the fertile soil, with access to water, and high rainfall except for *Jatriopha curcas* that can be grown on the degraded land. As it can be seen, the area suitable to grow sugar cane also suits for food crops production. In Tanzania there are more than 40 investors as registered by MEM that are increasing pressure on TIC as they ask for land for bio-fuels production. As far as TBF identified sites for bio-fuels production, still the area identified are wrongly located because some of them are highly populated, high rainfall, potential to water resources, fertile soils, and natural vegetations with high canopy cover particularly Miombo forests. The unsustainable bio-fuels production in Rufiji Basin is expecting to cause risks to land and water resources by increasing competitions between traditional, smallholder farmers and large scale conventional irrigation scheme (Figure 4). Thus escalate conflict between investors and out grower Association. The investors interested the trial of investing in bio-fuel productions in Tanzania are mostly from USA, EU, Japan, India and Malaysia (Table 2).

The major land issues in Tanzania which are associated with bio-fuel production are: (1) Land competitions between smallholders' farmers and investors, smallholders farmers and pastoralists, and downstream irrigation and upstream hydropower generation (ii) Loss of land value by disturbing hydrological circle due to conventional tillage, effluents discharges,

[32] Faustin P.Maganga ,Incorporating customary laws in implementation of IWRM: some insights from Rufiji River Basin, Tanzania, Vol 28,2003,pp.995-1000.

frequent mechanization and intensive water abstraction (iii) Lack of land information to the local people (iv) Inadequate institutional and infrastructural capital in Rufiji basin (v) Village land insecurity and loss of traditional symbolism(See figure 4).

Table 2 Bio-fuels investors in Tanzania.

Name of investors	Owner of the company	Sites Targeted	Bio-fuels crops
WILMA	USA	Biharamulo-Northwestern Kagera	Croton nuts
Sumagro of India	India	Kilosa	*Jatropha* for seed production
FELISA	Tanzanian and Belgium company	Kigoma	Oil palm
SEKAB	SEKAB GROUP-SWEDEN	Bagamoyo, Rufiji, Kilwa	Sugar cane
BioShape Tanzania Limited	Dutch company	Kilwa district	*Jatropha curcas*
Shanta Estates		Bagamoyo	*Jatropha curcas*
Sun Biofuels	Share(TEP Plc based in London and two Tanzanian investors)	Kisarawe	*Jatropha curcas*
Trinity and Bioenergy		Bagamoyo	*Jatropha curcas*
TaTEDO	Tanzanian	Arusha	*Jatropha*
PROKON	PROKON, Germany	Mpanda, Rukwa	*Jatropha curcas*
Diligent Tanzania Ltd	Dutch Firm-Diligent Energy Systems	Arusha	*Jatropha curcas*
CAMS Agri-Energy Tanzania	Major European Biofuel manufacturing and Trading Co. in joint venture with CAMS Agri-Energy Tanzania	45,000 hectares of land in two districts - Handeni and Bagamoyo	*Ethanol from Sorghum*

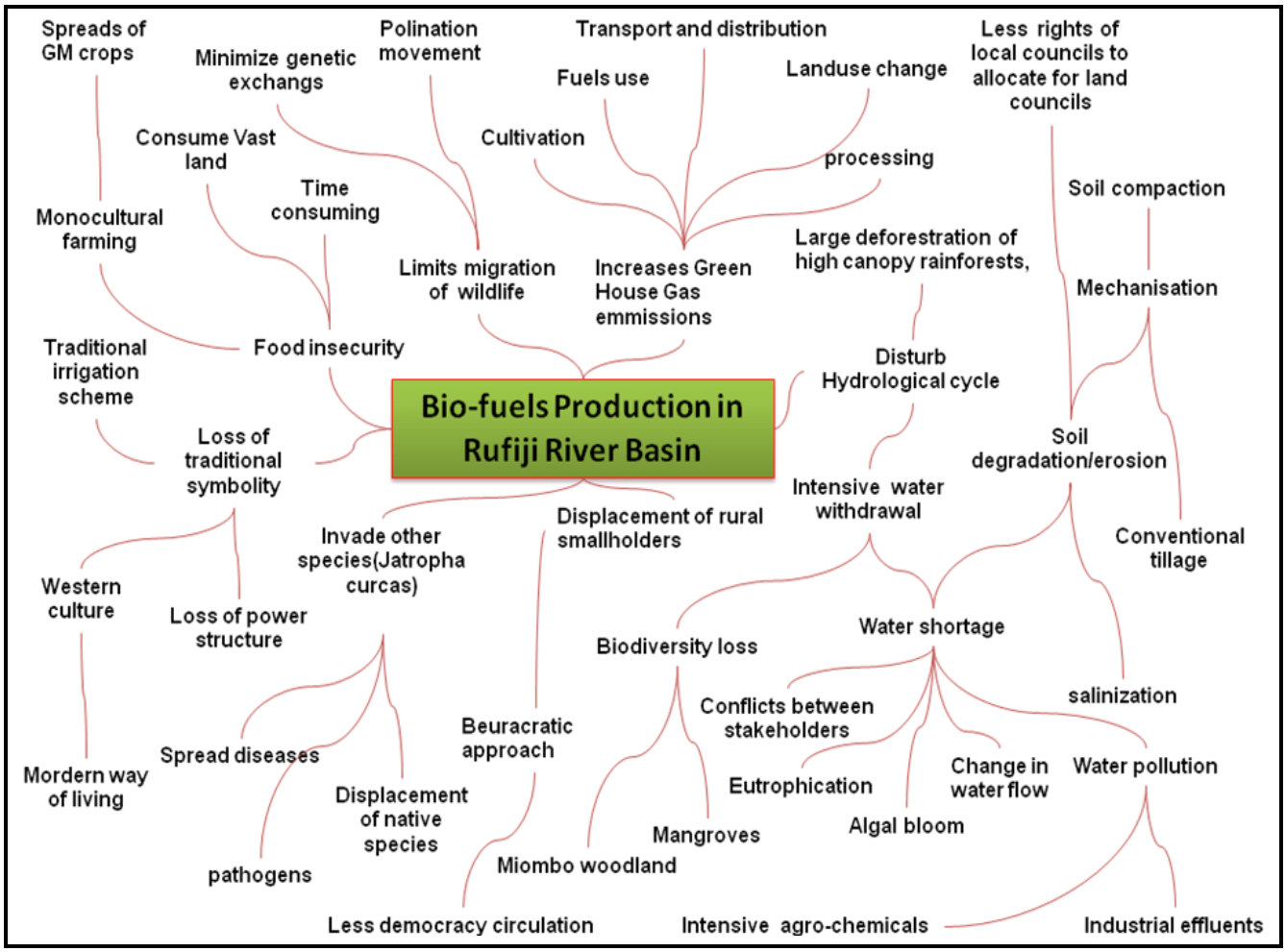


Figure 4 Land and water Issues of Bio-fuels production in Rufiji River Basin.

3.3.1 Land tenure and bio-fuel production in Tanzania

Tanzania has almost 94.5Mha of land designed as 44.4Mha potentials for Agriculture, 39Mha not potential for agriculture while 10.8Mha allocated for crops production. The land in Tanzania is regarded as a public land normally owned by the president of URT as the trustee for all Tanzanians. There are three types of land classification in Tanzania namely General land, Village land and Reserved land. General land is a land that is neither village land nor reserved land. The land is usually granted rights of occupancy to a client in terms of 33 years, 66 years or 99 years or under customary tenure. In Tanzania, the land clients can own and utilize the land based on terms of above rights of grants but still the land will remain to be the property of public. Because, the president has a power to transform village land to be general land, and general or reserved land to village land. The transformation here is the one that creates many problems to poor local people because the transformations sometimes do not consider the voice of the local society. In most cases the transformations consider only the legality of land ownership.

Reserved land is a land allocated for special purposes. Reserved land is usually designed by the president of URT under different ordinance. It includes National park Ordinance, Forest, game parks and game reserve Ordinance, Wildlife conservation Act, Town and Country planning Ordinance and hazardous land. For instance, the lower Rufiji River basin is occupied by Selous game reserves, Mangrove forests and Miombo woodland forests reserves which are continued to be governed according to legal provision of the forests governance while some reserved forest are under village councils. Lastly, Village land is that owned by village councils which comprises number of subcommittee members responsible for governing the land utilisation. The village council's members can be from village finance committee, planning committee, village peace and security committee, agricultural and infrastructure development committee, and cultures, education and social welfare of village assembly. Any village land issues are usually discussed at the village general assembly before passed to the village council for further approval.

3.3.2 Land legal aspects of bio-fuels production

In Tanzania the National Land Use Planning Commission (NLUP) is a major legal body used to coordinate, ensure land quality and effectiveness statutory of land use as adopted in the cabinet and presented to Parliament in 1995. The NLUP has been made purposely to promote and ensure wise use of land by guiding land allocations, prevent degradations and resolve land conflicts.The major principal legislation governing land tenure, administration and management in Tanzania are Land Act, Cap 113 (of 1999) and village land Act, Cap 114 (of 1999) miscellaneous amendments Act of 2004 and 2006.The land use planning of Tanzania has a long history varying from indigenous/customary, religious and state ownership. The below time line of Tanzania land use planning describes the institutions involved with their targets since the colonial era, see (Figure 5).

Tanzania 1999 Land Act and Village Land Act are debatably among the legal legislations that largely claim to cause impacts on the well-being of most Tanzanians. The acts are considered as static statutory law since they are ignoring the co-existence and interaction between multiple institutions such as state, customary of Rufiji ethnic group and religions. Since the acts provide legality of land institution framework to all of the three classification of land.

The Tanzania investment Act, 1997 describes the criteria of land for investment in Tanzania as restricted to the land that has been located for investment purposes. The land has to be identified, gazetted and allocated to the TIC. That means in order to get the land for bio-fuels investment in Tanzania, the procedure is to apply to TIC which creates derivative rights that it grants to investors. The derivative rights is defined as rights to occupy the land as allocated by central GoT, designed out of a rights of occupancy which includes a lease, a sub-lease, a licence and a usufructuary rights. TIC can grant a derivatives rights to investors for either short terms or long terms derivative rights and leases (between 5-98 years).This is similar to rights of occupancy period as explained in section 32 of 1999 Land Act which is mostly granted by the president of URT and applicable only to the general land or reserved land[33].

The perceptions of Tanzanian consider the 1999 Land Acts as fixed laws which forces local people out of their resource property. Because, the laws do not reconciles much the involvements of other institutions in the process of decision-making.Also, the process does not take into account the local institution norms and customer in land utilisation instead of focusing to the legal procedures. For example, General land has been prescribed as a land which includes all non reserved land or village Land. The land is sometimes considered as a residue land as described in the 1999 Land Act ``general land are all public land which is not reserved land or village land and includes unoccupied or unused village land´´[34].The unclear of the definition creates confusion between the investors and local land user for the land which are regarded as unused land. The definition results to land competitions because the literate local users reflects that public land property rights is trying to free surplus of village land to external investors. Although the land is granted rights of occupancy to users/investors by TIC normally .To accessing land in Tanzania seems to be very long process to investors as contributed by this bureaucratic approach which do not consider the involvement of civil societies in deciding for the use of their land.

[33]Medard Lucas Geho, Land use Report, 'Environmental Impact assessment of the Proposed SEKAB-BT Biofuels development project at the former Razaba cattle ranch in Bagamoyo´´,Tanzania, January 2008.
[34]Geir Sundet, "THE 1999 LAND ACT AND VILLAGE LAND ACT'',A technical analysis of the practical implications of the Acts ,February 2005

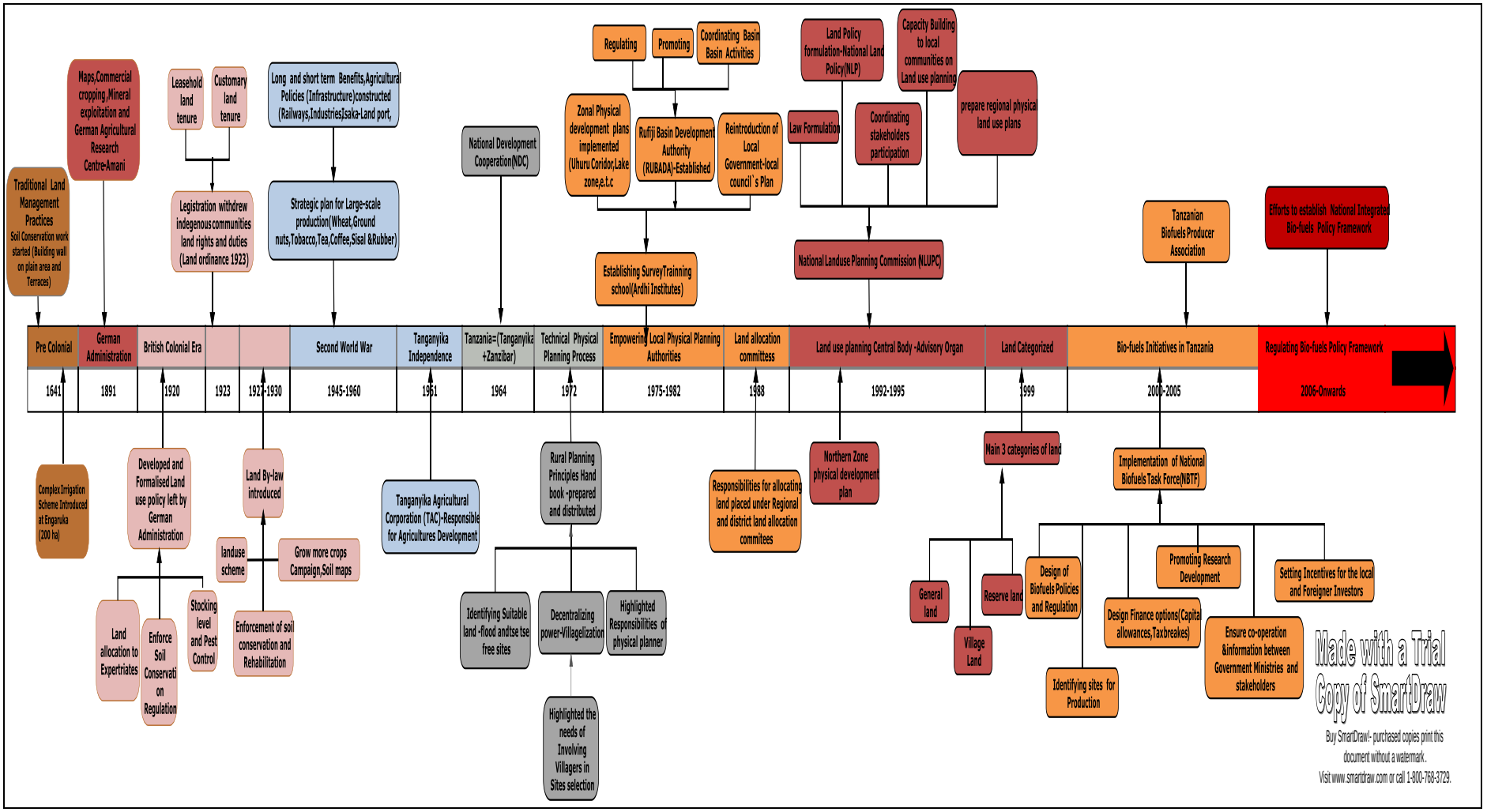


Figure 5 The below time line of Tanzania land use planning describes the institutions involved with their targets since the colonial era

3.3.3 Water issues and bio-fuels production in Tanzania

Water is a basic need for human consumptions and fundamental instruments for socio-economic development activities such as hydro power generation, irrigated agriculture, industrial production, livestock husbandry, mineral processing, navigations, recreation and tourisms industry. Tanzania is well known as a blessed country endowed with numerous and diverse water resources in the form of rivers, lakes, wetlands and aquifers. Tanzania drainage has been categorized into five major systems. These are including Indian Ocean drainage systems, the Atlantic Ocean drainage, the Mediterranean Sea drainage systems, the internal drainage of Lake Eyasi, Natron and Bubu depression and the internal drainage of Lake Rukwa[35]. For ease integrated and comprehensive management of water resources by ensuring equitable, efficient and sustainable development of resources; the drainage systems have further been divided into 9 river and lake basin. These are Wami/Ruvu, Rufiji, Ruvuma and southern Coast, Pangani, Lake Rukwa, Lake Nyasa, Lake Tanganyika and Lake Victoria, the internal drainage of Lake Eyasi, Manyara and Bubu depression (Figure 6). Each of these water bodies exhibit unique characteristics and a complex range of water resources management and development issues and challenges.

Despite its numerous water bodies, Tanzania faces water shortages in many areas due to increases of population (appr.40.1Million of people by early 2008), transformation of villages to urbanization, economic development, changes to the needs of water to people, intrusion of sea water to the delta and changes of cultural perception over water value and poor distribution of the resource in time and space .The findings from recent studies[36] shows that the lower Rufiji basin can face water competitions due to growing demands of water for irrigation, migration of pastoralists, domestic use and hydro power generation. Therefore, there are considerable conflicts between upstream irrigators and downstream hydro-power generation which need close attentions from responsible institution.

The climate variability in Tanzania are also contributing to water shortage due to changes in River run-off pattern, changes in rain fall pattern and shifting of rain belt, high evaporation rate, changes in agricultural water withdrawal pattern caused by variation of

[35]URT, "National water Policy", Government printers, Dar es Salaam, 2002.
[36] SEI and Institute of Resource Assessment,UDSM and Zoology Department, Inital Assessment of Socioeconomic and Environmental Risks and Opportunities of Large-scale Biofuels Production in the Rufiji District,May 2009

technology and changes in time period of spring surface runoff. Tanzania annual freshwater renewal rate per capita was estimated to be 2291.2 m^3 by 2007.The future of Tanzania freshwater resources per capita is expected to fall to 1500 m^3/capita/year by 2025 and hence position Tanzania to be among the water stress countries[37].The main uses of water in Tanzania are Agriculture specifically irrigation (89%), domestic uses (9%) and Industrial use (2%)[38] .

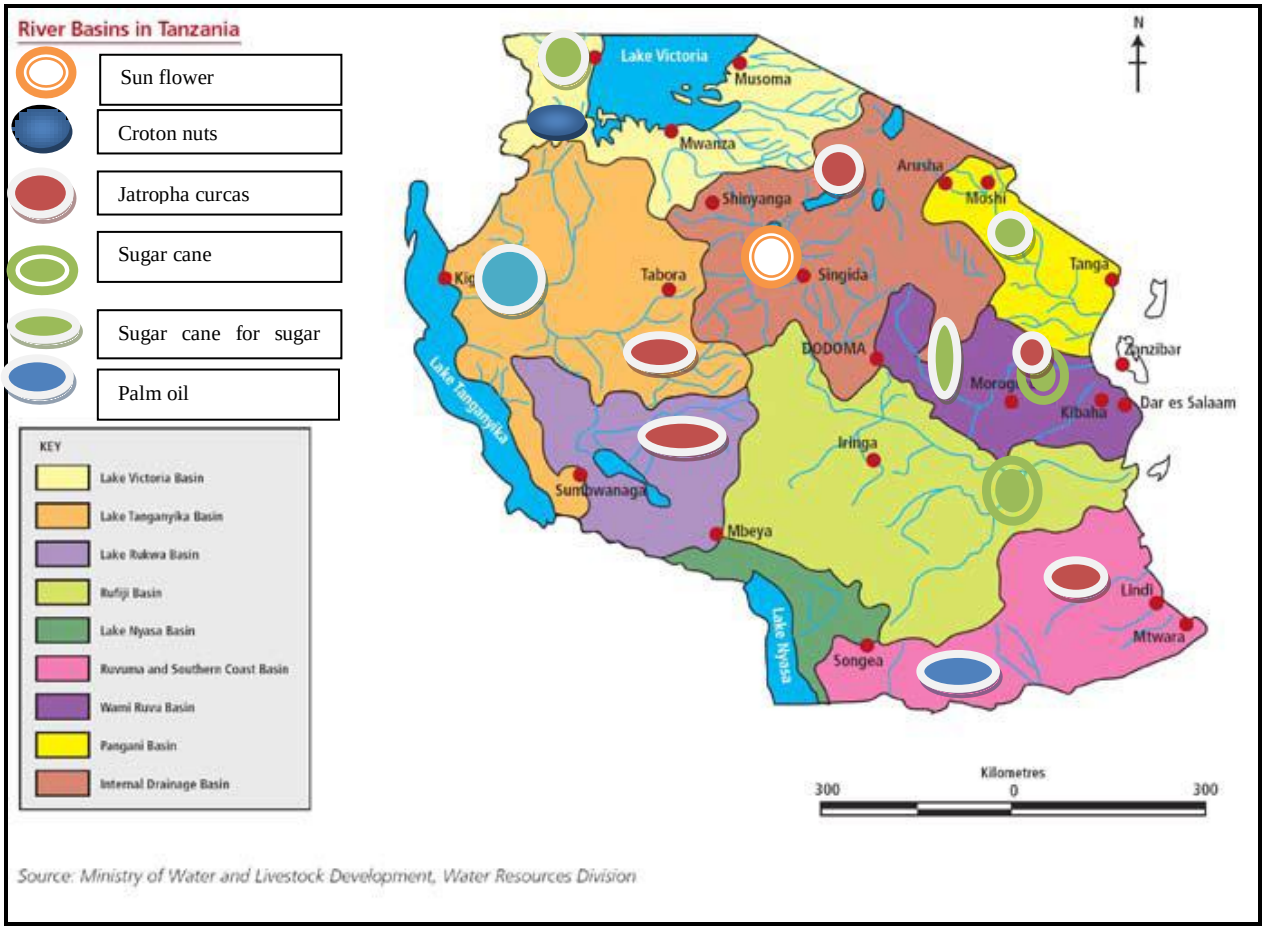


Figure 6 River basin in Tanzania and bio-fuel crops.

3.3.4 Tanzania water resources potential.

In Tanzania the main inflow of water resources are from rainfalls which contributes to 921,032Mm^3.Only 0.6 % of inflows water resources are used for domestic purposes, irrigation and animal husbandry (Table 3). This situation is calling for effort of managing the available

[37]World bank ,Environment at a Glance: Tanzania Environment Department, World Bank, Washington D.C, 2004
[38]URT, Ministry of water and Irrigation ,``National Water Sector Development Strategy´´, 2006

water resources by taking into high consideration of IWRM principles. To mention the lists of the major issues of water resources in lower Rufiji basin are;

- Planting and growing bio-fuels aliens and exotic tree species that abstract much water and contribute to water pollution.
- Increase of conflicts between upstream hydropower generation and lower irrigation schemes, investors and local water users, pastoralists (Maasai and Sukuma) and local farmers.
- Disturbing hydrological circle due to effluents discharges and extensive water abstraction.
- Illegal human activities related to agriculture, settlements in a Rufiji River valley basin and around water resources catchments.
- Inadequate hydrological data on water resources and its utilization to local communities.
- Massive deforestation for illegal timber and charcoal making as a source of energy to majority of citizens living in Dar es Salaam.
- Intrusion of herdsmen's or pastoralists in Rufiji River basin that leads to more water resources degradation.
- Limited public awareness and involvement in environmental protection and sustainable utilization of natural resources.

Table 3 Tanzania water potential

	Annual mean (Million m^3)			
	Inflow		Outflow	
Rainfall	921,032	100%		
Evapo-transpiration			827,313	89.8%
Runoff (lake and ocean)			89,530	9.7%
Ground water recharge			3,725	0.4%
Water use ,domestic, irrigation and livestock			5,116	0.6%

Source: URT-National Irrigation master plan, 2006

3.3.5 Linkages of water and Bio-fuels Crops

The consumption of water varies according to plants, geographical conditions and type of soil. Therefore it is very important for small holders to select the relevant bio-fuels cops according to availability of water and nature of their soil.Actully, sugarcane consumes more

water approximate 800mm per hectare as compared to other bio-fuel crops.Therefore, the large scale sugarcane plantations have to consider the available water resources and the type of technology that will be used for irrigation. For example, the use of drip irrigation might be a right technology for water application to the sugar cane plantation. Table 5 explain water requirements of bio-fuel crops. The scientists argues that the well maintained sugarcane plantations can also results to high yield of around 6000litres of ethanol per hectare. According to this argument, it is not surprising to say that, the large production of sugarcane can be the only alternatives for sustaining the national energy demands.

Table 5 Water Requirements for Bio-fuels Crops.

Crops	Irrigated crop water requirement		Annual obtainable fuels yield	Energy yield	Evapotranspiration equivalent	Potential crop evapotranspiration	Rainfed crop evapo-transpiration
	(mm/ha)	Litres/litre fuel	(litres/ha)	GJ/ha	(Litres/litre fuel)	(mm/ha)	(mm/ha)
Sugarcane	800	1333	6000	120	2000	1400	1000
Maize	300	857	3500	70	1357	550	400
Oil palm	0	0	5500	19	2364	1500	1300
Rapeseed	0	0	1200	42	3333	500	400

Source: FAO, 2008

3.3.6 Water Resources legislation in Tanzania

All water in Tanzania are vested in the URT as prescribes in Cap 331 of a main water utilization (control and regulation) Act.No.42 of 1974 as amended in 1981, 1989, 1997, 2001 and enforced together with other relevant legislation. For example Environmental Management Act No.20 of 2004.The statutory legislation are acting as pillar of water resources administration for granting the rights; describing to the users a different system of water controls from varying declaration and designation of all water as a property of the URT through national water or region water development strategy.The existing legislation related to the water sector has been developed over time through amendments to the original laws. For example, the amendments Act 1981 explains the different measures of pollution control, water quality standards, and permissible effluents standards.

The current legislation lack clarity and in some cases, lead to contradiction of intent and does not reflect the institutional and organizational changes necessary to implement the National Water Policy of 2002. The previous 1991 Water Policy had a goal that by 2002 clean and safe water should be provided for all Tanzanians a maximum of 400 metres from their households, but by 2002 only 50% of the rural population had access to reliable water supply

services.This indicates that, there is a need for bio-fuel companies to assist the rural population with water and sanitation in the areas whereby the company's farms are located in order to contribute to the goals stipulated in the policy. The 2002 Water Policy insists on the proper utilization of water resources. In the policy it is stipulated that extensive irrigation during dry season drives up the rivers thus disturbing ecosystems and wildlife. Therefore the bio-fuel investors are recommended to schedule well the time of performing irrigation. Irrigation can be done during the night when the evaporation rate is very low compared to day time.

Also the laws imply that the investors have to maintain the nature of the river by not disturbing the ecosystems and other wildlife which depends on water resources for their survival. For example, water intake point and river bank should be designed well by maintaining the naturality of the river which shall ensure the ecosystems and wildlife depending on water resources are not disturbed. Personally, I appreciate SEKAB plan in Rufiji basin of using new techniques of green sugar cane harvesting techniques and drip irrigation with emitters installed 18cm under the ground. These kinds of investment are sustainable since it promises resource benefits sharing between bio-fuel stakeholders. These kinds of investments can also attract smallholder block farmers to engage into the sugarcane production with much consideration on sustainable water utilisation.

The URT is finalizing the review of water legislation with the aim to harmonizing the conflicts related to water laws and regulations and integrating customary laws into statutory laws. The powers and responsibilities of new bio-fuel regulating institution will be enshrined in new laws, together with provision for regulation of the services[39]. Although Rufiji River Basin is not in the list of international cross-border basin but the establishment of Tanzania National Water Policy (2002) is giving the impression of Tanzania applying Article 5 and 7(1997) of UN Convention. The Article 5 of UN (1997) convention entitles each basin states to utilize watercourse in an equitable and reasonable manner, taking into account the interests of the water course states concerned, consistent with adequate protection of the water course. The laws aims much on water quantity as a factor that determines how much water should be used. This is similar to the Tanzania National Water Policy 2002 that emphases on water quantity and quality. Consequently, all applications of irrigations water at the bio-fuels

[39]Editorial team (Eng. A. J. Mukumwa, Mr. J. Mgaiwa, Mr. G. A. Saelie), Ministry of water and Irrigation, Maji Review, Vol No.10, November 2006, pp.1-54.

plantation have to take into account the aspect of water quality and quantity as insisted in the policy.

3.4 **Competitions between Food and Energy Production**

Bio-fuels production has been reported to expand rapidly with key drivers varying from south to the north by the outlook of high prices of fossil fuels and the needs to reduce GHG emissions[40]. However, the transition desire of findings clean and sustainable energy as alternatives for fossils fuels for transport sector and local energy use is forming a numbers of extra challenges in the African nations where much of the expansions is taking place. The investors are targeting Africa because of favorable climate, availability of water and huge arable land resources, availability of rainfall and availability of labour force (skilled, semi skilled and unskilled).Actually this transition solution of producing bio-fuels is causing lot of challenges to smallholders farming on what to grow and where. Is it food crop first or energy crops?

The western countries and Far East countries are setting targets of growing bio-fuels in order to fulfill the needs of using sustainable fuels in a transport sector. But, these countries don't have enough arable land to produce the feedstock themselves instead the developing countries are gearing up to respond on this demands with the targets of providing rural job and income, infrastructure development, increasing national market development through supportive policies and incentives, increasing the profitability in the agriculture, food processing and forestry sector, helps to restore the degraded land. Germany, Sweden, Norway, Netherland, USA, Japan, India, China and Malaysia are among the countries that have started the trial of growing bio-energy crops like sugar cane, *Jatropha carcus* or palm oil in the land of Tanzania. These projects are also placing local smallholder into dilemmas of deciding which crops and where they should grow food or energy crops. Since, Tanzania smallholders farmers are poor and lacking technologies.Bio-fuel crops cultivation is observed to be the first option of increasing rural human income though it consumes a lot of time. This limits farmers to concentrating on food crops production. Therefore; the study see the importance of both investors and governments to assists the technology transfer-agricultural machines to local farmers that will reduce time consumption on cultivation processes. On

[40]SIDA helps desk for Environmental Assessment, FACTS FROM SWEDBIO, ``Bio-fuels –potential and challenges for developing countries´´, Swedish EIA centre, SLU, Vol no.3 Feb 2008.

other side the intercropping has to be encouraged to the both smallholders block farms and large plantations.

Let's look at the European Union directives on bio-energy crops production.On 23 January 2008, the Commission of the European Community had put forward a new EU renewable energy directive related to bio-fuel that replace the existing measures adopted in 2001.The directive is providing strategies on the promotion of the use of bio-fuels or other renewable fuels for transportation purposes[41] . Some of the EU renewable energy directives are listed as; Use of at least 10% share of bio-fuels for transport sector by 2020, No production of bio-fuels from natural reserve, wetland, bio-diverse grassland and forests, Calculation of the share of energy from renewable sources, Establishment of bio-fuels competent bodies and registers of guarantees of origin, targeting at least 35% GHG reduction, and increasing to 50% by 2017, Increase incentive for bio-fuel production from degraded land, More emphasis to second bio-fuels generation, Information and training, reporting by the Member States the progress of bio-fuels development(Figures 7 and 8).

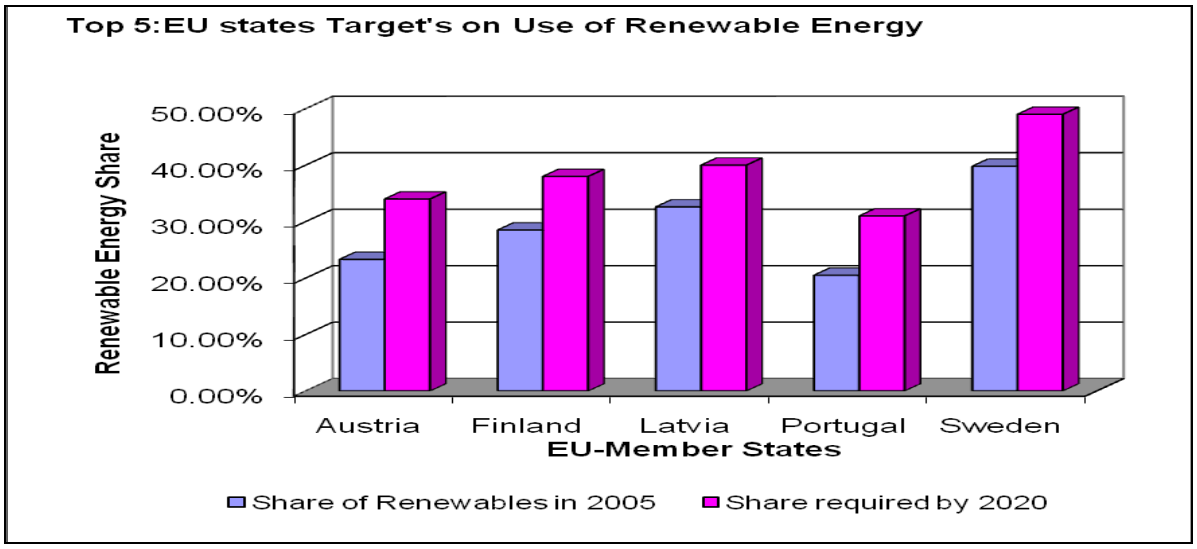


Figure 7 Top 5: EU-member states.

[41]COMMISSION OF THE EUROPEAN COMMUNITIES, DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources, Brussels, 23 January 2008

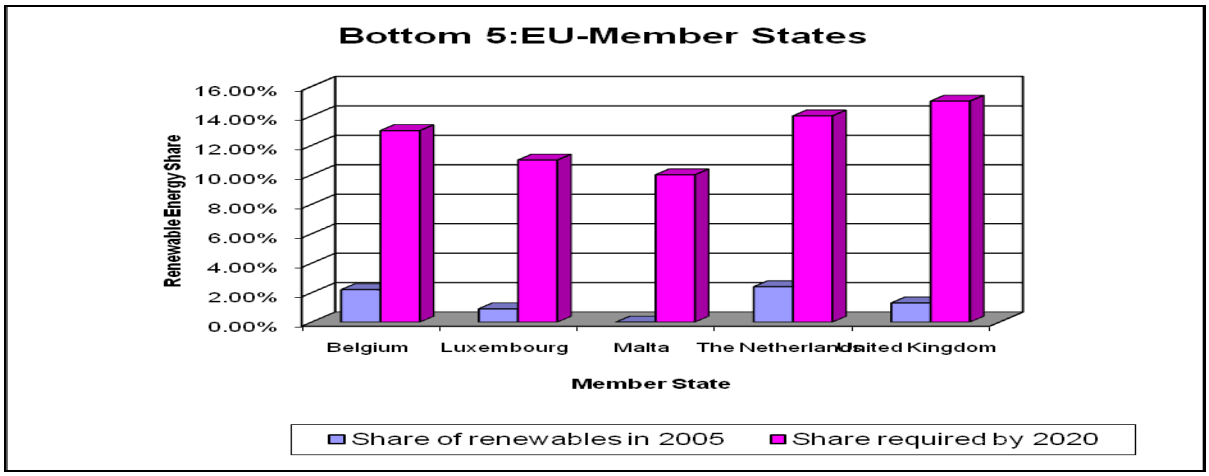


Figure 8 Bottom 5: EU-member states.

In the United States of America alone, there are huge demands of bio-fuels for domestic consumption. This comes after a former USA president, His Ex. George W. Bush to show a political initiation on promoting the use of bio-fuels for reinstalling sustainable environments. For example the new targets of 35billions gallons as presented in 2007 by former USA president (His EX. George W. Bush) which would require almost the entire USA domestic production of maize to ethanol. To strengthen this, the USA Energy Act of 2005 has put more emphasis on bio-fuels production by mandating the substitution of 7.5 billion gallons of gasoline for bio-fuels per year. Nowadays, the world top leader for bio-ethanol production is USA leading by 50% mostly coming from maize followed by Brazil with 37.8% mostly coming from sugar cane (Table 6)[42]. It is not only Maize which produces ethanol for USA renewable energy consumption but also Soya.USA is already utilized all suitable land for Maize and Soya cultivation. Due to insufficient amount of domestic feedstock, now days, USA is turning to southern Latin America to secure a cheap supply of feedstock for ethanol production. Soya production has caused tremendous problems in Latin America because the production caused the displacement of small farmers and local production towards meeting domestic food need.

In addition, many countries are showing interests of starting production of bio-fuels for energy security. For instance, Indian government as a new comer in the industry is promoting raid expansion of *Jatropha* as monoculture for bio-diesel on 50millions hectares on land classed as ``waste land´´. Warning of this production in India is falling on its ``likely to lead the destruction of primary and secondary forests in India´´.The Indian communities in the Himalayas are extremely concerned that the production will threaten their livelihood. While Indonesia government is planning to extend the production by converting another 20millions

[42] RFA and Licht, F.O, World ethanol and biofuels report, March 2008.

hectares of palm oils in the next 20 years. The present area planted has increased from 600000ha in 1985 to 6.4 million hectares. This expansion of area for planting palm oil has linked with logging for timber.

Table 6 World Ethanol Production in 2008.

Country	2007 Million Gallons	2008 Million Gallons	2007 Million liters	2008 Million liters	Sum of Bioethanol produced(liters)	%Bioethanol production 2007/2008(liter)
USA	6498.6	9000.0	29543.2	40914.8	70458.0	50.9
Brazil	5019.2	6472.2	22817.7	29423.2	52240.9	37.8
European Union	570.3	733.6	2592.6	3335.0	5927.6	4.3
China	486.0	501.9	2209.4	2281.7	4491.1	3.2
Canada	211.3	237.7	960.6	1080.6	2041.2	1.5
Other		128.4	0.0	583.7	583.7	0.4
Thailand	79.2	89.8	360.1	408.2	768.3	0.6
Colombia	74.9	79.3	340.5	360.5	701.0	0.5
India	52.8	66.0	240.0	300.0	540.1	0.4
Australia	26.4	26.4	120.0	120.0	240.0	0.2
Turkey	15.8	-	71.8	0.0	71.8	0.1
Pakistan	9.2	-	41.8	0.0	41.8	0.0
Peru	7.9	-	35.9	0.0	35.9	0.0
Argentina	5.2	-	23.6	0.0	23.6	0.0
Paraguay	4.7	-	21.4	0.0	21.4	0.0
Total	**13101.7**	**17335.2**	**59561.5**	**78807.4**	**138368.9**	**100.0**

Source: Adopted from RFA, F.O. Licht 2008 Estimates

The global overview above explains the trend of bio-fuels production in EU, USA and Asia countries. In short, the production of bio-fuels crops mostly request vast land in order to meet the profit targets. Therefore, the process to accessing big land for investments if not well planned can lead to displacement of small farmers by forcing them to leave food farming and migrate to urban peripheries, extremely vulnerable to rising food prices and transmitted diseases. Estimates of the role of bio-fuels in the hiking of food prices during 2008 have been debatable so much in several international media. It was estimated that 75% of the increase food prices was attributed by rapid expansion of bio-fuels production[43]. A secret study made by World Bank shows that bio-fuels production is responsible of current explosion in grains and food price worldwide. Though, recently the USA government in Rome during UN Food Summit argued that "only 3% of food prices" were due to bio-fuels.

[43] William Engdahl, World bank World Bank Secret Report, Global, July, 2008

3.5 Major policies behind local and international bio-fuels market development

The policies behind bio-fuel market development in Tanzania have been linked with different local and international policy goals like; CDM, fuels standards (blending mandates), incentives for bio-fuels investments, accessibility of credits and subsidies to smallholders, trade policies to remove barrier of international bio-fuels trade, bio-fuels incentives(tax exemptions and flex-fuels vehicle subsidies),and fossil- based fuels taxes. Tanzania is among 140 countries that ratified Kyoto Protocol with potential targeting to promote real investments through Clean Development Mechanism (CDM) resources[44]. The World Trade Organization's (WTO's) Doha Development Agenda motivates the international trading of green products such as bio-fuels. Tanzania, motivated by this agenda has the desire to increase promotion of bio-fuels production for domestic fuels demands and for export thereby earning foreign currency. The WTO as a main institution governing the price of fuels in the world, is also requesting certifications of bio-fuels products and processing machines, storage, distribution, and marketing facilities.

However, Tanzania is facing challenges of how small-scale bio-fuels production can meet western world consumer power. For example, a main limitation of export bio-fuels is from EU and USA which set big incentives and other financial support to bio-fuels production. Meeting this bio-fuels trading challenges, Tanzania has to carry out cost-benefits analysis by giving more priority to small scale entrepreneurs of bio-fuels products by; providing appropriate technology, creation of a stable or long market period to the out-growers, changing the type of education that allows youth and women to be bio-fuels entrepreneurship and finally introducing networking of bio-fuels entrepreneurship in the local area.

[44]UNCTAD.``KYOTO PROTOCOL OFFERS INVESTMENT OPPORTUNITIES IN DEVELOPING COUNTRIE´´,UNCTAD/PRESS/PR/2005/010,February 2005,Cited on April 2009 at http://www.unctad.org/Templates/webflyer.asp?docid=5754&intItemID=3369&lang=1

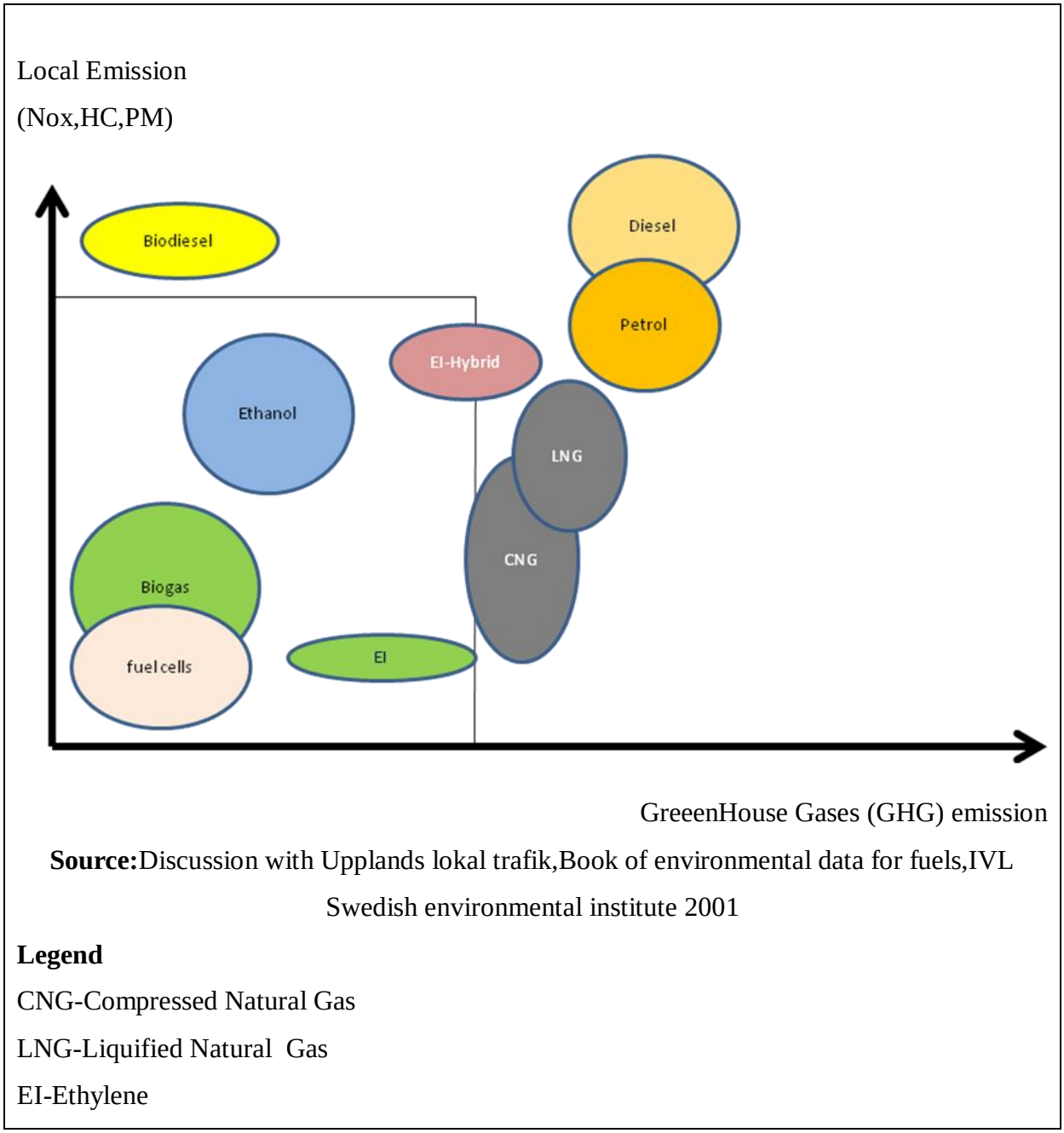
4. RESULT AND DISCUSSION

4.1 Bio-fuels initiatives in Tanzania

Drives of bio-fuels production in Tanzania have been initiated based on factors targeted by western world and for Tanzania herself. Western countries are investing on bio-fuel production in Tanzania with aims of mitigating climatic change followed by less fossil fuel dependency. Particularly in Europe, the cities pollution reductions have been given first priority by running flex-fuels cars and changing the habit of traveling unnecessary. To promote ethanol use for transport, ethanol (E85) is sold relatively cheaply in Sweden at the time ranged between 9.44-10.5 SEK/liter while flex-fuel cars are sold at 111 000-150 000 SEK. Environmental friendly car are cheaper than fossil fuels car. "*We are promoting flex-fuels cars ….Our concerns is on climatic change…… and European are travelling a lot, you cannot stop travelling*''. Describes, Erik, Bilomatic-Car dealers, Uppsala, Sweden. It means, they are encouraging environmental friendly transport that will not pollute the air and cause climatic change effects.

The local emission of Sulphur dioxide (SO_2), Nitrogen oxide (N_2O),Carbon monoxide(CO) and Particulate Matter(PM-dusts, acids and metals) appears to contribute more health impacts to people who works and lives in the cities compared to GHG which is largely contributed by CO_2 (Figure 9). These are resulting to serious health effects of asthma, irregular heartbeats, bronchitis and premature death for people with lung effects. The interpretation shows the developed countries are aiming for clean city air that can reduce health risks to their people while the developing nations are targeting bio-fuels production for energy security. The European Commission has initiated certification strategy for each imported bio-fuel products. The EC need to know who are the producers, the criteria's of productions and the effects caused by bio-fuels production to local people. This idea is well known to European bio-fuels consumers as explained "*we need to know the producers and standard of bio-ethanol we are using in our city buses"*says Ylva Cohn, Upplands Lokaltrafik, Uppsala ,Sweden. It means that the bio-fuels smallholder from least developed countries can have less opportunities to meet the western consumers power (efficient and certification) unless they conform to certification regulation. Otherwise they need to form a network of selling to investors that are well known to consumers as it has been planned to block farming. Also some of the northern countries believe that biodiesels are not

environmental friendly and are more complicated to use than biogas. That is why some bio-fuels users are planning to participate 100 percent in biogas production (most clean bio-fuels) from domestic waste products.



Source: Discussion with Upplands lokal trafik,Book of environmental data for fuels,IVL Swedish environmental institute 2001

Legend

CNG-Compressed Natural Gas

LNG-Liquified Natural Gas

EI-Ethylene

Figure 9 Fuels emission and Climatic changes.

Bio-fuels production in Tanzania appears to be a profit earning process since some of the investors see it is cheap to produce bio-ethanol locally. Some of the investors are asking to builds ethanol processing factories in Tanzania than exporting the raw juice to Europe for ethanol production. It is from this idea, some institutions believe sugar cane is for large investments and *Jatropha curcas* is for small scale investment. In the view of **sida**

"*Smallholder farmers in Tanzania cannot continue to grow sugar cane in small scale productions because does not meet the economic scale. For most efficiency clean energy is to invest sugar cane through large scale production while Jatropha is for small scale investments''.* Says Marie Berström and Anne-Lie Engvall respectively, **sida**, Stockholm, Sweden.The experiences show us, time and time, donor do not invests to the high-risks bio-fuels investment. Now donors are changing their direction by promoting sustainable bio-fuels production into smallholders located in the rural areas according to specification and technology modernization to affordable energy supply.

Meanwhile, some investors are entering in the business of bio-fuel production with different purposes. Some of their explicit targets are possibility of extracting other natural resources like timber and natural gas (Figure 10). Large scale bio-fuels production in Rufiji River Basin is "*a dead end because the foreigner investors are coming with different investment targets...some are targeting area used for food/rice production and high rainfed forest canopy-miombo woodland for bio-fuels production''.*He continued *" I am very upset with large scale bio-fuels companies that are causing harm to rural smallholders by displacing rural communities, who don't know even their own land rights ,compensations rights ,value and size of their land´´. Says* Peter Robertnz, Researcher, WWF Sweden.

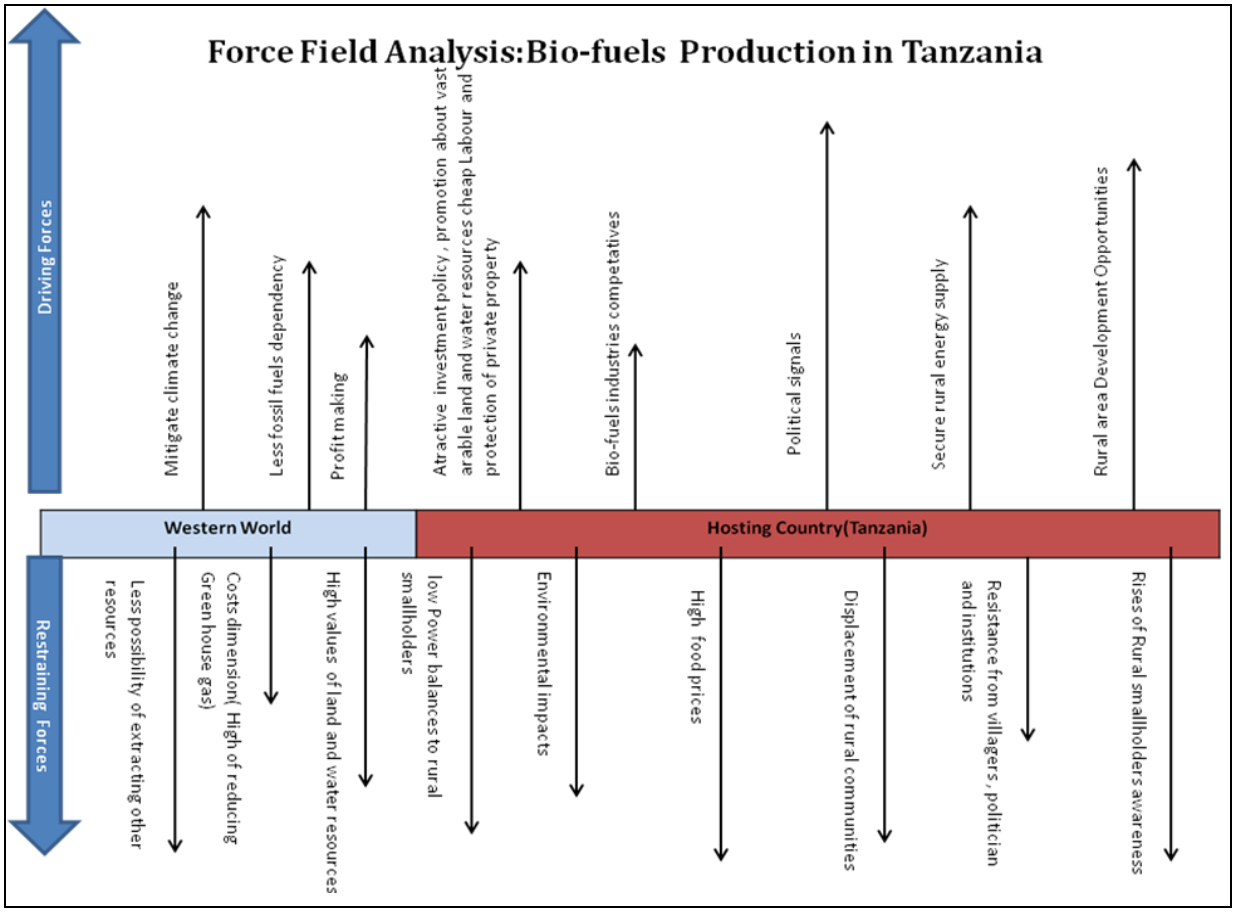


Figure 10 Force field analysis of bio-fuels production in Tanzania.

For Tanzania, the promotion of bio-fuel is highly motivated by politicians who perceive bio-fuels as one of the way for precipitating rural development. Many rural people in Tanzania don't have sustainable energy sources especially electricity. Majority of them are relying on biomass for their heating, cooking and other requirements (Figure11).A second source of energy in Tanzania is from fossils fuels mainly petroleum's that accounts for the following usage pattern; household (21%),transport (40%) ,industry (24%) ,agriculture (11%) and others(4%)[45].

[45] TaTEDO,``Compete international workshop on 'bioenergy policies for sustainable development in Africa' BIOENERGY POLICIES IN TANZANIA,25-28, NOVEMBER 2008 BAMAKO, MALI ,Cited on May 2009 at http://www.compete-bioafrica.net/events/events2/mali/Session1-5-Sawe-COMPETE-WS-Mali-2008.pdf

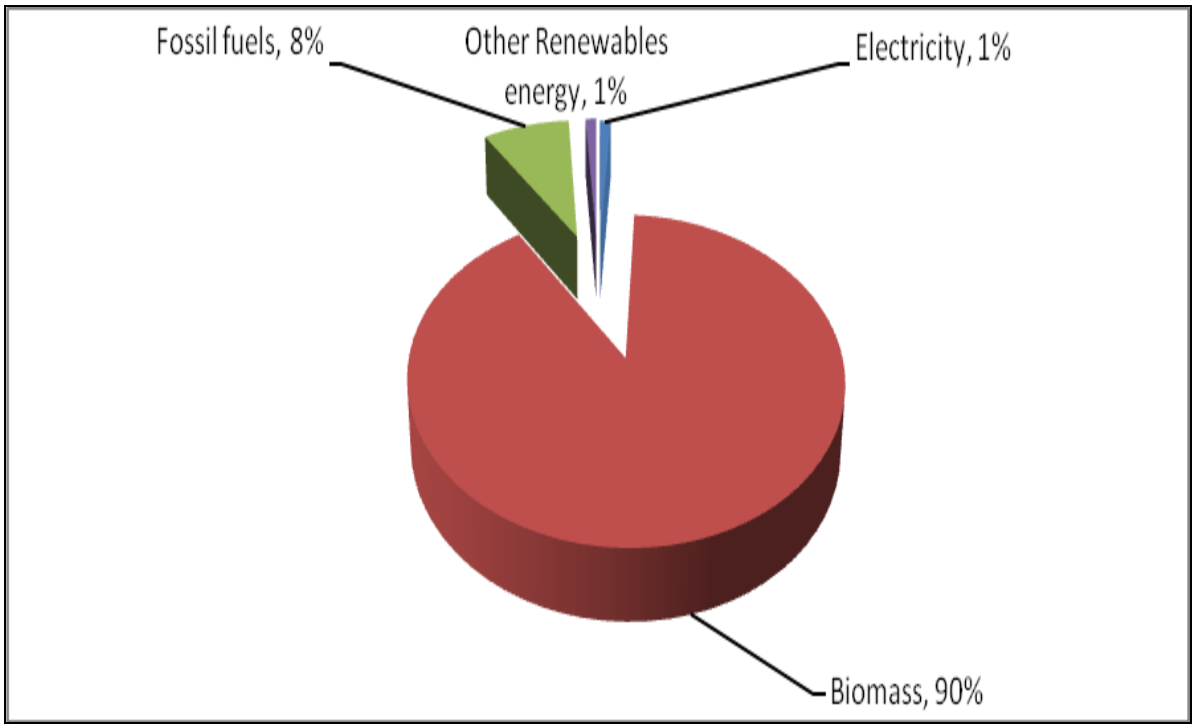


Figure 11 Energy consumption in Tanzania

The introduction of bio-fuels production in Tanzania is creating new phase of neo-colonialism associated with several challenges to smallhollders, by emphasing the production of bio-fuels instead of food crops for their own consumption and livelihood. The issues of bio-fuels have brought a major question of concerns, do the Tanzanians need bio-fuels production? The question can be answered based on the following criteria. Majority of smallholder farmers in Tanzania are extremely poor, depending on subsistence farming (0.5-1 acre) for household food demands. The people in the Rufiji district have no sustainable source of income rather than depending on fishing, charcoal making and illegal timber extraction. Bio-fuels production is deemed to be their first hand target for smallholders for the reason that the produced feedstock's can raise the household income. ``*... you don't need a large-scale bio-fuels production to rural smallholders. They can benefit from bio-fuels by-products if there is fair division or share of income, land rights, proper selection of bio-fuels crops to grow"* says Linda Engstrom, **Sida**,Sweden.Also the political initiative shows much concerns on needs of bio-fuels production as expressed ``*our people are very poor…., we need bio-fuels production especially sugar cane to alleviate this poverty."* says, Prof. Idris Ali Mtulia, MP, Rufiji constituency, CCM – Tanzania ruling political part.

Tanzania appear to have several comparative advantages of growing bio-fuels from its conducive climatic conditions, availability of labour from rural population and potential for expanding rainfed agriculture.Also,Tanzania geographic location favour easy exportation of liquid bio-fuels products as it open to Indian Ocean. Also the available supportive Land law: In Tanzania land belongs to Government and a lease for specific period is given to person(s)/company/institution(s).Tanzania has attractive investment policy –implemented through Tanzania Investment Centre, political will and stability compared to many other states. Tanzania wants to reduce the imports of petroleum products which consume more than 30% of Tanzania foreign exchange earnings. Therefore, Bio-fuel production could create rural development, employment, facilitate modernizing of agriculture sector and provide substitute to imported fossil fuels.

However, Tanzania has been presented as a country endowed with renewable energy resources still bio-fuels might be right energy solution to many poor rural people. The situation of renewable energy in Tanzania is mainly contributed from approximate 29.02billions m^3 of natural gases, 12millions TOE of potential biomass excluding bio-fuels, 4.7GW of macro hydropower (56.1MW developed) and 314MW of min hydropower of which only 1.5% have been developed. The other renewable energy are from 1200 Million Tonnes of Coals (304 millions tones are proven) and 4.5KW/km^2/day of solar installation. Due to lack of technology, Tanzania is failing to maximize the exploitation extra renewable energy from 150MW of geothermal[46].The richness of Tanzania on renewable resources has lead to the creation of opposition from various angle. For instance, within policy institutions, there are institutional challenges that prevent the investments of bio-fuels production in Tanzania `` *I don't support Bio-fuels production in Tanzania because it consumes a lot of land and results to food insecurity in a country....renewable resources such as natural gas, solar, hydropower and wind which are not yet exploited for energy production´´.* Says Zitto, Kabwe Zuberi, MP-Northern Kigoma Constituency, CHADEMA.This has prompted speculations that challenges of bio-fuels productions in Tanzania can be converted to opportunities whenever there would be sustainable bio-fuel regulating institution.

[46] Study team, Feasibility of large-scale bio-fuel production in Tanzania, Study report, April 2009

4.2 Institutions Perspectives for Sustainable Bio-fuel Production

4.2.1Roundtable Approach for Sustainable Bio-fuels Production: Increase Human Resource Capacity through Interaction

The key asset to regulate bio-fuel production in Tanzania is to increase institutions networking and involvement of different stakeholders. The process has open minded by asking new technologies from people who look beyond technical and/or sectoral boundaries for including the interaction and power play between different stakeholders. The round table approach can be a major tool for bio-fuel decision making by considering win-win situation of statutory and customary laws, plans, monitoring process, human and labour rights, rural social development, water, land, technology, nature conservation and GHG emission that favour the majority.

Now let us talk about reality, the institution perspectives on bio-fuel framework policy has to create bio-fuels investments with proper regulation that can go also in both ways. Is not about top down approach but is also bottom up approach that can allows interaction in horizontal direction. You cannot solve the problems when you break the interaction between actors. Also they have to increase a platform for bio-fuels smallholders and large scale actors. Promoting opportunity and benefits sharing that pledge rural development. Finally, targets need capacity response and management measures by implementing this will help to sustain the water and land administration, economic viability and social issues, awareness and education to local people in Rufiji River basin.

Therefore the institutions perspectives have been developed based on strength of study approach of reflexive governance. Attaining sustainable decision making the reflexive governance has to involve roundtable approach (Figure12) that will neutralize the bio-fuels actors. ``*Investors need to make agreements that favour the local interests via roundtable ....profit is substituting the idea of fossil fuels ....energy is pushing equilibrium due to changing of world blood of economy that consider Africa as enigma through power structures´´. Says* Anders, Researcher, and CEMUS. The strength of reflexive governance is based on its ability to minimize corruption during decision making process in managing natural resources. This implies that the governance hear the voices of the most vulnerable in society (marginalized and minorities) in decision-making. Ensuring sustainability decision making process, reflexive governance allows endogenous constrains and exogenous factors so as to bring response to the present and future needs of society through its trans-discipinary knowledge sharing in a participatory manner.

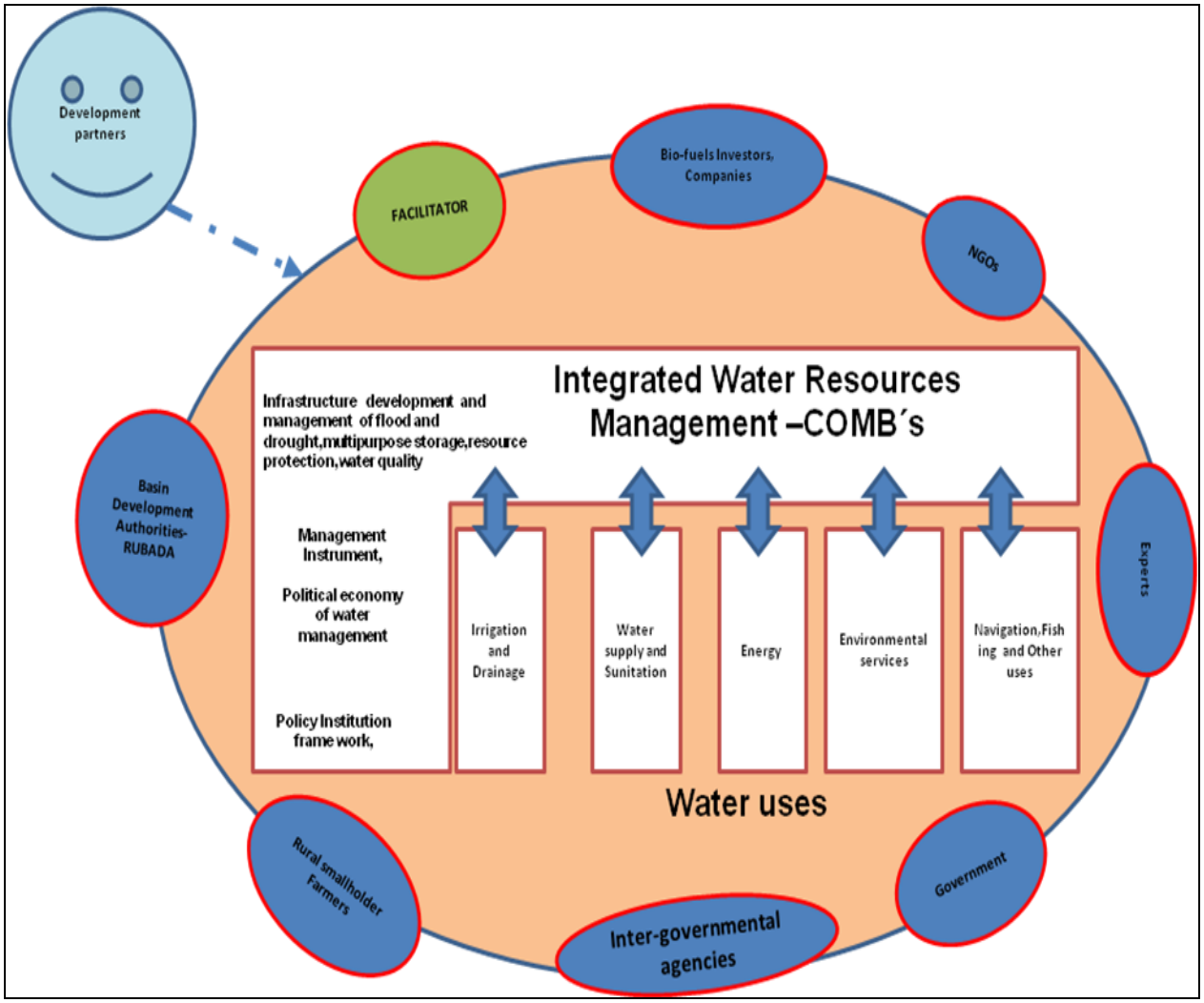


Figure 12 Bio-fuel roundtable approaches

Also the governance has to lead to interconnection between actors and structures (actor-system dynamics) that are needed to provide adequate problems solving situation. Since, the reflexive governance structures usually show huge level of interactions which enables the decision-making process to be more: participatory, consensus oriented, allowing unintended results, accountable, requesting for transparent among actors, responsive, effective and efficient, equitable , inclusive and follows the rule of law. This governance offers causative accounts of the steering deficits of liberal democratic states, and by extension, the advocacy

of governance arrangements capable of bringing all relevant public and private resources to bear on policy challenges.

The approach used to be open to unexpected changes and is very resilient. Since NBTF is prone to such unexpected changes, and if there are many instances of change, this approach may be productive. If those in charge of the water resources management are leaders of public consensus and changes occurring become problematic, then such problems will yield minimal disruption. This point is related to the long-term stability of the overall water resources projects. That is, any project that is placed within the reflexivity mutual structure has from the start relegated responsibility; therefore, the progression of the governance and its result ensures stability with a wider societal feedback loops which are shaped by the effects of its own decision making structures. The nature of cyclic process is focusing on integration degree of communication among different actors by win-win situation and stimulating to reach the concrete decision and actions which are explaining the knowledge pertaining to social phenomena. Innovations are introduced in the hope that they will have positive impacts on their targets, but also in certain knowledge there will be negative and unintended effects as well.

The inefficient use of reflexive governance can bring several challenges emerging from process and structure complexity, deliberation and reflexivity. In most case, the structure of this reflexive governance leads decision making to take much time in reaching agreements or consensus, because the approach itself involves many uncertainties and ambivalence which can be connected to the bio-fuels operations. Prior to the modern era, most land and water resource management were either based on traditions or customs. The challenge here is about the loss of natural decision making process. In modern society, many natural principles and immature decision making principles of many water issues are sometimes replaced by various principles or laws that are built on statutory basis. This gives the opportunity of losing historical values and ethics of governing Rufiji River basin resources. Also the governance process if not handled carefully can lead to lack of capacity of dealing with side effects .Because, there are problems arising when there is institutional resistance to different innovative solutions which wicked policy problems associated to water management. Finally, handling of this governance process needs transparency, tolerance and facilitator who will bring careful consideration in enhancing the stakes to be more agreed by the majority actors.

4.2.2 Water legislation converts bio-fuels framework policy into law and should

Towards sustainable bio-fuels framework policy on water and land utilization, and control should be taking policy decision along bio-fuels production to clarify the entitlements and responsibilities of users and water providers. This has to clarify the roles of the state in relation to other stakeholders, formalise water allocation system, provide legal status for water management institutions of government and water user groups, ensure sustainable use of the resource.The challenges of water issues has been explained on the following multiple cause diagram (Figure 13).

The large interests of many investors to bio-fuels production in lower Rufiji River basin can contribute to water scarcity. The basin is not captured by water barrier issues but might have serious water shortages in 5 years to come due to various reasons: behavior change on water utilization, agricultural expansion, lack of infrastructure allocation to tame the nature, increase of immigrants who seek jobs in bio-fuels plantations, level of development by transformation of village to urbanization, massive scale use of pesticides and fertilizers, deforestation, limitation of seasonal precipitation (Figure 14). Regulating water resources in a basin, the concerned body e.g. Rufiji Basin Water Body and RUBADA has to transform ownership to local people through capacity to enforce regulation, policy and legislation.

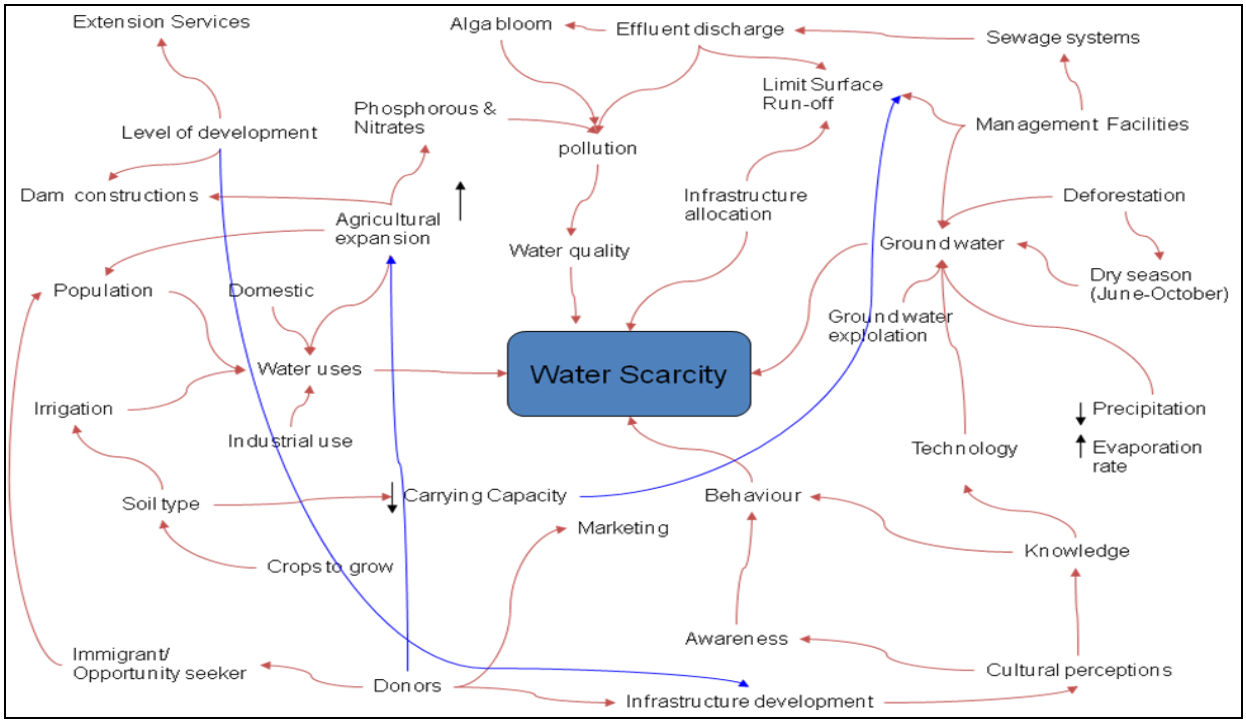


Figure 13 multiple causes for water scarcity along bio-fuels productions

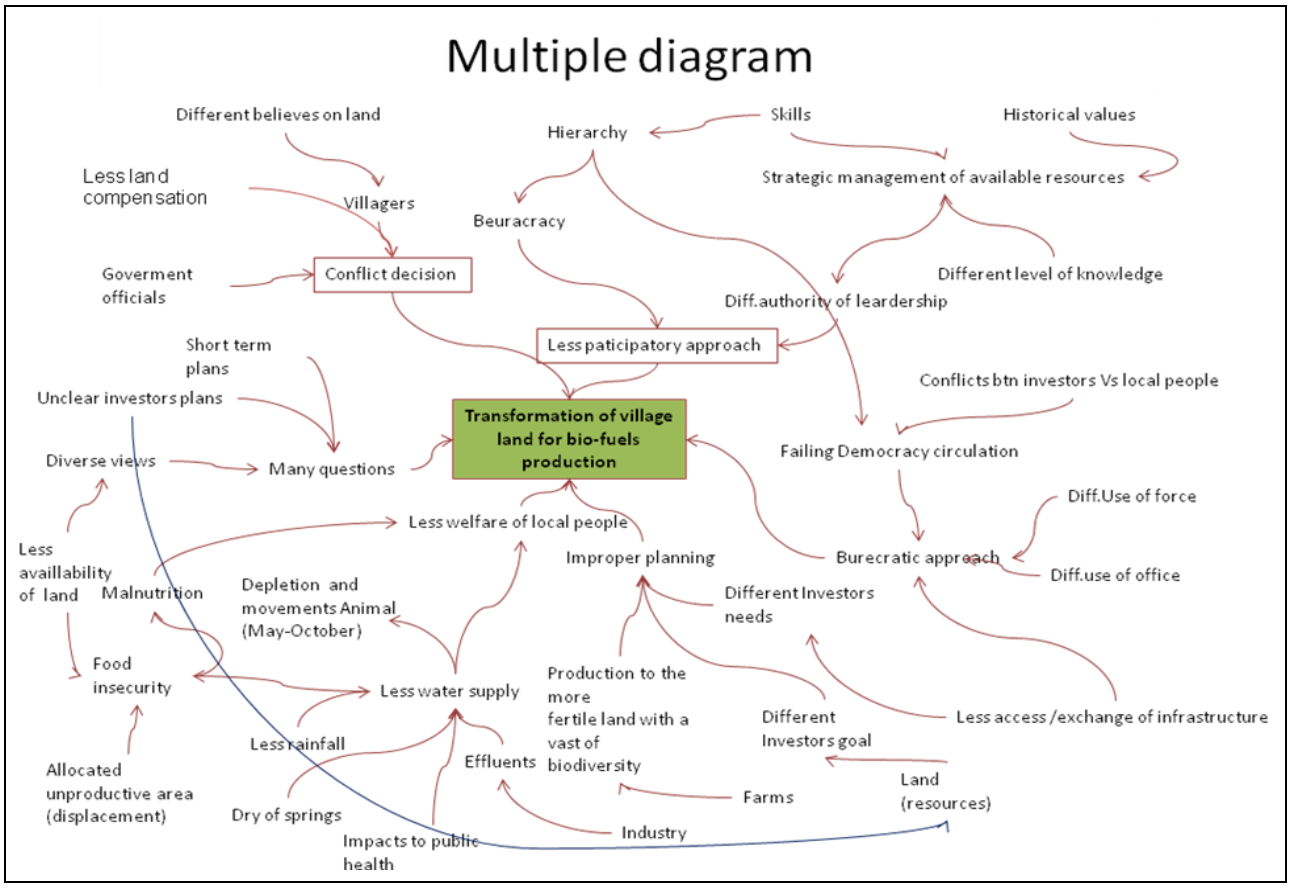


Figure 14 multiple cause of Transforming village land for bio-fuels productions

The strategies that made to meet water scarcity on bio-fuels production has to consider;

1) Strengthening the provision of a framework for issuing water permits, water allocation and monitoring by scheduling water with emphasis night irrigation.
2) Implementing new technology that leads to less water utilization such as drip irrigation, ground water exploitation.
3) Implementing comprehensive development plans to support monitoring of water use and guide investments, e.g. Construction of multipurpose large dams at upstream of lower Rufiji River (Stiegler's Gorge).
4) Strengthening and aligning potential water resources use with a national and international growth agenda such as NSGRP-MKUKUTA and MDGs respectively.
5) Provision of adequate hydrological information and expanding inventory of water users to the rural smallhollders in time.
6) Limit unnecessary water diversion unless stakeholders agree.

In case of land resources, more effort has to be directed on proper land planning, participation of actors in deciding village land allocation. Also the government through its TIC has to change land approach of so called ``free-ride mentality´´ of choosing land for investments. According to Åke Bendz``*Development must be done in cooperation with Rufiji local people, the principle of subsidiary"*.He added by stressing *"good education in fundamentally to make good decision, they are suppose to improve democracy at rural by empowering local people"*. The government shall not decide on all details, it has too much to do. In addition the process of land acquisition in Tanzania is very long that results to bureaucracy and corruption within the process. See the process below.

- Identification of village land and decision in village assembly
- Decision in district land allocation committee
- Forwarded to and decision by Commissioner of Land
- Commissioner of Land forwards to president for decision where land allocations can compromise food security
- President makes final decision and informs Commissioner of Land
- Commissioner of Land provides the land to TIC that presents Letter of Offer to investor specifying conditions for access in the Derivative Rights of Occupancy

4.3 Strengths and challenges of bio-fuels production in Tanzania

In the focus group discussions and semi-structured interviews made by the study, enabled to come up with various strength and weakness of bio-fuel production in Tanzania as evaluated by (SWOT) -Strengths, Weakness, Opportunities in the Table 7 . The SWOT was constructed by the study author after receiving almost 16 interviewees' answers of semi-structured questions. Other information were obtained after conducting 12 focused group discussion with key informants. The guideline questions were number 5, 7, 8, 11, 27 and 37 for semi-structured questions. While part B of focus group discussion were used to collect information which were focused on opportunities and challenges of bio-fuel development of smallholders.The major focused group discussion questions were categorised based on strength and future of bio-fuel (opportunity) –questions 7,10, and weakness and threats-questions 8 and 9, see appendix 1.

The SWOT chart was sent to some stakeholders who gave their potential comments and suggestions. The respondent comments show a great complexity of bio-fuels institutions caused by their diverse perspectives concerning bio-fuel opportunities and challenges. The challenges are largely depend on willingness of smallholders, nature of bio-fuels production systems and selection of crop to grow, access to water and land resources, and level of participation that influence decision making.Some believes that bio-fuels is rights solution for poverty eradication in Tanzania while others challenges the side effects caused by bio-fuels productions. The different perspectives of the bio-fuels stakeholders generate an interesting issue of exploring further of either bio-fuels crop to be grown by smallholders or not.

Table 7 SWOT analysis for bio-fuels production in Tanzania.

STRENGTH	WEAKNESS	OPPORTUNITIES	THREATS
Improve rural energy supply, especially in the transport sector	Precipitate degradation of natural resources (water ,land and biodiversity) for large -scale bio-fuels production	Agricultural/rural development – Creation of new jobs and income opportunities	Unhealthy of Urban and Rural dwellers from water pollution ,HIV and AIDs Infection and lungs infection
Raise of consumers power in the north countries	Bio-fuels investors with different targets ,unproved plan and less transparency	Creation of stable market for agricultural energy crops and technology transfer	Transformation of vast delta area with alluvial flood for Bio-fuels p plantations that threaten Ecosystem services and soil degradation
Improved vehicle performance (ethanol as octane enhancer)	Large production is focus on profits and feeding renewable energy demands to western world	Information disseminations to local people by knowing procedures in decision making	Displacement of local people caused by Poor approach of foreign investors on land
Saving of foreign exchange equal to the value of imports substituted	Unstable (Transition) energy solution	Reduction of GHG emissions – Opportunities for CDM and carbon trading	Local food insecurity caused by willingness of local people to involve in the Bio-fuels production
Contribution to clean environment through reduction of green house gases and other vehicle emissions	Indirect land use effects	Rural infrastructures development	Low price of Bio-fuels products and land compensation
Potential to halt deforestation and desertification, as they include drought resistant crops like *Jatropha curcas,* Sisal, Cassava and Sweet Sorghum	Economic and indigenous cultural exploitation	Revise policy on how to improve rural energy security(Mix of energy levels between national and local sources)	Lowering Rufiji water levels through high deforestation of rainforests and intensive abstraction of water resources
Renewability		Reduction of oil imports – Foreign exchange savings	Competition and/or conflicts over use of land and water resources between Large scale investors V/s Smallholders

STRENGTH	WEAKNESS	OPPORTUNITIES	THREATS
Replacing fossil fuels especially in vehicles		Social services opportunities (school, safe drinking water and health)	GHG emission due to dominations of fossil fuels price
Competitive of agro-fuels industries		Carbon finance opportunities to LCDs ,including CDM	Less awareness concerning bio-fuels cultivation and processing
Diversify bio-fuels system through round table for decision making		Interests of Donors to support small-holders towards bio fuels developments	Less access of information from central government to rural small holders concerning Bio-fuels
Enhancing strong local and international polarized debates		Participation of local community and potential to influence decision making of land use planning	Continuation of Top down natural resources approach
		Allocation and consumption of water for environmental purposes	Loss of workers' rights
Reduction of air pollution (Lead, SO2, CO)	-	Empower local institutions	High biodiversity values
Simple to use and cost- effectively that play in reducing energy poverty	-	Increase altitudes of energy crops and food crops registration for meeting international and local markets	-

4.4 Bio-fuels development–institutional analysis in Tanzania

The institutional analysis demonstrates a wide diversity of interests that MEM, in comparison with the large scale bio-fuel actors is very different, this is not a surprise. The Tanzania government is providing conducive environment for investors by increasing investment incentives but the interests of investors is to maximize profits through large production. The notable thing are who should or should not qualify for investment incentives. It is suppose to be well known that that tax incentives is a load to the URT government which a experiences the deficit in the several national budget.This is due to facts that tax incentives to Foreign Direct Incentive(FDI) reduces revenue to the Treasury.More justification are required to assess who is suppose to receive incentives by revising the criteria sets in 1996.The investment incentives are issued by TIC according to qualifying threshold for foreign investors between US$ 300,000 - US$ 500,000. Local investors face a threshold of US$ 100, 000. The identification can help help the URT government to minimise the channel of loosing the much-needed tax revenues unnecessarily. In order to cover this gap the important thing is to enable the creation of dynamic platform that has potential of making decision more efficient. The Bio-fuels development –institutional analysis has been analyzed according to actor's directions of interests as explained in details to the Table 8.

Table 8 Bio-fuels development -stakeholder analysis in Tanzania.

ACTORS	INTERESTS	INFLUENCE EXTENT	INFLUENCE DIRECTION
URT-Governmental organisation			
Ministry of Energy and Minerals (MEM)	Leading role for reforming energy and renewable energy regulations, laws and Interests for efficiency use. Facilitate development, mobilization, provide incentives for private investment initiatives and promote effective regulations, monitoring and coordination of the sector.	+ + + + +	Up
Ministry of Agriculture ,Food Security and Cooperatives(MAFC)	Implementing Agricultural policies ,Research and Training, Capacity building, Developing, promoting and providing appropriate agricultural technologies, and facilitates collaboration with private sectors	+ +++	Up
Ministry of Industry, Trade and Marketing	Commercial interests: legislation, efficient market systems and infrastructure development	+	Up
Ministry of Water and Irrigation	Conserving and protecting water resources for socio-economic development -water quality and quantity	+ +	Up
Ministry of Land ,housing and human settlement development	Sustainable land service delivery for socio-economic development	_	Down
National Biofuel Task Force(NBTF)	Advising and recommending the Government for the elaboration of bio-fuels policies and regulations for suitable National Bio-fuels framework conditions and cchannelling information to bio-fuels stakeholders	+ + + +	Up
Universities and Colleges	Reserch and Training	+	Up

Large scale bio-fuels investors	Climatic change mitigation, Profit making, Large production of bioethanol or biodiesel for Energetic aspects, Income generated possibilities by utilization of bio-fuel crops for oil and other by-products making.	++++	Up
Tanzanian Biofuels Producer Association (TBPA)	Voicing Bio-fuels producer desires to all stakeholders involved in Bio-fuels marketing and use	++	Up
National Environnemental Management Council (NEMC)	Profiling-Collecting and establishing useful information for national sustainable environmental management practices	+ + +	Up
Tanzania Investment Centre(TIC)	Promoting suitable environments conditions for investments	+	up
Development Partners			
World Bank	Fiduciary risks	+	Up
SIDA	Promoting sustainable bio-fuels production according to specification, modernize rural livelihood through energy security, Changes of investors approach to local communities ,Transparency, Consumers Power, bio-fuels production for country poverty alleviation	+ + + +	Up
FAO	Promote production of food on local farms	+/-	~
UNEP	Sustainable environment-Climatic change mitigation, environment governance ecosystem management, conflicts resolution	++	UP
UNDP	Facilitate democratic governance, poverty reduction, renewable energy for sustainable development, gender equality-women empowering	+ +	Up
NGOs(LEAT)	Educate the local people to know water, land, other natural resources rights and laws	+++	Up

5. CONCLUSION

Bio-fuels industry in Tanzania is claimed to displace rural communities during the process of acquiring land, increases Greenhouse Gas emission, massive biodiversity loss, disturbing hydrological cycle, and land use conflicts. In addition, land grabbing and degrading its values, limiting wildlife migration, spread of GM crops, transmitting plant diseases, losing of traditional symbolism, promoting a room for human rights violation. These challenges are raising essential questions to development partners by asking themselves whether it is possible to support or even accelerate bio-fuels production(in a pro-poor direction), without undermining their endogenous character, local ownership and the responsibility of the stakeholders involved?

To sustain the growth of 2025 Tanzania development vision by attaining a transitional economy for high economy growth, high quality livelihood, education, good governance and economic stability. The study recognizes the necessity of analyzing institutions involves in Tanzania bio-fuels industry. Because, Tanzania is beginner in bio-fuels production for export which demands large scale production for profit maximization and fitting international consumer power, energy efficiency and certification. To meet these demands the large land for growing fuels instead of food, and economies of scale. Therefore, Tanzania is recommended to learn very carefully from the global bio-fuels production leaders before it embarks on the project by considering the effort of raising water and land productivity, and social welfare to local people. For example, promotion of sustainable bio-fuel production on its arable land should aims to preserve local interests, solve rural energy supply deficit and fuels for transport, and improve people welfare, food security, access and allocation of water, land tenure and environment. Several findings have realized that the government, foreign investors and Tanzanian private group, social groups, religious group are interesting to join the bio-fuels productions.

With regards to growing interests of bio-fuel production in Tanzania, study see a great need of GoT to strengthen the existing weak legislative laws, looking again the investors approach, reduce accountability of NLUC,TIC on land allocation and hence protecting the endangered customary laws or rights of local poor people. It is period of empowering rural people by transforming ownership of bio-fuel industry through reflexive governance and roundtable on sustainable bio-fuels (RSB) approach. It is through the RSB approach when local people can observe, think, and even interpret further some of the technical investor plans, promises, physical assets and other benefit to be shared after or during investment to

take over. The study assumptions made was about B-O-T –bio-fuel investments. Moreover, bio-fuel regulatory institution of decision makers are facilitated through a process of learning, participants solve their own problems, participants are the real experts, but benefit from dialogue that enable in-depth knowledge sharing, and better buy-in. Final assumption is based on possibility of win-win situation to well designed bio-fuels regulatory institutions that can address and cater for core sustainability issues.

Since majority of Tanzanian are economically poor, the only one way of empowering them is through bio-fuels investments that will target on technology transfer to local people either by (B-O-T) Build, Operate and Transfer. Therefore, to ensure such kind of idea, a bio-fuel regulatory body/institution must be very strong, independent from government authority and has to involve a mixture of member varying from expert, facilitator, consultant, public sector, NGOs, Environmental laws, energy sector, agricultural sectors, association, marginalized group, plantation worker representatives, forestry and nature, future generation, media member, academics, transport sectors, marketing officers, women and religious group. Also the institution has to prepare periodic meeting, presentation, training, reporting to rural people, information sharing with local rural people as a way of capacity building to them. But they have to consider participatory tools and methods for facilitating the learning process of both their own rights on land and water resources, and other compensations rights. I hope in few five years there will be big changes once the idea proposed by this study will be taken under consideration. The study emphasizes the transparency and responsibility of institution as a porous pillar that listen from both directions. Also the study revealed the importance of regulatory institution to increase effort of promoting bio-fuels production on degraded land by increasing incentives and tax exemption for large scale investment. This can help also to restore the land too. Finally, the institutional analysis is like awaking institution development through (a) cooperation (b) capacity-building and (c) reporting(c) rules of water and land access.

6. Recommendations

The overall recommendation made by this study are focusing on the establishing action plans that stimulates effective policies, regulations and strategies necessary for sustainable bio-fuel development through RSB platforms and reflexive governance. This Action Plan/logical frame work (Table 9) is meant for bio-fuels regulatory institution to attain sustainable bio-fuels productions as a needed change in Tanzania bio-fuels industry.

Table 9 Action Plan for Bio-fuels Regulatory Institution.

Narrative summary	**Indicators**	**Verifications**	**Assumptions**
Goals: • Equal representation in the bio-fuels regulatory institution including marginalised group, government bodies, associations and utilities, producers, religious institutions and NGO • Review and reform of the weak existing policies,legal,customary and regulatory institutional frameworks and standards • Strengthening information accessibility, reporting, training and expanding inventory of land and water resources. • Establishment of bio-fuels roundtable and reflective governance linked to better natural resource management practices. • Encourage intercropping and crop rotations with bio-fuels crops for maintaining food security. • Increase incentive and tax exemption for large scale bio-fuel production to degraded land and emphasis to second bio-fuels generation. • Enforcing land and water resources allocation, land rights, adequate land compensation and technical support to smallholders liquid bio-fuels processing for value adding	• Mixture of members in the bio-fuels regulatory institution • Numbers of roundtable meetings,dialogue,forum, platform, presentation, workshop,excursions and information campaigns • Amendments of weak policies or develop new bio-fuels policy or bio-fuels Act • Numbers of bio-fuels investments that targeting on technology transfer to local people either by (B-O-T) • Adopt reflexive governance in bio-fuels institution policies and support. • Numbers of local and investors producing bio-fuel to degraded land, and, hence food security. • Awareness of local land rights and compensation rights	• Initiation of sustainable bio-fuels regulatory institution. • Increase cooperation between actors, transparency, Openess, comprehensible written reports to rural people. • Strategies for developing bio-fuels policies initiation responsibility of institution. • Initiation of bio-fuels roundtables and reflexive governance in Tanzania. • Spread of information on bio-fuels and investments locally, nationally and/or regionally. • Increases local awareness on land rights and introducing a new land compensation model.	- • Bio-fuel regulatory institution of decision makers are facilitated through a RSB process of learning. • Win-win situation to well designed bio-fuels regulatory institution to address and furnish sustainability criteria. • Bio-fuels actors solve their own problems through roundtable and reflexive governance approach. • B-O-T bio-fuel large scale investments for poverty reduction. • Bio-fuels actors are real experts, but benefit from dialogue

Purposes: Baseline information for strengthening the bio-fuels guidelines, policy, legal, regulatory institutional framework to support the sustainable bio-fuels industry development through roundtable and reflexive governance approach in Tanzania and, hence increase income and human resource capacity through interaction	• Increase number of local and international actors to engage into developing bio-fuels. • Poverty reduction due to rise of rural income, • Infrastructure development, at local level. • Potential to use bio-fuels at all levels.	• Strategies on how large scale investments can integrate and strengthen smallholders production, use and entrepreneurship.	that enable in-depth knowledge sharing, and better buy-in • Granting water and land rights for local sustainable livelihood
Outputs: • Specific bio-fuels guidelines, policies and Acts for sustainable bio-fuels development. • Map- out of suitable sites for bio-fuels productions. • Reports and delivering other relevant information to bio-fuels actors. • Conventional bio-fuels production by maintaining food security. • Reduces natural resources competitions, land degradation, deforestation and mitigate climate change.	• Numbers of maps identifying sites for bio-fuels productions, reserved, general and village land • Numbers of reports promoting sustainable bio-fuels productions. • Hydrological information for reduction of land and water resources conflicts	• Availability of maps • Reports hydrological information at bio-fuels regulatory institution office, &TIC • Village office-VIC • National library • Bio-fuel Research institutions • Academics institutions • Internets & web pages	• Less knowledge on survey –use of GIS techniques. • Unwillingness of local to participate any conventional bio-fuels productions.

Activities:	**Inputs:**	**Center for information:**	**External factors:**
• Hold publicity campaigns, presentations, plans and meeting. • Recruits smallholders on better bio-fuels farming practices, processing and marketing. • Document reports, hold bio-fuels training course at university(SUA and UDSM). • Demonstrates the benefits of bio-fuels to villagers and school age children.	• Sourcing fund/budgets. • Bio-fuel curriculum at university. Transport facilities to villages. • Training space at the village level. • Extension officers/field workers. Teaching facilities. • Constructing village information centers(VIC).	• BTF office • TIC • Village office-VIC • National library • Bio-fuel Research institution • Academics institutions • Internets web pages	• Less political will, • Global economic crisis, Climatic change • Less interests from development partners. • Conflicts within local area and from neighboring region. • Insufficient bio-fuels teachers. • Spreads of diseases such as HIV and other STDs diseases.

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Appendix 1

The questionnaire in the survey instrument and questions for focus group discussion

I:QUESTIONNAIRE

Questionnaire No……..Date…….

Respondent Title……...

(1=Researcher, 2=Political leader, 3=Village Council leader, 4= local institution member, 5=NGOs, 6=Customers, 7=International Organization, 8=Producers, 9=Local citizen)

A:Bio-fuels driven forces

1. What stimulate bio-fuels development in Tanzania?

(i) Host country development and poverty alleviation strategies

(ii) European Union (EU) energy security, less fossil fuel dependency and indirect effects land use change (iii) America ethanol or biodiesel use

(iv) Climate change mitigation (v) others (please specify)……

2. What types of bio-fuels crops to be promoted for commercial production to Smallholder in Tanzania?

(i)Bio-diesel crops such as *Jatropha*, soya beans, rapeseed, pongamia, musine, castor beans or palm oil

(ii)Bio-ethanol crops such as sugar cane, tropical sugar beet, maize, millets, Sorghum, wheat or cassava

(iii)Cellulosic materials such as timber, waste products from forestry, agriculture or households

(iv) Others, (please specify)……..

3. How do you foresee bio-fuels developments to local community as?

(i)Sustainable energy solution (ii) Transition energy solution

(iii)Small part energy solution (v) others, (please specify) ……

4. Encouraging criteria to bio-fuels development in Rufiji River basin?

Encouraging and/or Motivating criteria	1	2	3	4
Good political signal of host country				
Good investment policy and protection of private property				
Attractive geographic conditions (sufficient rainfalls, adequate temperature, availability to sufficient water from perennial Rufiji River and fertile land)				
Accessibility of Labour				
Willingness of smallholder to involve in bio-fuel cropping				
European Union stand points and indirect land use effects				
Needs of Tanzania from finding other sources of energy to local community				
Reducing dependency of fossil fuels				
Global mitigation of GHGs and Carbon Sink				

(1=yes absolutely, 2=Rather Yes, 3=Rather No, 4=No at all)

B: Bio-fuels for smallholders

5. What are projected impacts of bio-fuels development to smallholder farmers?

(i)Competition for land (iii) Conflicts over use of water

(ii)Economic and indigenous cultural exploitation (iv) Exploitation of biodiversity

(v)Creates a stable or long market period to out-growers

(vi) Human rights violation and abuses such as land grabs spread of STDs diseases and HIV/AIDs

(vii)Others, (please specify)……

6. Could bio-fuels development in Rufiji Valley subjected to what environmental impacts,

Bio-fuels and Environmental	1	2	3	4
Loss of natural habitats, flora and fauna				
Water scarcity from intensive use of water for irrigation and industrial				
Aquatic ecosystem, coastline, river basin, wetlands and mangrove destruction				
Destruction of traditions, cultures, dignity, archeological, scientific value, loss ability to self-sufficient through wise use of water and land resources.				
Land degradation and misuses such as erosion, desertification and salinization				

Pollution from effluents and air pollution				

(1=Strongly Agree, 2=Rather Agree, 3=Rather Disagree, 4=Disagree)

7. Mention types of development do you consider to be created by bio-fuels development

(i)……...

(ii)……..…

8. Do you see bio-fuels development in Rufiji valley as a room for?

Land utilization	1	2	3	4
Precipitating massive land grabs of tribal, traditional, marginal land and limiting the villages land use planning				
Increasing rights of local councils to allocate land use for intensification purposes				
Enhancing land quality that ensures sustainable utilization of land for long term planning				
Land utilization	1	2	3	4
Increasing land values that uplifts the well being of people				
Increasing land related conflicts among stakeholders				
Strengthening and ensuring a property rights, decentralization the land base natural resources and secure land tenure(i.e. forms of land tenure and indigenous land tenure arrangements in the basin)				
Increase participations of local community and potential to influence decision making of land use planning of general, village and reserved land				
Others, please specify……				

(1=Strongly Agree, 2=Rather Agree, 3=Rather Disagree, 4=Disagree)

9. Where do you consider smallholders to grow bio-fuels crops?

(i)Drier or poor (ii) Fertile land

(iii)None (iv) Others, please, specify……

10. Which method do you desire for land acquisition to local community in Tanzania?

(i)Village government locations (ii) Inheritances

(iii) Land grabbing (iv) Granted rights of occupancy by president

(v)Land tenancy (vi) Others, please, specify……

11. Do bio-fuels cropping in Tanzania provide sustainable safeguarding for?

(Select in preferences 1=High, 2=Average, 3=Low)

	GHG balancing
	Global energy demand
	Employment creation
	Ethanol production for export
	Bio-diesel production for driving local machines
	Infrastructure development
	Regional/country growth
	Others, please, specify……..

12. What do you consider as the main course of land degradation?

(i)Methodology of cultivation (ii) Land clearing and deforestation

(iii) Selection of sites for cultivation (iv) Temperature

13. What is a main projected impact to soil health in Rufiji River Basin regarding bio-fuels cultivation?

(i)Soil compaction (ii) Over Irrigation Cultivation

(iii) Conventional tillage (iv) Zero tillage

(v) Sea water intrusion to inland (vi) Intensive use of agrochemicals

(vii)Others, (Please, specify)……

14. What are projected land use conflicts after five years of bio-fuels development?

(i)Large scale investors V/s smallholders (ii) Smallholder farmers V/s pastoralists

(iii)Boundaries conflicts smallholder farmers V/s large scale investors

(iv)Other (please specify)……..

15. Please, mention mechanism that can be used for resolving such conflicts

……

……

Water Resources

16. What is a main abstraction of freshwater for bio-fuels feedstock's production?

(i)Domestic use (ii) Industrial use

(iii)Agricultural purposes e.g. irrigation (iv) Other, (please specify)……..

17. Can you mention how bio-fuels development affects availability of freshwater resources and land uses?

(i)……...

(ii)……..

18. What can be a main course of freshwater scarcity in the basin?

(i) Increasing water demand due to population growth, industrialization, urbanization

(ii)Water pollution from agrochemicals, industrial effluents, domestic use

(iii)Uneven water availability due to geographical patterns and climatic changes

19. could freshwater scarcity in Rufiji River basin limits;

Limiting factors	1=High	2=Average	3=Low
Production of bio-fuels crops			
Region food security			
Public health, Sanitations and other water utilities			
Transportations along the river			
Traditional and/or cultural human believes			
Development of Irrigation schemes (traditional, smallholder farmers and large scale irrigation schemes)			
Ecosystems and other biodiversity			
Exploitation of freshwater resources such as fish, mangroves *et cetera*)			
Reduce opportunity for hydropower generation			

20. What are the better management practices that could ensure sustainable bio-fuels development in the bio-fuels industry?

(i)Efficient Irrigation system (Drip irrigation) (ii)Increase water use efficiency and water allocations among users (iii)Rational chemical use

(iv)Modified tillage by cropping, terracing and strip planting (v)Reduce effluents from agriculture, industry and domestics

21. If you imagine the best possible scenario for Rufiji River basin water situation, what would you like to see in place in the next 5 years with regards to water management (Mention at least three points)

(i)……..

(ii)……..

(iii) ……

Market

22. Which institution is supposed to decide the prices of bio-fuels products?

(i)Bio-fuels out-growers association (ii)Private Investors

(iii)Central government of host country (iv)World Trade Organization (WTO)

(v)European Union Commission (EU) (vi)Others, please, specify……

23. Will you pay for high price of bio-fuels products?

(a) (i)Yes (ii)No

(b)Why? Please,specify……

24. As a bio-fuels consumers, what kind of support do you need?

(i)Subsidies for purchase of biofuels and co-products (ii) Tax exemptions

(iii)Subsidies for flex –fuel vehicle. (iv) Other (specify)……

25. What do you consider as a main use of bio-fuels products to local community of Tanzania?

(i)Residential use (ii) local industry use

(iii)Transport (iv) Others (please, specify)……

26. What are the markets drivers of bio-fuels development in Tanzania? (Choose maximum 3 factors)

	Fair division , share of income or subsidies and support
	Improving policies which creates new market opportunities
	Accessibility of credits to smallholders
	High Bio-fuels commodities price

	Presence of incentives to local communities
	Others,please,specify……..

27. What do you consider as alternatives solutions for reducing land and water resources competition along Bio-fuels production?

	Integrating food and energy production systems
	Encouraging new energy crops to unsuitable land
	Technology improvement by converting cellulose from plants
	Increasing water use efficient(sharing, scheduling and equitable distribution)
	Others,please,specify……..

28. Main source of lightning	

1=Electricity, 2=Kerosene, 3=Gas, 4=Candle, 5=Solar energy, 6=Fuel wood,7=others

29.Main source of cooking fuels	

1=Electricity, 2=Kerosene, 3=Gas, 4=fuel wood, 5=Solar energy, 6=other biomass, 7=others

30.Main source of energy for heating	

1=Electricity, 2=Kerosene, 3=Gas, 4=fuel wood, 5=Solar energy, 6=other biomass, 7=others

31.Forms of Bio-fuels using for transport	

1=Electricity, 2= Liquid bio-ethanol, 3=Gas, 4= Liquid bio-diesel, 5=Solar energy, 6=Fuel wood, 7= Cellulosic materials derived from timbers and other waste products, 8=others

32. Can you state other renewable energy to replace fossil fuel to smallholders?

……

……

Food security

33. Do you experience any food crisis at any period of the year? ..... (1=Yes, 2=No)

34. (a) If yes, which parts of the year do you most experience food crisis?.....

(1=throughout the year, 2=the rain season, 3=the dry season, 4=in the mid of the year)

(b)If yes, for how many months?.....

35. What are the main causes for the food shortage in the region?

(i)Floods (ii)Droughts (iii)Little access of cultivating land

(iv)Over-selling of food crops (v)Overuse in traditional ceremonies

(vi)Pests and diseases (viii)Poor storage facilities

(viii)Low productivities (ix)Highly engagements of rural smallholders in bio-fuels production

36. What to improve food security in the region?

(i)Integrating food crops and bioenergy crops production (intercropping)

(ii)Use appropriate farming technology (shifting agriculture, use of organic fertilizers)

(iii)Use efficient irrigation systems

(iv)Other specify)……

37. What opportunities for concerted/combined action by this study do you see in relation to Rufiji water resources managements?

……....

II:FOCUS GROUP DISCUSSION

Introduction

Give brief answers of the following questions.

A: Driven forces and environmental protection

1) What are driven forces of smallholder bio-fuels development in Tanzania?

2) Why is Tanzania Investment Centre (TIC) continuing to promote Tanzania has unused/untapped arable land while the villages' councils have already prepared their own land use planning?

3) How do you consider giving huge arable land to large scale bio-fuels investors that causes harm to local people is like repeating same mistake done to privatizing mining sector in Tanzania? If so, how?

4) How is it possible to assure environmental protection as part of bio-fuels production and use?

5) How will bio-fuels development affect availability of freshwater resources and land uses?

6) (a)How can bio-fuels out-compete alternatives for local energy supplies?
   (b)What are bio-fuels crops to be grown by smallholders that produce opportunities compared to others in terms of?
   (i)Environmental protection……
   (ii)Revenue/income…… and (iii) efficiency …… If so how?

B: Opportunities and Challenges of Bio-fuels development to smallholders.

7) (a)What are present potentials and challenges of bio-fuels development to smallholders /local when involved in commercial production in Tanzania?

   (b)What are the international concerns/efforts held in making sustainable production of the bio-fuels to smallholder farmers in developing countries?

8) How is it possible to assure food security alongside bio-fuels industry to smallholder farmers? If so how?

9) Do donors give support to smallholder involved in bio-fuels production? If so how?

10) How do you foresee the future of bio-fuels industry in Tanzania by assuming the present opportunities, challenges and threat.

Appendix 2

Table 9 Seminars participated

Date	**Themes of the seminar**	**Venue**
17-22 August 2008	World Water Week in Stockholm, Sweden	Stockholmsmässan, Stockholm
4 December 2008	Bio-fuels and Smallholders in Africa	The Nordic Africa Institute, Kungsgatan 38, Uppsala
5-6 February 2009	Conference in Environmental Communication, Uppsala from expert to facilitator: the changing face of natural resource managers	Eklundshof Hotel, Uppsala
20 May 2009	Aspects of SEKAB's plans for large scale bio-fuel production in Tanzania - focus on Rufiji district and the conditions for development and poverty reduction.	Stockholm University, Ahlman hall, Geosciences Building, U-house 3rd floor.

Appendix 3

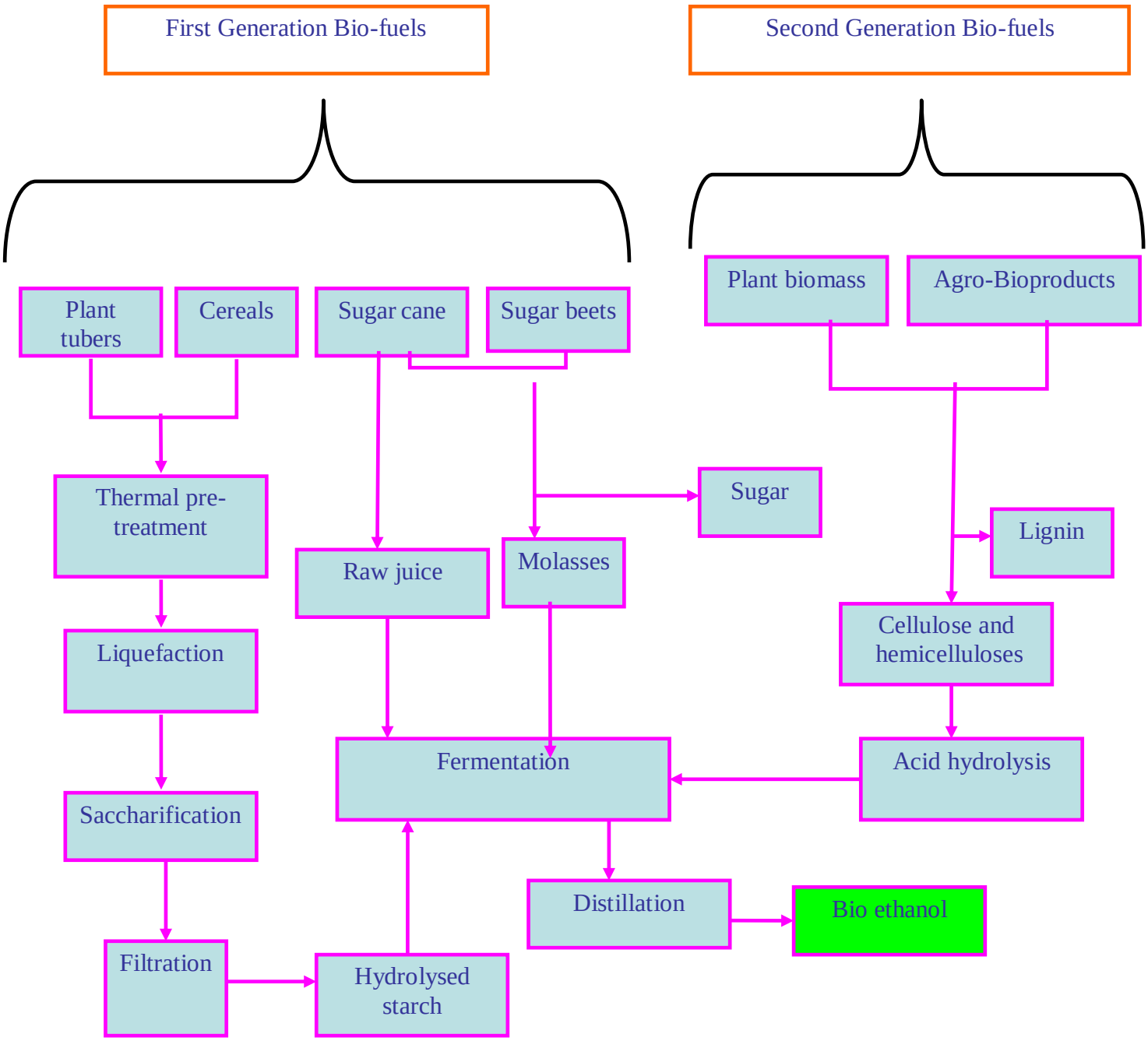

Figure 1 Bioethanol major processing steps

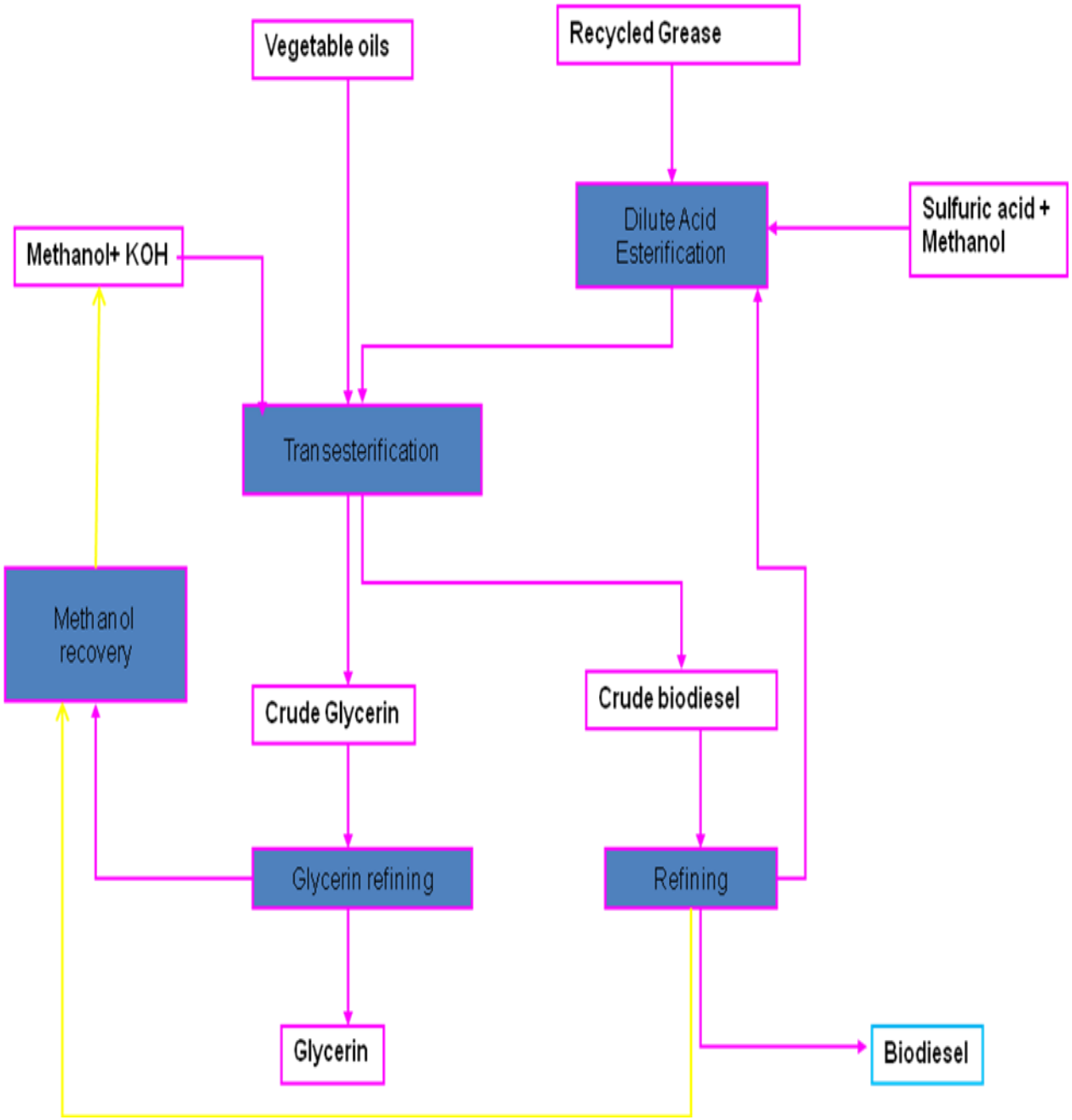

Figure 1 Biodiesel major processing steps

Source: Developed from "The Paths to Sustainable Development", available at:http://www.total.com/static/en/medias/topic103/Total_2003_fs03_Biofuels.pdf