



**Ministry of Agriculture
Kenya**



**Food and Agriculture Organisation
of the United Nations**

Report for Inception Workshop for FAO Project on Climate Change and the Tea sector in Kenya: Economic and Social Impact Assessment

Organized by FAO in collaboration with Ministry of Agriculture



7th - 8th February 2012

Hotel Cathay, Nakuru, Kenya.

ABBREVIATIONS

CCU	Climate Change Unit.
ETP	Ethical Tea Partnership.
FAO	Food and Agriculture Organisation of the United Nations
FOAR	Food Agriculture Representative in Kenya
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GAP	Good Agricultural Practises
GDP	Gross Domestic Product
KFS	Kenya Forestry Service
KIPPRA	Kenya Institute of Public Policy Research and Analysis
KTDA	Kenya Tea Development Agency.
KTGA	Kenya Tea Growers Association
KMD	Kenya Meteorological Department
MEMR	Ministry of Environment and Mineral Resources
MoA	Ministry of Agriculture
NCCRS	National Climate Change Response Strategy.
TBK	Tea Board of Kenya.
TRFK	Tea Research Foundation of Kenya.
RA	Rainforest Alliance.

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EXECUTIVE SUMMARY

The workshop held on 7-8th February 2012 at Cathay Hotel in Nakuru, Kenya brought together stakeholders in Kenyan tea industry and representatives of Food and Agriculture Organization of United Nations (FAO) with an aim of formulations of the road map and determination of the required framework for undertaking an integrated impact assessment of climate change on tea industry in Kenya. Institutions represented in the workshop include tea subsectors actors (i.e. large and smallholder farmers), industry regulator, government ministries involved in agriculture and climate change issues, research institutions, consultants, farmers and non-governmental organizations. The forum provided an avenue of sharing knowledge on climate change and tea production in Kenya, and also deliberated on the future of the integrated impact assessment of the climate change on the tea sector.

The goals of the project were highlighted as to develop a conceptual framework for integrating economic and social impact into climate change adaptation action at district and community level, develop criteria and indicators of adaptation to guide policy decisions and economic incentives for local value chains and agricultural markets consistent with locally targeted climate change adaptation actions; and provide technical assistance and capacity building at national and regional level for policy planning, project implementation and stakeholders support in the areas of adaptation and resiliency enhancement for small farmers and local rural communities. The expected output of the workshop was to define an appropriate road map for the pilot project well as adequate areas of intervention for smallholder farmers. FAO acknowledged the importance of the workshop to the project in that it was expected to take stock of current stage of knowledge on the impacts of climate change on tea production systems and the implications for adaptation in order to establish a baseline for the project from which to develop and evaluate the impact of the project and the approach to be developed and implemented; identify gaps in research and field experience; present and discuss the models and approaches of analysis for a thorough assessment of the impact of climate change and possible ways for smallholder farmers to adapt to climate change, and have an overview of policies related to agriculture and climate change in Kenya.

The Kenyan government acknowledged the importance of the workshop as a national expert consultation on the issue of climate change and was expected to:- build a knowledge base on climate change for agriculture sector, with particular focus on tea, bring together the technical expertise in the area of climate change to address its cross-cutting dimensions: economic, social (including food security) and environmental aspects (water scarcity), develop short and medium term programme planning and implementation and develop an institutional framework for enabling in participation in carbon markets. The expected outputs of the workshop by the government included:- identification of the impacts of climate change on the sector and preparation of the industry on how to absorb likely shocks, identification of the critical

interventions to address the threats of climate change, identification of enabling policies and strategies to allow sector adjust quickly to anticipated changes as result of climate change and inclusiveness in project implementation. The government concerns was driven by among other factors the importance of agriculture and tea production for the Kenya's economy including direct and indirect contribution to GDP, exports dependency, employment source and food security. Other concern is the fact that the Kenyan agricultural system is largely rainfed, with unreliable rainfalls in most areas leading to frequent incidences of droughts.

Efforts by Kenyan government to address climate change through the National Climate Change Response Strategy (NCCRS) were highlighted. NCCRS provides a framework for addressing threats of climate change as well as taking advantages of any opportunities that may arise and pursues to mainstream issue of climate change on the national development programmes. Issues pinpointed in the NCCRS include; evidence and impacts of climate change, strategic focus; vision, mission and objectives; adaptation and mitigation options; education and awareness programmes; capacity building framework; research and development; climate change governance; action plan; cost and resource mobilization and conclusion; recommendation and way forward. Other issues presented were on the NCCRS implementation strategies, the roadmap developed for implementation of the strategy by the Ministry of Environment and Natural Resources (MENR). Other initiatives by the MoA on addressing threats of climate change included; the fast-tracking development of policies and strategies to implement the NCCRS; rolling out of Agricultural Sector Development Strategy 2010 - 2020 (ASDS); initiation of the Climate Change Unit (CCU); promotion of practices for adaptation and mitigating the threats of climate change and collaborative projects on climate change.

Evidence of climate change on tea growing areas were presented as reduction in annual rainfall since 1958, decreased soil water deficits and increased temperatures (both maximum and minimum), increase in radiation and the resultant reduction in tea yields. Updates on tea breeding efforts (research) to respond to biotic and abiotic stress and the effect of other tea routine management practices on water moisture deficit and that and tea mortality were presented. Tea was observed as an important source of employment, livelihood and as a competitive enterprise in Kenyan highlands which had led to evolution of a sophisticated and efficient value chain. Tea contribution to the economy was observed to be significant and also expanding in foreign earnings, contribution to GDP and source of direct and indirect employment. The sectors has had multiplier effects to other sectors especially health, education, energy and rural infrastructure, and also supplying of high quality, healthy and environmentally safe tea to the world market. A baseline on the status of smallholder tea sub-sector and the available opportunities for intervention on climate change mitigation and adaptation research and information dissemination were also presented. Efforts of the estates subsector in diversifying to more enterprises, value-additions products line and expansion of markets in addressing tea industry were also highlighted.

Availability of climate parameters data by Kenya Meteorology Department was presented including methodologies of weather data collection, analysis and dissemination; scope and spread of weather information gathering facilities and opportunities of modeling climatic and weather patterns in agriculture/tea sector. Findings of on-going studies and research initiatives that the FAO project could learn from were presented. A paper on “Climate Change Scenarios: Case of the ETP in tea in Kenya” provided some case examples on mapping suitability and impact of climate change on tea; developing a capacity building toolbox to respond to climate change; testing the toolbox, and energy saving for households. Another study on “Socio-institutional characteristics of tea growing areas and implication for vulnerability and resilience to climate change adaptability: The role of women and youth in the tea industry” provide an insight on importance of targeting the relevant actors in agriculture as far as information/technology dissemination were concerned.

Through groups discussion and in cognizance of the FAO project proposal for an integrated impact assessment as exemplified by the Moroccan case and the goals of Kenyan case, research priorities, tools, capacity building and policy adjustment necessary for adaptation and mitigation of climate change impacts on tea-industry and agro-system in Kenya were identified. Observation and deliberations made from the workshops will guide the implementation of the project are.

1. Although it was acknowledged that the country had some data on weather factors that could be used in modeling climate change impacts on tea production in Kenya. Concerns were raised on the sufficiency of available data in terms of:-

- i. limited coverage on data
 - ii. parameters covered
 - iii. quality of data
 - iv. information not dissemination
 - v. limitation of data on historical
 - vi. data processing
 - vii. propriety issues with data
2. Existing research gaps within the sector which could hinder climate change modeling were identified as;-
- i. Lack of collated information on water moisture management
 - ii. Weak linkages between research, dissemination and farmers
 - iii. Opportunities of irrigation in tea production
 - iv. Lack of a common methodology for measuring carbon in tea
 - v. Information on carbon footprint for tea especially for smallholders
 - vi. No inventory of renewable energy sources for tea industry
 - vii. Lack of information on energy use efficiency for the tea industry along the value chain

3. Additional capacity in terms of data required were listed as:-

- i. Molecular breeding for drought, frost and hail tolerance
- ii. developing tea production models
- iii. developing tea predictive models for extreme phenomena (frost and hailstorm)
- iv. water moisture management
- v. opportunities of irrigation of tea
- vi. developing common tea methodology for measuring Carbon in tea
- vii. developing carbon footprint for tea especially for smallholders
- viii. study on energy use efficiency for the tea industry along the value chain
- ix. database management
- x. policy to regulate the climate change issues
- xi. effective dissemination system.

4. Vulnerability of tea sector to climate change was associated to:-

- i. High dependant of the crop for livelihoods by a large number of farmers.
- ii. Low on-farm genetic diversity
- iii. Quality decrease
- iv. Yields decrease
- v. Tea processing capacity
- vi. Social economic aspects.

5. Important issues of concerns for various institutions on impacts of climate change on tea industry were identified as:-

- i. Shift in choice and enterprise composition
- ii. Reduction of income and loss of employment
- iii. Household health status and food security
- iv. Increased dependency ratio
- v. Capacity to adapt to climate change

6. Constraints to adoption of climate-smart technologies were identified as

Social Constraints:

- Land subdivision ownership and access
- Decision making at farm level and who is to implement
- Capacity for dissemination methods
- Extension methodology and farm management
- Low Level of return from farm produce

Cultural factors

Institutional barriers

7. To address the low productivity which is predicted as an impact of climate change recommendations for the following studies were made;-

- i. tea value-chain analysis in view of climate change
- ii. economic analysis of adaptation strategies
- iii. creation of a financing facility for tea replanting
- iv. Analysis of tea production cost at farm level

8. To address the threat of food insecurity which is a predicted impact of climate change recommendations for the following studies were made;-

- i. undertaking of economic modeling on tea viability under different climate change scenarios
- ii. undertaking of economic modeling on other alternative crops/farming systems viability under different climate change scenarios

WORKSHOP PROCEEDINGS

Session 1: Opening Session and Key Speeches.

Chaired by Esther Magambo (Ministry of Agriculture)

Introduction and welcome note by FAO

Members of the plenary introduced themselves by stating their names, organization they were associated with and professional background. Having all protocol observed in terms of self introduction and presentations of the guest speakers from the FAO and the Ministry of Agriculture, the activities of the workshop proceeded.

Remarks by FAO Representative in Kenya

Augusta Abate

The FAO representative in Kenya welcomed the stakeholders to the national-level expert consultation workshop and acknowledged the importance of the FAO pilot project to the country. In the speech, the rationale of the FAO initiating the project in Kenya was explained and the events leading to the launch were highlighted. Among activities undertaken prior to launching of the project included:- consultation and feedback collection that led to consensus on the project's approach. The goals of the project were highlighted as to develop a conceptual framework for integrating economic and social impact into climate change adaptation action at district and community level, develop criteria and indicators of adaptation to guide policy decisions and economic incentives for local value chains and agricultural markets consistent with locally targeted climate change adaptation actions; and provide technical assistance and capacity building at national and regional level for policy planning, project implementation and stakeholders support in the areas of adaptation and resiliency enhancement for small farmers and local rural communities. The expected output of the workshop was to define an appropriate road map for the pilot project as well as adequate areas of intervention for smallholder farmers. FAO acknowledged the importance of the workshop to the project in that it was expected to take stock of current stage of knowledge on the impacts of climate change on tea production systems and the implications for adaptation in order to establish a baseline for the project from which to develop and evaluate the impact of the project and the approach to be developed and implemented; identify gaps in research and field experience; present and discuss the models and approaches of analysis for a thorough assessment of the impact of climate change and possible ways for smallholder farmers to adapt to climate change, and have an overview of policies related to agriculture and climate change in Kenya. The presentation highlighted on the importance of understanding of the impact of climate change on agricultural production in order to improve farmers resiliency to potentially negative yield trends, increased market volatility and dwindling resources so as to reduce their vulnerability. .

Keynote address by the Permanent Secretary Ministry of Agriculture Representative

Eng. Jisper Akanya

The speech highlighted the importance of agriculture and tea production for the Kenya's economy including direct and indirect contribution to GDP, exports dependency, employment source and food security. It also described the Kenyan agricultural system as largely rainfed, with unreliable rainfalls in most areas leading to frequent incidences of droughts. Potential impacts of climate change to agriculture and the tea subsector were highlighted. Efforts by the government to intervene in agricultural and other sectors to climate-proof the country against detrimental effects were listed including policy documents and projects already being implemented. Climate change interventions for all the policy documents including:- Vision 2030, National Climate Change Response Strategy, The Agricultural Development Strategy, Strategic Plan for the Ministry of Agriculture, National Agriculture Sector Extension Policy and Agriculture (Farm Forestry Rule) were highlighted. A number of other mechanisms being implemented including agricultural practices and projects were highlighted. The speech also presented the government's view on the workshop and its expectation.

The Kenyan government acknowledged the importance of the workshop as a national expert consultation on the issue of climate change and was expected to:- build a knowledge base on climate change for agriculture sector, with particular focus on tea, bring together the technical expertise in the area of climate change to address its cross-cutting dimensions: economic, social (including food security) and environmental aspects (water scarcity), develop short and medium term programme planning and implementation and develop an institutional framework for enabling in participation in carbon markets. The expected outputs of the workshop by the government included:- identification of the impacts of climate change on the sector and preparation of the industry on how to absorb likely shocks, identification of the critical interventions to address the threats of climate change, identification of enabling policies and implantable strategies to allow sector adjust quickly to anticipate changes as result to climate change and inclusiveness in project implementation. From the speech it became clear that the government is committed in addressing the threat of climate change and welcomes initiatives that will assist in ensuring relevant mitigation and adaptation strategies are established, disseminated and implemented. The government has taken the obligation on ensuring that the country does not suffer the detrimental effects of climate change and thus is inviting stakeholders to work collectively in addressing the challenge.

Plenary Discussions:

The opening remarks which raised the key issues to be addressed in the workshop sparked discussions on availability of national policy on environment and climate change, whether different ministries were working separately on addressing climate change, understanding of environmental changes in the country and its effects, and involvement of the youth in capacity building in agriculture

SESSION 2: Setting the stage.

Chaired by Samuel Njane (TBK)

Implementation of the National Climate Change Response Strategy

Michael Makokha, CCS (Ministry of Environment and Mineral Resources)

The presentation was on Kenyan government's efforts in addressing the challenge of climate change as highlighted in the National Climate Change Response Strategy (NCCRS). NCCRS, was launched in 2009 and provides a framework for addressing threats of climate change as well as taking advantages of any opportunities that may arise. The NCCRS pursues to mainstream issue of climate change on the national development programmes. It attempts to inform nationwide climate change programme development and activities, including efforts towards the attainment of Millennium Development Goals (MDGs), Vision 2030 and the Constitution of Kenya.

To provide more insight into the document and issues it addressed, content of each chapter were highlighted. The chapters presented included introduction that emphasized strengthening of the key development blue prints to reflect the climate change. Other chapters were on evidence and impacts of climate change, strategic focus, vision mission and objectives, adaptation and mitigation options, education and awareness programmes, capacity building framework, research and development, climate change governance, action plan, cost and resource mobilization and conclusion, recommendation and way forward. Other issues presented were on the NCCRS implementation strategies, the roadmap developed for implementation of the strategy by the Ministry of Environment and Natural Resources (MENR). The status of currently major undertakings in developing a comprehensive National Climate Change Action Plan to operationalize the NCCRS were highlighted. The eight main subcomponents of the NCCRS Action Plan were highlighted and activities to be undertaken under each subcomponent. The subcomponents of NCCRS were reported as:- long-term national low carbon development pathway, enabling policy and regulatory framework, national adaptation plan (NAP), nationally appropriate mitigations actions (NAMAs), national technology action plan, national performance and benefit measurement (MRV), knowledge management and capacity development, financial mechanism and coordination.

The presentation is a testimony that the Kenyan government has acknowledged climate change as a real threat to the country's development agenda and has formulated a framework for intervention. In this perspective the FAO project on tea will find a favourable environment as it will build into activities of the government agenda. Although the project's objectives may be micro in nature unlike the national agenda which is macro, the output of the project will be a major contribution to country's climate change intervention agenda. Synchronizing the projects activities and outcomes to the NCCRS is important for experience sharing, capacity building, resources efficient utilization and avoiding multiplication of activities. Both the FAO project and the NCCRS stand to benefit each other and it is therefore important to consider each as a compliment to the other.

Climate Change and Agriculture: National Readiness to Address Climate Change

Esther Magambo, Ministry of Agriculture

The important role agriculture plays in Kenyan economic development were highlighted. It was noted that agriculture contributed 24, 60, 45 and 70 percent of gross domestic product (GDP), foreign earnings, government's budget and employment opportunities respectively. The sector supports and provides livelihoods to 80 percent of the country's 40 million people and accounts for 70 percent of raw materials to other sectors' industries. Albeit it's importance, agriculture in Kenya was reported to be vulnerable to changes in weather and climate due to aridity of large portion of the country, dependency on rainfall and low investment in irrigation infrastructure.

Among policy intervention that have been put in place to increase agricultural productivity and to relieve it reliance burden include:- the Vision 2030 and the National Climate Change Response Strategy (NCCRS) the presentation noted. The presentation highlighted other initiatives by the Ministry of Agriculture on addressing threats of climate change. The initiatives included fast-tracking development of policies and strategies to implement the NCCRS, rolling out of Agricultural Sector Development Strategy 2010 - 2020 (ASDS), and initiation of the Climate Change Unit (CCU). The workshop was informed on the objectives of CCU, which included coordinating climate change related initiatives in agriculture and enhancing collaboration, establishing and maintaining of relevant databank, building capacity and creating awareness on adaptation and mitigation at all levels. Agricultural practices that the Ministry has adopted for adaptation and mitigating the threats of climate change were reported as promotion of conservation agriculture, agroforestry, appropriate use of inputs, trainings on SLM, drought tolerant crops and high value traditional crops, soil and water conservation, water harvesting, value addition, technologies for grain storage and specific project interventions.

The presentation provided details of existing collaboration between Ministry of Agriculture and other partners focusing on climate change. Ministry's expectations on the project (FAO Assessment of Social Economic Impacts of Climate Change on Tea Sector) which was being launched were highlighted. The main expectation of the project by the Ministry was pinpointed as availing of agro-metrological data. The data availed was expected to guide; the setting of planting and harvesting dates for various crops in relation to seasons, choice of various crops for the various agro-ecological zones, choice of various agronomic practices/ technologies, early warning for food security and risk management, forecasting, prevention and mitigation of adverse natural disasters such as droughts, floods and landslides, pest and disease management and improving national research and extension services.

The presentation showed country's readiness to mitigate and adapt to climate change challenge through a number of strategies, partnership and policy formulation. A number of activities are proposed without clear indications of prioritization. Another issue that became apparent was sequencing of activities, experience sharing and coordination. Since some shortlisted activities for intervention coincides with tradition cultural practices in agriculture, the most relevant intervention may need to focus on up-scaling agricultural development in general. It is apparent that climate change is not viewed as systematic shifts that may allow for acclimatization to the natural changes but abrupt phenomena that may require alteration of all tradition agricultural activities. Considering Kenya's history of research, climate variability and agricultural production there may be practical lessons from existing literature and practices by agricultural practitioners. For example, Farm Management Handbooks, published by Ministry of Agriculture in 1981-1983 illustrates guiding principles in successful agricultural production considering the natural environment (agro-ecological and edaphic factors), agricultural enterprise characteristics and socio-economic characteristics of farmers. Changes are occurring with time but they may not be such sudden to warrant disregarding historical information available.

Plenary Discussion:-

Issues of concern during the plenary discussion included on: the estimates of carbon emissions per sectors of the economy and ranking of the emitters, whether the climate change secretariat and climate change unit are developing climate change separately, availability of timeliness for achieving the activities outlined in the climate change unit, availability of sufficient financial resources to fund the action plans of NCCRS, the role of other stakeholders in implementation of the climate smart projects by the Ministry of Agriculture, membership of the technical working group in the climate change unit, whether activities outlined for climatic change response will be applied differently in the tea sector and how variability in climate and crop production will be mainstreamed into climate change agenda.

Sensitivity of Kenyas' tea industry to climate change

Prof. Francis Wachira, Tea Research Foundation of Kenya (TRFK)

In tea growing zones evidence of climate change were presented as reduction in annual rainfall since 1958, decreased soil water deficits and increased temperatures. Rainfall for Kericho decreased annually by 4.82mm over the study duration while temperature increased annually by 0.016°C in 52 years. Both maximum and minimum temperatures were observed to have risen by between 0.1 and 2.9°C. Over the years, radiation was reported to have increased in tea growing areas. High correlation was observed between annual national tea production and rainfall reported in TRFK, Kericho with reduction in amount of tea produced coinciding with drought periods. Decreased yields were observed with increase in temperature. Also low yields were associated with cases of increased soil water deficit.

Research findings showed that trees improve the micro-climate of tea thereby reducing the effects of extreme weather events especially frost. Tea has been observed to stock carbon with difference on levels of stock between seedling and clones reported. Although biomass accumulation was less in tea than other types of forests including plantations and natural, tea was reported to have sustained carbon sequestration due to the crop's management practices. Other issue presented included on the strategy taken by tea sector's actors to ensure sustained supply of fuel wood through afforestation. Updates on tea breeding efforts to respond to biotic and abiotic stress and the effect of fertilizer application on water moisture and tea mortality were presented. Drought resistance clones and fertilizer application management were presented as a major adaptation for the tea crop. Other opportunities for addressing the climate change challenge include:- preparations for policies and strategies, tea industry to negotiate for carbon credit, awareness creation, analysis of weather patterns in tea areas, data collection and forecasting , efficient management of soil and water resources, soil water conservation measures, sustainable management of forests, water harvesting strategies, use of sustainable energy and crop insurance.

Although observable evidence of climate changes in tea growing areas was presented, they coincided with indication of an increase in tea yields. This contradiction was explained to be associated with the fact that the sector have innovated improved production technologies that have been adopted by farmers. This implied that the threat of climate change could be mitigated by development and adoption of improved technology. Opportunities to mitigate climate change also existed with shifts in existing agricultural practices e.g. fertilizer application rates. The Kenyan tea industry was presented as being ready to address the climate change with research and relevant extension services. Yet more research work were also necessary to answer some questions especially on whether tea is benefiting from observed weather changes or what proportion of impacts from climate change is being mitigated by technological improvement and which particular technologies are responding positively. It may be important to note at this stage that since its establishment in 1950s TRFK has been involved in research to tackle challenges on crop-environment relation mostly drought implying that ever since early 1900 issues of climate

and tea production has been a concern. It is important therefore to delineate the issues of climate that were being focused in the 1950s and those that require attention now that climate has changed.

An Overview of Tea Industry in Kenya
Samuel Njane, Tea Board of Kenya (TBK)

The presentation highlighted on the tea production systems in Kenya showing the numbers, acreages, total tea production and factory ownership by the two tea production sub-sectors. Tea was observed as an important source of employment, livelihood and as a competitive enterprise in Kenyan highlands which had led to evolution of a sophisticated and efficient value chain. Tea contribution to the economy was observed to be significant and also expanding in foreign earnings, contribution to GDP and source of direct and indirect employment. The success of the sectors has multiplier effects to other sectors especially health, education, energy and rural infrastructure. Kenya tea production is also important in the global arena being the largest exporter and supplier of high quality, healthy and environmentally safe tea to the world market. Albeit its importance, the tea sector was observed to be facing challenges in marketing aspects and climate change threats.

Targeting Kenya tea sector for a case study on the impact of climate change on tea production provide a good lesson for other countries and enterprises in that the sector has been successful. It has attracted a large proportion of population in its dependency through direct and indirect employment and solely plays a critical role in the macro-economic stability and country development. Any negative shifts in production potent repercussions that will not only affect the farmers, but other businessmen, government returns and the entire world consumers of tea. With such a big stake in livelihood, national economy and international arena it calls for timely intervention. The sector provides a unique opportunity for understanding how sophisticated and efficient value chains could be used in responding to global crisis such as climate change. The role each actor could play, opportunities available for stakeholders and the levels of success is an important lesson for other countries and agricultural enterprises. Acknowledgement of the need to address climate change by Tea Board of Kenya and its willingness to collaborate with other stakeholders' is important for greater impacts of this project, in that the institution regulates the industry and has also been pivotal in providing leadership to the sector. Observable success of the tea sector in Kenya is partly associated with the leadership by Tea Board of Kenya.

Session 3: Status of tea sector and implication of climate change:

Session Chair: Dr. Wilson K. Rono

Challenges and opportunities of small scale tea growers in Kenya

Peter Mbadi, Kenya Tea Development Agency (KTDA)

The history of the smallholder tea sub-sector was presented which highlighted various developments from 1903 to the current situation. The contribution of smallholder tea sub-sector to Kenya's economy was presented. The importance of smallholder tea production to the economy included:- livelihood support (10% of population), foreign exchange (49 billion in 2010), GDP (2.4%) and promotion of rural development. Also presented was on the smallholder's management agency's mandate and management structure for the 65 tea processing factories. Environment for optimal tea growing in Kenya was reported as altitude (1500 – 2250 masl), rainfall (1200-2500 mm annually), temperature (13°C to 30°C), soil depth (2m) and soil pH (4-6). Graphs on annual increment on area under tea, number of growers and amount of tea produced by smallholder from 1964 to current were presented. Counties where tea is grown in both East (Kiambu, Meru, Embu, Nyeri, Kirinyaga and Murang'a) and West (Kakamega, Kericho, Kisii, Nandi, Trans-Nzoia) of Rift were shown. It was shown that proportion of KTDA revenue paid to farmers were high ranging between 68 and 75 percent between years 2007 and 2009.

Recent achievement of smallholder subsector were highlighted as enhanced processing capacity (20 new factory constructed in 10 years), productivity improvement through modernization, mechanization and automation, tea quality assurance, various compliance certifications, adoption of new extension methodologies (FFS) and development of alternative energy sources. Challenges for the sector included those associated with marketing (for example fluctuating prices, exchange rate volatility, cost of marketing and competition). Tea production challenges included increase in cost of inputs (labour, energy and fertilizer), poor infrastructure, decreasing farm sizes and weather factors. Adaptation strategies for climate change include energy cost reduction strategies, tea products diversification and collaborative studies on drought and pest tolerant clones (TRFK) and climate change adoption strategies (ETP and GIZ). It was noted that KTDA has collaborative project on farmers Field Schools and rainforest alliance certification.

This presentation was able to provide a baseline on the status of smallholder tea sub-sector in Kenya. The presentation highlighted on available opportunities for intervention on climate change mitigation and adaptation research and information dissemination. The structure of the sub-sector in production and information dissemination was observed as sophisticated and all inclusive and would be appropriate to ensure that any technology on climate change effectively reached the farmers and allowed for monitoring of any impacts. The presentation was also able to illustrate existence of other challenges beyond the climate change which also need to be addressed. To effectively address the climate challenge it would be important to also clearly understand the effects and implications of the other challenges to the tea sector in Kenya. Any development therefore should endeavour to separate the effects of each of these constraints to be able to effectively capture and monitor climate change impacts.

Challenges and opportunities of large scale tea growers in Kenya

Richard Mose, Finleys

The presentation show cased a large estate multinational tea grower in Kenya. The company had invested in 9 tea estates, 5 tea factories and 2 flower farms estates all in an area of 12,838 ha in one of tea growing counties. The enterprise provided employment to about 15,000 persons who were joined by their 19700 dependents within company's housing estate of about 12,166 houses. Social services provided by the company included health services (19 centres) and education (72 centres, ranging from nursery to secondary education levels). In spite of the large investment, the company reported climate and environmental factors as the major hindrance to its profitability. Incidences and intensity of changes observed in weather factors (drought, frost and hail) were reported as main constraints to successful operations. The changes have led to upsurge in diseases and pests, seasonality in tea production, deteriorating tea quality and shifts in comparative advantages of tea farming in relation to other enterprises. Adaptation strategies by the company include investment in research on breeding, diversification tea product lines (green, orthodox, tea extracts) direct sales to enjoy better margins, diversification to other enterprises and monitoring of climate information, issues associated with climate change calls for carbon foot printing, energy use efficiency.

This presentation raised the questions of activities being undertaken for climate change impact adaptation and mitigations and those undertaken to maximize profit due to products markets dynamism. For example estates companies have been known to have engaged in propagation of eucalyptus in response of energy demand for more that 50 years; change in climate may only raminify the benefits of such an activity having been taken. An important lesson from this presentation is as investors pursue to increase returns from their agricultural activities, opportunities for climate change impacts adaptation and mitigation are being implemented.

Weather data collection and modelling climate and weather patterns: Implication for research on climate change and tea in Kenya

Simon Gathara, Kenya Meteorological Department

This paper alluded to the fact that climate in Kenya has changed and illustrated some case examples of observation that validate the changes. Some climate change signals already observed in Kenya and in the East African region included:- rise in air temperature (that have resulted to melting of mountain glaciers), increasing frequency of ENSO events (extreme climate events), resurgences of and expansion of diseases belts (malaria and meningitis), rivers becoming more seasonal or disappearing altogether (river Njoro and Mereroni), shrinking of lake sizes (Lake Baringo and Nakuru), severe coral bleaching and shifts in rainfall seasons. Data presented

showed that maximum temperatures have increased in all regions of the country by between 0.1 and 2.1°C. Except in Coastal strip where minimum temperature decreased by 0.3 –1.0°C, all other regions reported increase by between 0.7 and 2.9°C in the last 50 years. Although annual variation in total rainfall has been observed, on average the amount received annually in four area (Narok, Nyahururu, Kericho and Marsabit) indicated a decline trend between 1960 and 2010. From this paper it became clear that Kenya is becoming drier and warmer. The impact of these changes of climate will not only affect human welfare but will also influence the biological systems and water resource availability. Presentation showed how growth cycles of plants will be affected by increased temperature leading to quality and yields distortions. Adaptation strategies for agriculture included development of irrigation systems and more research to ensure relevant intervention strategies

The presentation also highlighted how weather data is collected, analyzed and disseminated to the users. The presentation was also able to show the scope and spread of weather information gathering facilities and what type of weather data was available sourced either within or without the country. The presentation alluded to opportunities of modeling climatic and weather patterns in agriculture/tea sector due to availability of vast data and information documented since year 1800. The author illustrated how data could be gotten from Kenya Meteorological Department (KMD) and in which packages/forms. Also reported to be available is the socio-economic data for entire agricultural sector.

The main lesson from this presentation was on availability of data for climate change analysis. KMD has a rich database on weather from within the country and without that could be used for modeling climate change impacts on any crop enterprise in the country. The institution also has climate modeling capacity in terms of personal and equipments (computer software). The services of KMD are available to the country with potential customers required to specify areas of capacity needs. It would be therefore important to engage KMD in the activities of the FAO project on assessing climate change impact on tea industry.

Plenary Discussion:-

Issues that arose from the presentations in this session were on availability of policies controlling land fragmentation, availability of measures to mitigating climate change, the extent of the meteorological department to predict extreme phenomena (i.e. hail and frost) and whether there is an avenue of communication to stakeholders, whether spraying crops with water before a frost incidence could increase crop survival, factors considered in the assessing soil and water conservation, ability of tea variety that thrives on environment with temperatures to survive in marginal areas, the existence of key constraint that may hinder tea farmers from adapting climate change strategies and interventions considering the efficient and sophisticated structure of the

industry. The need for a national tea conference where all stakeholders would share available information was suggested.

CIAT Study on Climate Change Scenarios for Kenya: Responding to Climate Change in Tea through GIZ Supported PPPs

David Mshila, GIZ

This presentation was on a study that had been undertaken in Kenya on tea “Climate Change Scenarios: Case of the ETP in tea in Kenya”. The presenter emphasized some chapters in the study report as relevant for the FAO proposed study. The topics that were highlighted as important were -i). mapping suitability and impact of climate change on tea, ii). developing a capacity building toolbox to respond to climate change, iii). Testing the toolbox, and iv), energy saving for households. The objectives of the study were reported as; to analyse on a country base the impact of climate change for tea and other important crops, assemble site specific approaches and best practices to respond to climate change under conditions of small-holder farming, pilot test approaches and best practices under these conditions and develop training material for trainers and lead farmers. It was reported that both temperature and rainfall in tea growing areas in Kenya will rise with increase in rainfall outweighed by high evapo-transpiration. Area suitable for tea growing will decrease considerably by 2050 from altitude between 1500 and 2100 metres above sea level (m. asl) to 2100 and 2300 m asl.

More activities are being undertaken on tea production in Kenya including: mapping tea suitability for 2020 and 2050, identifying best approaches and practices of adaptation to climate change in tea, testing approaches and practices and developing training material and training of trainers, extension workers and key tea farmers. CIAT is undertaking more climate change adaptation studies on coffee in East Africa and Latin America. Activities on coffee and climate change include on adaptation strategies in coffee industry for various countries, development of a pioneering participatory approach to respond to climate change, developing adaptation responses to climate change by small coffee producers, developing an add-on module for climate change as part of sustainability standards and exploring ways to estimate green house gaseous (GHG) emissions for a carbon credit system. Strategic choice of partners enhances achievement of the studies’ objectives.

An important lesson from this presentation was on existence of initiatives that are attempting to address climate change issue for the tea and other crops’ enterprises. Outputs from these initiatives will build into the current efforts by FAO. Already studies are showing strength and weakness on their findings and are pinpointing on issues that need to be addressed if greater impacts are to be achieved. The holistic approach of these initiatives in geographical coverage

and wider crop enterprises targeting is important especially where the need for comparison arises. Since some studies are on-going in areas that the FAO project wishes to address it would be advisable comparison of notes in order to share experiences, evaluate research designs required and determine existing gaps that require research or operational interventions.

Socio-institutional characteristics of tea growing areas and implication for vulnerability and resilience to climate change adaptability: The role of women and youth in the tea industry in Kenya

Paul Kiprono, Tea Research Foundation of Kenya

The presentation was about a study carried out in tea growing areas to determine the role of women and youth in the industry. Although the sample was small (66 smallholder's farmers in five Counties) the study was able to provide an insight on importance of targeting the relevant actors in agriculture as far as information/ technology dissemination is concerned. Socio-economic difference in terms of education, gender, levels of decision making, land ownership and age factors defines the responsibilities allocation for various agricultural practices. The paper concluded by recommending inclusion of all household members in addressing climate change including women, the youth and hired labour. The presentation also called for women and youth empowerment through access of land to ensure efficiency and sustainable tea production. The presentation showed that learning opportunities from previous research output exists. Although some of these research may or may not be directly targeting climate change.

The presentation emphasized the understanding of the interaction of environmental, socio-economic and cultural factors affecting agricultural production. Successful implementation of the FAO project would require understanding the synergies affecting agricultural production; determine the relevant intervention strategies and the best indicators for monitoring and evaluation. To successfully achieve its goals, the FAO project will be required to engage a battery of professionals in its team including anthropologists, sociologists, economists and other natural scientists involved in tea production.

Plenary Discussion:

Concerns were raised on the interest on tea by this project and whether other crops would be covered and how they will be integrated in the project, which crops could replace if the environment of its growing changed, and availability of tea varieties that could adopt in areas with high temperatures, harmonization of communication to farmers to demystify some of the terminologies, and pursuing integrated approach for Kenyan program in the tea sector

Day two

Session 4: Climate change and the tea sector in Kenya: Priorities for Research, Tools, Capacity building and Policy adjustment.

Chaired by Francis Wachira (TRFK)

Climate Change and the tea sector in Kenya: FAO project proposal for an integrated impact assessment

Aziz Elbehri, FAO Rome

The presentation highlighted on the challenge of climate change and the FAO strategy. It showed how various climatic factors has been changing over the years and predictions of how the situations in the future. The study was able to illustrate that changes expected in the future varied from region to region and gave a case of Morocco where rainfall predicted to decrease while in Kenya precipitation was predicted to be higher but variable than currently. Some of the challenges posed by predicted changes in climate were highlighted including:- decreased agricultural production, doubling of population facing water scarcity, doubling of wood fuel demand, complication of forest resources management and increased pests and fires. Climate changes strategies undertaken by FAO were highlighted as adaptation and mitigation priority areas. Adaptation priority areas covered by FAO strategies were reported to include, data and knowledge for impact assessment and adaptation, governance for climate change adaptation, livelihood resilience to climate change, conservation and sustainable management of biodiversity, innovative technologies, improved disaster risk management. Mitigation priority interventions were listed as strengthen agriculture in climate change negotiations, data and knowledge, methods and technologies, governance. Also listed were FAO programmes and projects on climate change.

Climate change was described as multi-dimensional and its assessment required integrated approach where all components and their interactions were addressed. The components were demonstrated to include biological resources, bio-physical and climatic factors, and human dimension. Other important factors that were highlighted as important to consider during assessment were balancing of complexity with tractability and the need to select the level of scale. Climate change impact assessment projects in Morocco and Kenya were described. The Moroccan project was described in terms of choice of the area to of coverage, the project zone and crops covered, project's objectives, integrated approach adopted (inclusive of economic, bio-physical and hydraulic and socio-institutional modules) and activities already undertaken and the scheduled ones. Also described is the Kenyan project by FAO on climate change in the tea sector. Issues highlighted include the broad objectives, the need for definition of a road map for

the project, the need to determine the required framework (definition of project area, identification of expertise/tools and research/decision tools) for the climate change and tea assessment. The expectation of the workshop was reiterated as the definition of the road map and determination of the required framework. To provide more insight on the projects outputs some examples of models were illustrated including the AquaCrop, EX-ACT and household vulnerability analysis.

The presentation was able to provide a background of the FAO activities of climate change, expound of the Kenyan and Moroccan impact assessment projects' concepts, inculcate participants and stakeholders to the launched projects activities and demonstrate on the expectations and requirements. The presentations provided a strong foundation for participants to meditate and contribute their views on the entire project during the plenary. It also allowed participants conceptualize the road map and framework required for the project as they were deliberating on the way forward for the project. He guided the participants into group discussions in order to define the road map for the pilot project in Kenya.

Plenary Discussion:-

The presentation stimulated discussion on a number of issues included:- weather the FAO project will duplicate what is going on in other institutions and how it will relate with other ongoing initiatives, which parameters were used in Moroccan assessment of vulnerability to climate change, whether Moroccan have attempted to implement the findings, whether designs and strategies of the project addresses the concerns of climate change at the household level, the project timeframe and how the tools will be used to monitor changes in the carbon balance. Through the discussions some recommendations were made on the use of uniform parameters for assessing climate change, the need to brainstorm the aspects to be considered and which can be looked into the project at hand, lessons from African Adaptation Program to climate change could build on to this project, the need to undertake a baseline that will help in monitoring changes in carbon balance, the need for reviewing what is already known from the prior research, the need for being strategic in choosing the targets for the project, the me at hand.

Methodologies to be applied will depend on the approach to how they will be adopted and applied. A lot has been done and it would be good to consolidate these and have a one stop shop for information.

GROUP'S DISCUSSION AND RECOMMENDATIONS.

Three groups were formed to which each was given an area to discuss and guiding questions into the discussions.

Group 1

This tackled the scientific/technical aspect of the project. It looked into the current state of knowledge, research gaps, identifying local expertise and research capacity needs. It zeroed in identifying the key vulnerability areas for tea vis a vis climate change, strengths and weaknesses of the current production system in light of the expected changes due to global warming.

What knowledge do we have in regards to Climate Change:-

The group members' acknowledged that the country had some data on weather factors that could be used in modeling climate change impacts on tea production in Kenya. Concerns were raised on the sufficiency of available data in terms of:-

- Limited coverage on data: The data suspected to be available was described as insufficient in terms of geographical coverage. While a number of institutions especially those involved in tea value chain had been recording weather factors information, group's members felt that the available data could not effectively be used for modeling due to problem of representation of tea growing zones. Identified stakeholders to be targeted in addressing this challenge were TRFK, KMD, Respective Tea Factories, Tea estates, Volunteers weather station owners and the ministry of Agriculture.
- Parameters covered. Mostly weather stations collected information on minimum and maximum temperature, and rainfall which were suspected insufficient for achieving the project's goal. Identified stakeholders to be targeted in addressing this challenge were TRFK, KMD, Respective Tea Factories, Tea estates, Volunteers weather station owners and the ministry of Agriculture.
- Quality of data:- The quality of data available with different stakeholders could not be quantified. Identified stakeholders to be targeted in addressing this challenge were TRFK, KMD, Respective Tea Factories, Tea estates, Volunteers weather station owners and the ministry of Agriculture.
- Information not dissemination:- While institutions have been known to collect weather information no dissemination has been done on what, how and other details of what is available with different stakeholders.
- Limitation of data on historical:- Members felt that the information available may not have been collected over a duration that could allow its use in climate change modeling. To analyze climate change a data duration threshold was required.
- Data processing: The group noted that although weather factors information have been recorded by a number of institutions, not all of them had taken the initiative of computer processing it. Some information was still in books, cards and files and therefore required processing.

- Propriety issues with data: - It was observed that institutions with data had used own resources for data collection and storage. Queries arose on whether all institutions were willing to share or sell their data to be used for climate change modeling.
- Data not available: - While members felt that data was available in the country its availability could not be validated. Need to validate the availability and quality of data from voluntary weather station. The need to undertake inventory on who has data, their geographical distribution and what data is available was recommended. Also recommended was the establishment of main parameters required for climate change modeling.

2. The group also noted of attempts to develop tea nutrients and weather parameter model in 1997, they went on to acknowledge unavailability of tea production model in the country. It was agreed that some parameters are available for model development while necessary equipments and methodologies for assessment and prediction of extreme weather events were lacking.

Research gaps:-

Other research gaps existing within the sector that could hinder climate change modeling included:-

- viii. Lack of collated information on water moisture management
- ix. Weak linkages between research, dissemination and farmers
- x. Opportunities of irrigation in tea production
- xi. Lack of a common methodology for measuring carbon in tea
- xii. Information on carbon footprint for tea especially for smallholders
- xiii. No inventory of renewable energy sources for tea industry
- xiv. Lack of information on energy use efficiency for the tea industry along the value chain

2. Vulnerability:-

a). Tea as an enterprise in Kenya was considered to be vulnerable to climate change due to

- vii. High dependant of the crop for livelihoods by a large number of farmers. Farmers in tea growing areas were dependent on tea for all their financial needs including buying food, school fees, health services etc.
- viii. Low on-farm genetic diversity:- Tea farming was observed to be relying on few clones of tea with farmers mostly having one clone covering the entire farm.
- ix. Quality decrease: tea quality was reported to be very sensitive to changes in weather factors
- x. Yields decrease: Tea production and yields were reported to be very sensitive to change in weather factors including temperature and rainfall.
- xi. Tea processing capacity: The group observed that tea processing equipments are designed and fabricated for the sole role of tea processing through cut tear and cull

(CTC). Already the industry had huge capacity of the equipments which could be rendered idle if tea production was to be affected by climate change.

- xii. Social economic aspects:- Tea was observed to contribute significantly to rural employment leading to social harmony and rural development. Due to the large number of people employed within the tea sector, any shock by climate change that could affect employment would affect social economic welfare of tea growing areas.

b). Other crops vulnerability: -

c). Geographical vulnerability: A consensus was reached that there was lack of information on levels of vulnerability in various agro-ecological zones.

Strength of existing production systems The group listed some of the strengths of the tea industry existing production systems:-

- i. industry well structured
- ii. Sufficient labour
- iii. Way of information dissemination
- iv. The industry is still enjoying high revenue
- v. Potential for adoption of other enterprises
- vi. The Kenyan sector is market leader hence will influence price
- vii. Availability of research capacity and technology availability
- viii. Profiling the existing extension staff and provide relevant training

Weakness of existing production system

- i. Reliance of rainfed production system
- ii. Monoculture production system
- iii. The crop is vulnerable (sensitive) to weather factors
- iv. Monocropping farming system
- v. idle labour during the low seasons
- vi. Seasonality variability
- vii. Low value-addition and product diversification
- viii. Narrow focus of market
- ix. Low domestic consumption
- x. Many certified agents
- xi. Dissemination capacity for the technology

3. covered under transect section in Question 2

4. Additional capacity in terms of data required were listed as:-

- xii. Molecular breeding for drought, frost and hail tolerance
- xiii. developing tea production models
- xiv. developing tea predictive models for extreme phenomena (frost and hailstorm)
- xv. water moisture management
- xvi. opportunities of irrigation of tea
- xvii. developing common tea methodology for measuring Carbon in tea
- xviii. developing carbon footprint for tea especially for smallholders
- xix. study on energy use efficiency for the tea industry along the value chain

- xx. database management
- xxi. policy to regulate the climate change issues
- xxii. dissemination

Plenary Discussion:

Issues of concern from the presentation were on the need for prioritization of activities to be undertaken by the project among the many recommended.

Group 2

This group discussed the economic impact assessments. It looked into needs for economic research assessments of climate change within tea growing areas. It identified areas of concerns, focus areas for research and developing capacity.

Climate change and lower tea production:

Climate change was predicted that it was to lead to the shifting of tea ecological zone, leading to reduced productivity and quality, tea with high fiber, higher production costs, reduced income and lower pieces in the international markets. Sustainable options for mitigation of the impacts include farmers' education. Farmers' field schools were identified as institution requiring capacity building for quick adoption of new technologies. Another option is for farmers to uprooting or replacement of tea bushes with drought resistant and high productive clones. Costs associated with reduction in production for 3-4 years of crop replacement. Low adoption rate of technologies due to scattered producers, low education of farmers. Other costs will be associated with dissemination of information/extension services, opportunity costs of uprooting tea and conflicts associated with land property rights.

Research gaps identified include:-

- i. Information gaps on the costs and financial return foregone with tea uprooting
- ii. Real costs associated with tea production due to climate change
- iii. Value addition of adapting climate smart technologies
- iv. Financing mechanism for replanting tea
- v. Poor economic analysis at the farm level (poor record management by farmers)

Recommendation

Tea value-chain analysis in view of climate change

Economic analysis of adaptation strategies

Creation of a financing facility for replanting

Analysis of production cost at farm level

Stakeholders to be targeted Include TRFK, KTDA, KTGA, TBK, KIPPRA, Tegemeo Institute, universities, government department of agricultural economics; consultants

Target beneficiaries : Selected small-scale producers in East and West of Rift Valley, with different agro-ecological zones (Kericho, Nandi) and selected more vulnerable zones

Climate change and food insecurity

Issues associated with food security include high dependence on tea in East Rift Valley, high monoculture rate (75%), food security affected indirectly by impact of the major source of income crop, unavailability of food in the market lower incomes. Sustainable options in addressing food security issues include diversification of food production and targeting farmers' field school for capacity-building to facilitate quick adoption of agricultural smart technologies. Cost related with the intervention strategies of diversification to food crops production include: -more land fragmentation (plots too small to diversify), archaic land tenure system, deforestation for agricultural land and unsustainable use of natural resources especially water issues. Main research gap is factors influencing implementation of government policy on land ownership. It was noted that government policies on land ownership in place, but no effort to implement them.

Recommendations

Necessary research undertakings required to guide on food security impacts of climate change include :-

- i. undertaking of economic modeling on tea viability under different climate change scenarios
- ii. undertaking of economic modeling on other alternative crops/farming systems viability under different climate change scenarios

- iii. comparison of value-chain analysis of alternative crops / enterprises (profitability, cost of production, added value, etc.) using the models developed by KIPPRA (crystal; enterprise comparison)

Targeted stakeholders : Institutions that could be targeted for successful implementation of the above interventions that concerns food security include Ministry of land (land policy 2009), KIPPRA, TEGEMEO, universities, school of environment, government department of agriculture, economics research center and consultants

Target beneficiaries: Selected small scale producers in East and West of Rift Valley with different agro-ecological zones (e.g. Kericho, Nandi) and selected more vulnerable zones.

Group 3

This group looked into socio institutional impact assessment (including tea producers). It identified needs for socio-institutional impact assessment of climate change with in tea growing areas. It narrowed to areas of concerns, focus areas for research and developing capacity.

The group members who discussed this theme of socio-institutional impact assessment aimed to deliberate on assessments of vulnerability and capacity for adaptation by small holders. Specifically the group deliberate on issue concerning:-priority issues; needs for assessment; capacity building program; identification of local expertise; further research and analysis needs; needs for socio-institutional impact assessment of climate change within tea growing areas-areas of concerns; focus areas for research and developing capacity. Addressing this issue was necessitated by concerns that impacts of climate change may include:-

- vi. Shift in choice and enterprise composition
- vii. Reduction of income and loss of employment
- viii. Household health status and food security
- ix. Increased dependency ratio
- x. Capacity to adapt to climate change

Constraints to adoption of climate-smart technologies:-

Broadly constraints to adoption of climate-smart technologies were identified as social, cultural and institutional.

Social Constraints:

Five issues were identified as critical social constraints that were to prevent smallholder farms from adopting climate-smart technologies were

- Land subdivision ownership and access
- Decision making at farm level and who is to implement
- Capacity for dissemination methods
- Extension methodology and farm management
- Low Level of return from farm produce

i). Land subdivision ownership and access

The group identified issues surrounding land sizes, subdivision, ownership and access as a critical social constraints that may prevent small holders from adopting climate-smart technology. It recommended that the issues raised on land could well be tackled at national level through implementation of land policy and awareness creation among farmers on importance of operating economic viable farm sizes. The relevant institutions to address the challenge were identified as the central government especially the line Ministry associated with land. While all stakeholders in the tea industry and climate were required to mainstream issues of land subdivision agenda on its field activities, sensitization of extension agencies and farmers on the significance of uneconomical land subdivision was emphasized.

2. Decision making at farm level and who is to implement. Decision making and implementations by various actors at the household was observed as an important issue that deserves consideration as it could hinder adaptation of climate smart technologies. Although decision making are by household head mostly men are advanced in age, implementation is by the youth, women and hired labour. Both the decision maker and implementers need to be targeted. In some cases based on activity and risk of financial losses men, women and the youth find themselves involved in either decision making or their implementation or both activities. The groups recommended that efforts should be put in developing criteria to identify target decision makers and training for both the decision makers and implementers. Other activities to address the constraint should include training, monitoring and evaluation of the adaptation strategies proposed.

3. Capacity for dissemination: The group members felt that the capacity for information dissemination was insufficient. The listed areas where capacity is lacking to include on extension methods, ability to package information appropriately and the language barriers especially with technical terms that have no vernacular words. Inadequacy in the number of extension agents was also identified where the ratio of an extension officer to farmers was quite high. The group recommended the engagement of consultants to train trainers of trainers (ToT) who would latter train extension agents who would subsequently train the farmers. Institutions to be targeted to ameliorate of this constraint include the ToTs, extension agents and farmers. Main intervention activities will involve training and monitoring and evaluation.

4. Extension methodologies and farm management. Issues of concerns in extension methodologies and farm management were concerned with qualifications and techniques for

provision of extension services and farm management information. The group recommended training of extension officers with the issue addressed at policy level. Institutions to be targeted includes the small scale and the plantation subsectors. Activities to be undertaken include develop standard training modules applicable to target groups and dissemination of the modules to target groups.

5. Low Level of return from farm produce. Group's members were concerned with the low profitability from farming and felt that it was to constraint adoption of climate change smart technologies. Members felt that their existed need to conduct economic analysis of various farm enterprises with a view of establishing returns from those undertakings. Results of the enterprise analysis were proposed to be an important input in developing climate change action plans. The institution to be addressed for this intervention was the household. Main activity under this intervention was research.

Cultural factors:- Among cultural issues identify as hindrance to adoption of climate included:- land (including issues based on ownership, access and utilization), religion and beliefs (taboos, myths), education, age, gender parity in decision making and implementation on cultural constraints to adoption of climate-smart technologies, climate change strategies were to be informed by social cultural backgrounds of the community targeted. The relevant intervention in this case was to sensitize communities on significance of climate change strategies recommended. Extension agents were identified as the core institution for targeting. The main activity to address the cultural constraints to adoption of technologies was training.

Institutional barriers:- Constraints to adoption of climate-smart technologies that were institutional in nature were identified as: government bureaucracy and inadequate facilitation, capacity for extension services (ratio, skill gap, inadequate facilitation), private sector operations (duplication of services, bureaucracy and rigid project lines, ownership of projects) and capacities of other stakeholders (levels of education, facilitation, ownership). Interventions to address institutional constraints will include advocacy, developing joint concept notes for funding, adaptation of integrated extension approaches (e.g. farmer field schools (FFS) or lead farmers model to assure sustainability), integrated trainings in organizations extension budgets for sustainability, collaborative project implementation. Target groups for intervention include all the stakeholders. The main activity will involve training and networking.

Required expertise:- Addressing the challenges of assessing vulnerability and capacity for adaptation by small holders will require a multi-professional approach. Professionals required include environmentalist, sociologist, economists, agronomist and trainers (private sector and government representatives). Interventions necessary in ensuring relevant professionals are involved in the implementation of the project include: identification of experts based on training and need assessment. Institutions identified for targeting in addressing the intervention included all tea value chain actors. Main activity to be undertaken under this intervention was identified as conducting of the baseline survey.

Institutional requirements: Capacity necessary for addressing institutional requirement to address the assessment of vulnerability and capacity for adaptation by smallholder farmers were identified to include: funding (for development of training tools, survey and facilitation), capacity building on climate change strategies, creating forums for sharing experiences and best practices, developing joint concepts for funding raising and identification of gaps at institutional levels and building capacities. In addressing the constraints associated with capacity necessary for addressing institutional requirement in assessment of vulnerability and capacity for adaptation by smallholders, FAO was identified as the institution that could facilitate at onset. Individual institutions were also required to contribute to ensure sustainability of the activities. Institutions identified for targeting includes Kenya Tea Growers Association (KTGA), Kenya Development Agency (KTDA), Kenya Metrological Department (KMD), TRFK, GIZ, ETP and TBK. Other institutions that could be targeted include certification bodies and agricultural sector line ministries. The main activities under this intervention were proposed as:- knowledge sharing among institutions, identification of information gaps and creation of data bank and developing a way forward strategy for effective adaptation.

Plenary Discussion:-

Issues raised on the presentation included failure for the group to prioritize the key concerns, lack of concerns targeting policies and failure to include all experts especially the anthropologists in their targeted stakeholders for activities implantation.

Session 5: Wrap up session and way forward

- i. There is a need to put in place sustainable measures, institutional arrangement and systems for the purpose of this project
- ii. There is a need to come up with priorities for the way forward
- iii. It is the responsibility of Kenya as the lead advisor on developing the way forward in developing climate change interventions.
- iv. The project was recommended as being useful to the country and the tea industry. It was recommended that the project target small-scale farmers and consolidate all stakeholders to form one entity before approaching the small-scale farmers

Appendix.

List of the workshop participants.

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