COMPETITIVE GRANTS SYSTEM (CGS)

CALL FOR CONCEPT NOTES

for

ADAPTIVE COLLABORATIVE RESEARCH

1.0 PREAMBLE

1.1 Agriculture is the backbone of the Kenyan economy contributing directly 27% of GDP; 65% of export earnings; and 27% of the GDP indirectly through links with manufacturing, distribution and service-related sectors. Almost all (approximately 98 percent) of agriculture in Kenya is rain-fed; hence, extremely vulnerable to the increasing temperatures and droughts. Kenyan agriculture is thus highly volatile, mainly due to extreme weather events, for example, erratic rainfall, droughts and rising mean temperatures, which are increasing in frequency and intensity with climate change. Other factors include commodities price fluctuations, pests and diseases, and floods. Climate-smart agriculture (CSA) aims to achieve three outcomes (triple wins): i) sustainably increasing agricultural productivity and incomes; ii) adapting and building resilience to climate change; and iii) reducing and/or removing greenhouse gas (GHG) emissions. This offers an appropriate strategic framework for responding to the challenges. Meeting these challenges requires technologies, innovations and management practices (TIMPs) to build resilience and adaption to climate change.

1.2 The Kenya Climate Smart Agriculture Project (KCSAP) is a Government of Kenya (GoK) project, supported by the World Bank under the State Department for Crops Development in the Ministry of Agriculture, Livestock, Fisheries & Irrigation (MoALF&I). The Project Development Objective (PDO) is ***"To increase agricultural productivity and build resilience to climate change risks in targeted smallholder farming and pastoral***

communities in Kenya, and in the event of an Eligible Crisis or Emergency, to provide immediate and effective response'. The project focuses primarily on: (i) improving water/soil management, especially within smallholder systems in the marginal rainfall zones—specifically, in smallholder mixed crop-livestock, crop-livestock-tree (agro-silvo-pastoral) production systems and in crop forest (agro-forestry) production systems; (ii) promoting sustainable, community-driven rangeland management and improved access to quality livestock services in ASALs—specifically, in pastoral/extensive livestock production systems; (iii) supporting the generation and dissemination of improved agricultural TIMPs and building sustainable seed systems; and (iv) enhancing access to quality agro-weather, climate, advisory, and market information services among farmers/herders for improved decision making.

The project is being implemented in the following 24 counties, namely: Marsabit, Isiolo, Tana River, Garissa, Wajir, and Mandera (Arid areas): West Pokot, Baringo, Laikipia, Machakos, Nyeri, Tharaka Nithi, Lamu, Taita Taveta and Kajiado (Semi-Arid areas): Busia, Siaya, Nyandarua, Bomet, Kericho, Kakamega, Uasin Gishu, Elgeyo Marakwet and Kisumu (Medium to high rainfall areas). The KCSAP priority value chains are: cassava, green grams, sorghum, millet, pigeon peas, bananas, tomato, Irish potatoes, beans, apiculture, indigenous poultry (meat and eggs), dairy (cattle, camel and goats), red meat (cattle) and aquaculture.

1.3 KCSAP has established a competitive Grants System (CGS) to provide collaborative research grants (CRGs) that support implementation of agricultural research through the National Agricultural Research System (NARS) framework led by Kenya Agricultural and Livestock Research Organization (KALRO). The KCSAP-CGS is designed to achieve efficiency, synergy, and cost effectiveness by applying inter-disciplinary, multi-institutional and holistic collaborative research incorporating the agricultural product value chain approach and the public-private-partnership (PPP) strategy.

1.4 **Main objective of the CGS**: To support implementation of adaptive and applied collaborative research for development, validation and dissemination of market-led, demand-driven, context specific CSA. The KCSAP CGS uses the 'Collaborative Research Model' (CRM) as its main vehicle for research projects' development and implementation. The model applies the Agricultural Product Value Chain (APVC) approach as its primary

framework for research priority setting, planning and implementation; and PPP as the basis for establishing research consortia.

1.5 Research Call: KCSAP is inviting concept notes from public and private agricultural research and development institutions, universities, and any organization involved in agricultural research to conduct **adaptive collaborative research** along priority agricultural product value chains (APVC) to generate context-specific CSA-TIMPs that contribute to attainment of the triple wins; namely i) increased productivity, ii) enhancing resilience, and iii) reducing GHG emissions

'***Adaptive Research***' in the KCSAP context, is on-farm research undertaken to enhance productivity and/or solve farmers' problems. TIMPs exist within KALRO, agricultural universities and other NARS institutions, developed by scientists in these institutions, which can respond to CSA needs of the country. Some of these TIMPs require further testing, prior to up-scaling for adoption in the target project counties. Research under this framework will focus on participatory field-testing to address issues on refining/improving context-specific CSA-TIMPs that contribute to attainment of the triple wins; namely i) increasing productivity, ii) enhancing resilience, and iii) reducing GHG emissions.. The research process shall require concerted efforts of multi-institutional and multi-disciplinary teams and will therefore be undertaken by competitively identified Research Consortia.

2.0 GUIDELINES FOR DEVELOPMENT OF THE CONCEPT NOTE

2.1 GENERAL REQUIREMENTS

A Concept note MUST demonstrate:

(a) Clear multi-institutional, multi-disciplinary and APVC approaches;

(b) Definite and context-specific research interventions and target beneficiaries at specific segments of APVC continuum;

(c) Market orientation and agri-business development potential;

(d) Potential to contribute to at least one of the CSA triple wins (increased productivity, enhanced resilience, reduced greenhouse gases emissions) and their sustainability;

(e) Integration of cross-cutting issues i.e. gender, vulnerable and marginalised groups (VMGs), social-cultural and environmental issues;

(f) Potential for generation of new information/knowledge on TIMPs for decision making

(g) Potential for pro-poor growth;

(h) Potential for impact;

(i) Attainable outputs within the project timeframe of three years.

2.2 SPECIFIC REQUIREMENTS FOR CONCEPT NOTES

2.2.1 Title: Should be short, clear and simple and should reflect the scope of the project - (***Maximum - 17 words***).

2.2.2 Background: Should provide a broad overview of the proposed project describing the sub-sector and its contribution to the national economy and a brief review of work undertaken in the subject area. A concise statement on the selected value chain's/thematic area highlighting context-specific CSA issues, constraints and opportunities should also be provided ***(Maximum - One page*).**

Statement of the Problem and Justification: Should be brief and clearly specify identified CSA constraints/research gaps along the APVC. It should justify the need for the proposed interventions. The approach should be innovative and consider target beneficiaries in the CSA TIMPs transfer and highlight possible impact in respect to the triple wins.

The statement should:

(a) Have sufficient technical and scientific information to justify the project.

(b) Have sufficient evidence of linkage between the research, production and market and how the weak linkages will be addressed.

(c) Demonstrate innovativeness in the project approach.

(d) Indicate suitability of the project study area to provide adequate opportunities for testing and promotion of CSA TIMPs

(e) Indicate the project's potential to bring about improved livelihoods in terms of food and nutrition security, health and employment.

(f) Indicate how the beneficiaries will be involved in the project design and implementation.

(g) Indicate how the cross-cutting issues i.e. gender, vulnerable and marginalised groups (VMGs), social-cultural, and environmental issues, will be mainstreamed into the project; - (***Maximum - 200 Words***).

2.2.3 Collaboration and Partnerships: Should clearly demonstrate collaboration and partnership indicating effective linkages among the different actors in the APVC continuum; and how their mix, skills and roles will contribute to the proposed research emphasis on CSA - (***Maximum - 100 Words***).

2.2.4 Goal and Objectives: The research goal should clearly show how the project will contribute to the CSA triple wins and the national development goals as elaborated in Agricultural Sector Transformation and Growth Strategy (ASTGS, 2019-2029), the Kenya Climate Smart Agriculture Strategy (2017-2026) and Vision 2030. The objectives should be SMART and listed in order of priority - (***Maximum - 100 Words***).

2.2.5 Expected Outputs and Outcomes: Describe the expected research outputs that the project should attain, with each output addressing a specific objective. Indicate the project's theory of change by highlighting the outputs uptake pathways, target stakeholders/partners/ultimate beneficiaries and formal/informal institutions that will adopt and use the findings. Consider:

(a) Realistically attainable outputs.

(b) Ability of proposed activities to deliver the outputs and attain the objectives.

(c) Technology dissemination and uptake promotion pathways.

(d) Potential for up-scaling and out-scaling the outputs.

(e) Sustainable mechanisms for exploitation of Project outputs - (***Maximum - 150 Words***).

2.2.6 Beneficiaries of the Outputs and Outcomes: Target group(s) should be clearly indicated and the accruing benefits – (***Maximum - 150 Words***).

2.2.7 Research plan/Methodology: Should provide a brief description of how the project will be developed and implemented, activities to be undertaken and how data will be collected

and analysed. The research plan should demonstrate involvement of relevant stakeholders and describe innovative approaches and methods to be used to achieve the desired outputs. The activities to accomplish each output should be sequential, necessary and sufficient. It should provide an indicative summary of the planned activities and expected outputs. In specifying an activity or group of activities associated with each output of the project, a brief description of the design of the study/survey/experiment and the communication and knowledge sharing strategy should be provided including market orientation and agri-business development potential.

Details of location of specific components of the research, including possible attention to environmental, social and gender issues should be included. A holistic approach involving participatory research methods and technology uptake pathways should be described. A clear monitoring and evaluation plan MUST be presented indicating necessary and sufficient milestones required to track the attainment of each activity. The research plan should also show a clear exit strategy. – (***Maximum – 500 Words***).

2.2.8 Major Assumptions and Risks: Include factors that might contribute to project's failure to achieve its objectives. - (***Maximum - 100 Words***).

2.2.9 Logical Framework*:* Sequencing of how results will be derived – (***In form of a table***).

2.2.10 Activity based Budget: A realistic and activity based budget should be provided. Brief summary notes explaining the need for the listed and budgeted items may be included.

3.0 THEMATIC AREAS AND RESEARCH FOCUS

3.1 KCSAP CGS/CRGs-AD 2019/CSC/01: CLIMATE SMART CROPS

Background: Climate change and weather variability contribute to low crop productivity which negatively impact on food and nutritional security as well as household incomes. This may further contribute to environmental degradation and poverty. In addition, climate variability and change leads to resurgence of pests and diseases resulting in low crops yields.

The situation is further compounded by high post-harvest produce losses occasioned by poor storage which could compromise food safety, further deepening food and nutritional challenges. Nutrition insecurity is compounded by inadequate access to bio-fortified crops. Limited access to suitable machinery poses an additional challenge to farmers along the entire value chain as they strive to improve efficiency in crop production and productivity. Further, limited processing and value addition and low farmer capacity for investment result in low household incomes; thereby, perpetuating the poverty cycle. The NARS has generated many crop TIMPs; some of which can be directly up-scaled while others require validation, and further research. Linkages to defined markets are poor and value addition limited, while the high cost of production limits productivity of many crop enterprises. Thus, the challenge is to ensure that farmers have ready access to context specific CSA TIMPs to help them improve productivity, and enhance resilience to climate change risks thereby ensuring sustained livelihoods.

The priority value chains for this thematic area are: **banana, cassava, green grams, millet, potato, pigeon peas, sorghum and tomato.**

3.1.1 KCSAP CGS/CRGs-AD 2019/CSC/01-1/Banana

a) **Objective:** To validate and disseminate context specific CSA TIMPs for increased sustainable banana production, product diversity and income generation to improve livelihoods of smallholder farming communities in project areas.

b) **Background Information:** Genus *Musa* (banana and plantain) was introduced to the African continent about three thousand years ago; and, has diversified with time through farmer selection of somatic mutants into more than 60 cooking banana types in the East African Highlands; and, more than 120 plantain types in West and Central Africa. Banana is among the most important horticultural crops in Kenya accounting for about 32 per cent of marketed value of fruits produced in the country today. Banana is an important source of food and nutrition security in the country providing much needed energy, minerals and vitamins. Also, it is an important source of livestock feed. The 'Banana Value Chain' generates income to smallholder farmers all the year round, creates employment for a large section of the rural population and contributes about Ksh. 17 billion to the national economy annually. Because of its importance, banana production has out-scaled considerably from the high rainfall/high production areas to the lower rainfall/low production arid and semi-arid lands (ASALs).

Despite its importance and potential for increased growth, banana production and utilization potential in the country has not been fully realized. Yields of 30 to 40 t /ha are realizable; yet, local smallholder farmers harvest 10 t/ha or less. Constraints limiting the realization of the banana potential include; variable and erratic rainfall, unavailability of clean planting materials of suitable and adaptable varieties, low and declining soil fertility, limited use of recommended production inputs, high incidence of pests and diseases and limited information on suitable management practices. Diseases often lead to over 40 per cent crop losses. Viral diseases such as Cucumber Mosaic Virus (CMV), Banana Bunchy Top Virus (BBTV), Banana Streak Virus (BSV), Banana Bract Mosaic Virus (BBrMV) and Banana Mild Mosaic Virus BanMMV) are important. Other diseases include; Sigatoka, *Fusarium* wilt (Panama Disease) and Xanthomonas Wilt (BXW). Validation of appropriate TIMPs to address these constraints focusing on the mid- to high- rainfall areas and the ASALs is crucial.

Potential areas of intervention include: a) availing appropriate varieties, b) improving access to good quality planting material, c) improving agronomic practices, d) improving access and use of farm inputs, e) management of pests and diseases, f) reducing postharvest losses, g) value addition, and h) improving marketing channels and infrastructure. Banana has been identified by six project counties (Baringo, Kericho, Bomet, West Pokot, Nyeri and Tharaka Nithi) as one of their priority value chains for upgrading.

c) **Areas of Research Focus:** Consider one or more the areas listed below with regard to banana for your concept note.

   (i) Validate and disseminate improved high yielding drought and disease tolerant banana varieties adapted to different agro-ecological zones of the ASALs.

   (ii) Validate and disseminate best bet integrated agronomic practices focusing on water harvesting and water use efficiency, soil fertility management and crop management practices.

(iii) Validate and disseminate suitable Integrated Pest Management (IPM) practices for priority diseases and pests incorporating surveillance strategies for selected key diseases and their vectors.

(iv) Validate and disseminate post-harvest TIMPs to minimize loses, enhance product diversity and improve quality by incorporating maturity, storage and packaging aspects.

(v) Test and promote integrated TIMPs for pest and disease control and management, e.g. Fusarium wilt, Banana *Xanthomonas* Wilt (BXW), Black Sigatoka, banana Weevils and nematodes

(vi) Test and promote improved post-harvest technologies for both dessert, cooking and plantain bananas

(vii) Test and promote value addition & product diversification

(viii) Conduct studies to identify domestic and export markets for bananas and its products and develop models to link farmers to these markets

(ix) Conduct studies on market access and price stabilization/policy issues

3.1.2 KCSAP CGS/CRGs-AD 2019/CSC/01-2/Cassava

a) **Objective:** To validate context specific CSA TIMPs for sustainable cassava productivity for food and nutrition security, employment creation and improved livelihoods of target smallholder communities.

b) **Background:** Cassava (*Manihot esculenta* Crantz), contributes significantly towards Kenya's national goal for food and nutrition security, poverty alleviation, jobs creation, and industrial products. Apart from being a human food, cassava has a commercialization potential for replacing 10-30% and 60-70% of maize in animal feeds and confectionery products, respectively, and 60% of barley in beer malt. Cassava is the most widely grown root crop particularly in the arid and semi-arid lands, and an important source of dietary energy for over 500 million people in developing countries. Area under cassava production in Kenya is estimated at 83,486 ha, with annual production of 1,481,518 tons. Although cassava has high potential to address food security, its production is threatened by climate variability and change amidst biotic

challenges which are being experienced in the country. In addition, off take of cassava production has faced challenges due to constraints occasioned by diseases (Cassava Brown Streak Disease (CBSD), late maturing varieties, lack of climate smart adaptable varieties, low yields, lack of seed systems, insufficient value addition, and limited markets linkages. Suitable technologies are therefore required to address challenges along cassava value chain occasioned by climate change.

Potential areas of intervention include; increased productivity, reduced postharvest losses, pests and diseases control, access to good quality planting material, appropriate CSA varieties, good agronomic practices, improved value addition and processing. Cassava has been identified by three project counties (Lamu, Kisumu, and Busia) as one of their priority value chains for upgrading.

c) **Research Focus:** Concept notes should focus on one or more of the following areas:

- **(i)** Test and disseminate climate smart cassava varieties and their associated agronomic practices for different market niches
- **(ii)** Validate community based production and distribution of clean cassava planting materials.
- **(iii)** Validate integrated soil, water and nutrient management TIMPs for the ASALs,
- **(iv)** Test and promote integrated TIMPs for pest and diseases control and management.
- **(v)** Test and promote improved storage technologies for both seed cuttings and harvested tubers
- **(vi)** Value addition, processing, product diversification and consumer studies.
- **(vii)** Test and validate cassava business model(s) for niche market linkages.

3.1.3 KCSAP CGS/CRGs-AD 2019/CSC/01-3/Green grams

a) **Objective:** To enhance green gram (*Vigna radiata)* productivity through validation of efficient climate smart agriculture (CSA) technologies, innovations and management practices (TIMPs) for improved food, nutrition and income security for smallholder communities in project counties.

b) **Background:** Green gram is a central income generating agro-enterprise for the rural communities thus contributing to Kenya's economic growth. With more than 302,000 ha under green gram, the country produces 149,000 tons annually which is far below the domestic demand. It contributes to over Ksh. 32 billion to the Kenya's economy. Over the last five years, the country has registered a 77% increase in green gram acreage from 188,000 ha in 2012 to over 302, 000 ha in 2017. This is attributed to expansion of green gram to non-traditional growing areas. Despite its importance in drought prone environments and high demand, its yields have remained low. For example, yields declined from 0.61 t ha^{-1} in 2015 to 0.49 t ha^{-1} in 2017. However, the increase in green gram acreage and production has not met the growing domestic demand. With the changing climate which might negatively affect green gram productivity, application of climate smart technologies is one way of addressing the declining productivity.

Potential areas of intervention include: (i) awareness creation on improved varieties, (ii) improving agronomic practices and increased and appropriate use of agricultural inputs, (iii)) improving access to certified seed of improved varieties, (iv) improving Extension Services, (v) reducing postharvest losses, (vi) management of pests and diseases, (vii) value addition, (viii) mechanization, and (ix) improving market access. Green gram has been identified by five project counties (Isiolo, Machakos, Taita Taveta, Tharaka Nithi, West Pokot) as a priority value chain for up-scaling.

(c) **Research Focus:** Concept notes should focus on one or more of the following areas:

(i) Dissemination and promotion of climate smart green gram varieties
(ii) Validate farmer and market acceptable climate smart green gram varieties
(iii) Validate sustainable water and soil management (water harvesting, Conservation Agriculture, etc) for green grams
(iv) Promote efficient green gram seed production and delivery systems
(v) Validate and promote technologies that minimize post-harvest losses
(vi) Validate and promote sustainable diseases and pests management TIMPs.
(vii) Validate and promote green gram value-added food products
(viii) Validate and promote cost effective labour saving technologies along the value chain
(xi) Strengthen market linkages.

3.1.4 KCSAP CGS/CRGs-AD 2019/CSC/01-4/Finger Millet

a) **Objective:** To validate and disseminate context specific CSA TIMPs for increased finger millet production, marketing and utilization for human and industrial consumption; and, for livestock feed; hence, increased food and nutrition security and incomes of target communities.

b) **Background:** Finger millet (*Eleusine coracana* (L.) Gaertn) is an important drought tolerant small grain food crop indigenous to East Africa; and, grown by smallholder farmers. It is most prominent among the millets for its high nutritive value and excellent storability; hence, its importance in food and nutrition security. It is also important for its cultural value. Further, finger millet stover has been documented to make good fodder for livestock, containing up to 61 per cent total digestible nutrients.

In Kenya, the crop is currently estimated to be grown on about 85,000 ha annually mainly in Western and Rift valley regions. Low yields ranging from 500 to 750 kg/ha constitute the main problem associated with finger millet production. These low yields compare poorly with average yields of 2,500 kg ha^{-1} attained from improved research varieties; and, overall potential yield of over 5,000 kg ha^{-1}. Major constraints hampering finger millet production and utilization include limited knowledge on availability improved varieties, poor crop management practices, high labour requirement and low level of mechanization, pests and diseases, poor soil fertility, limited commercial utilization and lack of an organized marketing system. Nevertheless, the crop has potential to produce fairly high grain and forage yield with less inputs compared to other grain crops, provided that good management practices are applied.

There is need to develop, validate and disseminate more drought tolerant varieties and disease resistant/pest tolerant varieties, adapted to low inputs in marginal lands/ASALs. Also, there is need for testing and validating suitable agronomic packages including appropriate mechanization technologies. Finger millet has been identified by three project counties (Bomet, Kericho and West Pokot) as a priority value chain for up-grading.

c) **Areas of Research Focus:** Consider one or more the areas listed below with regard to finger millet for your concept note.

(i) Validation and dissemination of improved high yielding drought, disease resistant finger millet varieties adapted to marginal rainfall areas of Kenya, in particular the ASALs.

(ii) Validation and dissemination of best bet integrated agronomic practices focusing on soil fertility management, water use efficiency, suitable and cost effective weed control approaches and appropriate mechanization to alleviate high labour requirements and reduce drudgery.

(iii) Validation and dissemination of post-harvest handling technologies focusing on threshing, winnowing and storage.

(iv) Validation and dissemination technologies for value addition and product diversification for increased market demand and enhanced consumer preferences.

3.1.5 KCSAP CGS/CRGs-AD 2019/CSC/01-5/Potato

a) **Objective:** To develop and validate context specific CSA TIMPs for enhanced and sustained potato productivity for food and nutrition security, employment creation and improved livelihoods of target smallholder communities.

b) **Background:** Potato contributes significantly towards Kenya's national goal for food and nutrition security, poverty alleviation, job creation, and industrial products. The area under production is approximately 151,987 ha with annual production estimated to be 1,519,870 t. The crop is grown by about 800,000 smallholders who contribute over 90% of the production and employs about 2.7 million actors along the value chain. It contributes over Kshs 50 billion to the economy annually. However, most of the production is under rain-fed conditions and is therefore vulnerable to the effects of climate variability and change. The crop's potential has not been fully exploited owing to various challenges along the value chain. Suitable technologies are therefore required to address challenges occasioned by climate change. Potato has been identified by four project counties (Elgeyo Marakwet, Nyandarua, Nyeri and Taita Taveta) as one of their priority value chains for upgrading.

Potential areas of intervention include (a) improving access to good quality planting material, (b) availing appropriate varieties (c) improving access and use of farm inputs, (d) improving agronomic practices, (e) management of pests and diseases, (f) storage technology and reducing postharvest losses, and (g) improving market access

c) **Research Focus:** Concept notes should focus on one or more of the following areas:
   - **(i)** Adaptation of climate smart potato varieties and their associated agronomic practices for different market niches
   - **(ii)** Validate community based seed potato production and distribution models to improve access to quality seed by smallholder farmers
   - **(iii)** Validate integrated soil, water and nutrient management TIMPs for the ASALs
   - **(iv)** Validate and promote integrated TIMPs for pest and disease control and management, e.g. bacterial wilt and late blight; leaf miners, potato tuber moth and potato cysts nematodes
   - **(v)** Validate and promote improved storage technologies for both seed and ware potatoes
   - **(vi)** Value addition and product diversification
   - **(vii)** Marketing models and price stabilization/policy issues.

3.1.6 KCSAP CGS/CRGs-AD 2019/CSC/01-6/Pigeon peas

a) **Objective:** Enhancing pigeon pea CSA TIMPs for improved productivity, food and nutritional security and incomes for smallholder communities in Kenya.

b) **Background:** Pigeon pea is a drought-tolerant crop primarily grown by smallholder farmers in ASALs mostly for cash and food security. The pulse permits multiple harvests throughout the year and is considered a suitable climate smart crop for the ASALs. It has a high protein content making it vital for preventing malnutrition commonly associated with starch-based diets of vulnerable rural communities. With more than 276,000 ha under pigeon pea, the country produces 275,000 tons contributing to over US$ 170 million to the Kenya's economy. Despite its importance in drought prone environments and the crucial role it plays in food security and income generation, little attention has been given to testing and validation of climate smart technologies for sustainable productivity.

Potential areas of intervention include; a) improving productivity, b) adoption of good agronomic practices, c) effective seed distribution networks for access to certified seed of improved varieties, d) adequate extension services, e) pests and diseases control, f) reduced storage losses and quality, and g) increased access to market linkages. Pigeon pea has been identified as a key commodity for up-scaling by Machakos County.

c) **Research Focus:** Concept notes should focus on one or more of the following areas:
   (i) Testing and validating climate smart pigeon pea varieties
   (iii) Validating efficient formal pigeon pea seed production and delivery systems
   (v) Validate sustainable diseases and pests management CSA TIMPs.
   (vi) Validate and strengthen market linkages of pigeon peas value chain

3.1.7. KCSAP CGS/CRGs-AD 2019/CSC/01-7/Sorghum

a) Objective: The objective is to contribute to food security, industrial growth, agribusiness enterprise development and improved household income among targeted farming communities in Kenya through validation and dissemination of context specific sorghum CSA TIMPs

b) Background*:* Sorghum [*Sorghum bicolor* (L.) Moench] is ranked fifth in importance as a food crop worldwide after maize, wheat, rice and barley. In Kenya, the crop is grown on some estimated 184,654 ha and it support over 25% of Kenyans in food supply and more than 26% of livestock as source of feed. It is adapted to the arid and semi-arid lands which accounts for about 80% of Kenya's total land mass and which receives less than 750 mm of annual rainfall. It is estimated that sorghum requires about 332 kg water for 1 kg of dry matter compared to 368 kg and 514 kg of water for similar amount of dry matter in maize and wheat, respectively, making it a smart choice for climate smart agriculture (CSA). The production of sorghum has risen in the last ten years from some 54,000 MT in 2008 to about 180,000 MT in 2018. The rise in sorghum production has been occasioned by industrial demand, particularly the East African brewing limited (EABL) company. This demonstrates that market is the main driver for increasing sorghum production in Kenya.

However, production is still low relative to the fact that sorghum is among the few crops with rich diversity, which offer multiple possibilities for selection of genotypes adaptable to both CSA TIMPs and a wide range of uses. Sorghum has potential to support domestic food needs and industrial growth, particularly the feed processing, baking, brewing, agrochemical and bio-energy. These markets are yet to be tapped for economic gain and improved livelihoods of the players in the value chain. The impeding challenges include lack of suitable varieties to support the available market and where available, seed accessibility is limiting. There is also limited effort to deliberately avail and promote suitable sorghum material for different uses, such as; feed, baked food products, confectionaries, industrial alcohol, and as a blending ingredient in cereal food processing.

The potential areas of intervention include (a) increasing awareness of improved varieties, b) validation of improved varieties, (b) access to good quality seed, (c) improving agronomic practices (d) management of pests and diseases including bird damage, (e) storage technology and high postharvest losses, (f) mechanization, (g) increasing consumption and marketing. Sorghum has been identified by eight project counties (Baringo, Siaya, Isiolo, Kericho, Kisumu, Laikipia, Mandera and West Pokot) as one of their priority value chains for upgrading.

c) Research Focus:

i) Validate and promote suitable varieties for different agro-ecological zones for feed processing, industrial malting and brewing, industrial ethanol, baking and confectionary products, forage and fodder

ii) Validate and promote TIMPs for integrated soil, water and nutrient management including tolerance to saline soils and high temperatures prevalent in the arid and semi-arid lands

iii) Screen and validate varieties low in anti-feedant [cyanogenic glycosides (eg prussic acid), lignin and cellulose] properties in sorghum forage and fodder;

iv) Validate and promote weed management TIMPs include striga weed

v) Promote seed production and distribution systems

vi) Value addition and product diversification for different consumer

vii) Validate and promote mechanization TIMPs

viii) Evaluate and develop business models for market linkages.

3.1.8. KCSAP CGS/CRGs-AD 2019/CSC/01-8/Tomato

a) **Objective:** To develop and validate context specific CSA TIMPs for enhanced and sustainable tomato productivity for food and nutrition security, employment creation and improved livelihoods of target smallholder communities.

b) **Background:** Tomato *Solanum lycopersicum* L. is the second most important exotic vegetable and is widely consumed in Kenya. Tomato plays a critical role in meeting Kenya's food and nutritional security, supplying raw materials for processing industries, generation of income, foreign exchange earnings and creation of employment opportunities. The crop is grown by smallholder farmers in about 21,920 ha with production of 410,033 tonnes. While average yields of 500 t/ha have been recorded in Europe, the average yield of tomato in Kenya is half the worlds' average of 37.6 t/ha. Tomato production is mainly rain-fed hence highly vulnerable to the effects of climate variability and change. The crop potential has not been fully exploited owing to various challenges along the value chain. Climate-smart intervention technologies should be developed for a productive, sustainable and robust tomato value chain in Kenya.

Potential areas of intervention include; seasonality of production; appropriate varieties for different markets, Pests and Diseases, good agronomic practices, appropriate soil and water management, reduced post-harvest losses, enhanced value addition, and improved market linkages. Tomato has been identified by seven project Counties (Kajiado, Biomet, Siaya, Elgeyo Marakwet, West Pokot, Garissa and Mandera) as one of their priority value chains for upgrading.

c) **Research Focus:** Concept notes should focus on one or more of the following areas:

(i) Testing and adaptation of climate smart tomato varieties and their associated agronomic practices for different market niches

(ii) Validate community based tomato seedling production and distribution models to improve access to quality planting material for smallholder farmers

(iii) Validate integrated climate smart soil, water and nutrient management TIMPs for the ASALs

(iv) Test and promote integrated TIMPs for pest and diseases management

(v) Assessing and quantifying postharvest and mitigation measures along the value chain

(vi) Assess and promote value addition and product diversification

(vii) Evaluating business models, market linkages and networks for improved price stabilization issues

3.2. *KCSAP CGS/CRGs-AD 2019/CSLA/02: CLIMATE SMART LIVESTOCK & AQUACULTURE*

Background: Kenya has an estimated 4.5 million dairy cows, 13.7 million local zebus, 25.6 million goats, 18.7 million sheep and 3.3 million camels; 28 million birds (of which 76% is free ranging indigenous chicken with only 22% being commercial layers and broilers and another 2% of other poultry species). The country has fast growing fish species and fresh and marine water resources suitable for varied aquaculture systems. In reference to apiculture, about 80 % of Kenya's land is favourable for beekeeping especially in ASAL areas, which provide livelihoods to 80% of small scale farmers. Due to the high contribution of the livestock sector to the AgGDP (about 40%) and its importance to food security and employment creation, there is need to undertake research to ensure increased productivity in the changing climatic conditions. Other than milk, the country is a net importer of livestock products, and the increasing future demand indicates that even with milk there is need to treble current production by 2030. Livestock and aquaculture, like all other agricultural sub-sectors, is will be affected by the effects of climate change that are being experienced globally. There is need to re-orient production to conform with this reality to include genotypes and feed resources that are adapted to this change taking into consideration emerging and re-emerging diseases and safety of the milk and milk products, and GHG emissions.

The priority value chains for this thematic area are: apiculture, indigenous poultry (meat and eggs), aquaculture, dairy, and red meat (cattle).

KCSAP CGS/CRGs-AD 2019/CSLA/02-1/ DAIRY

(a) **Objective:** To enhance and sustain high dairy animal productivity for improved livelihoods, food and nutrition security and employment creation of the target communities through climate smart technologies and practices.

(b) **Background:** Kenya has an estimated 4.5 million dairy cows, 13.7 million local zebus, 25.6 million goats, 18.7 million sheep and 3.3 million camels; the dairy sub-sector being based on a combination of these species. The current combined production is 5.2 billion litres annually, which is just above the demand. Kenya will continue to experience growing demand for milk and dairy products driven by expanding urbanization, an increasing population and growing middle class and hence the need to increase milk available. It is estimated that the demand will rise to 12.5 billion litres by 2030. The specific objectives of the Kenyan dairy sub-sector should include; improvement of individual animal productivity resulting in competitiveness; positive contribution to the livelihoods of households; food and nutrition security through increased domestic consumption of milk and milk products and ensuring the safety of consumed milk. The dairy sector, like all other agricultural sectors, is and will be affected by the effects of climate change that are being experienced globally. There is need to re-orient production to conform with this reality to include genotypes, feed resources that are adapted to this change taking into consideration emerging and re-emerging diseases and safety of the milk and milk products, and GHG emission. Under KCSAP research shall focus on all aspects of cattle, goats and camel milk value chains.

(c) **Research Focus:** Consider one or more of the areas listed below with regard to the cow, goat and camel milk production:

- **(i)** Validate and promote climate smart forage and fodder varieties and develop their husbandry and conservation for dry season feeding strategy.
- ***(ii)*** Germplasm improvement and development through cross breeding and conservation of appropriate and adaptable breeds.
- **(iii)** Selection of dairy breeds for adaptability to climate change using economic breeding value by deriving Economic Breeding Indices (EBI) with a focus on farm profitability.

(iv) Formulation of safe, appropriate and cost-effective feed rations for improvement of productivity centred on adaptability, resilience and reduction of GHGs

(v) Improved utilization of crop-residues and agro-industrial by-products as feed to sustain productivity during dry seasons

(vi) Rumen microorganism manipulation to reduce GHG emission.

(vii) Strategies for management of diseases endemic / priority / emerging / zoonotic / re-emerging diseases, including surveillance.

(viii) Dairy products diversification.

(ix) Validation and promotion of appropriate dairy housing, and efficient manure management systems.

3.2.2. KCSAP CGS/CRGs-AD 2019/CSLA/02-2/ RED MEATS

(a) Objective: To enhance the red meats value chains for improved productivity and commercialization of meat and meat products through climate smart technologies and practices.

(b) Background. Red meats in Kenya are produced from cattle, goats, sheep and camels and constitute about 70 – 80 percent of all the meat consumed in the Country. Cattle is Kenya's most important source of red meat, supplying by volume 75.6 percent of the nation's ruminant off-take for slaughter. This is distantly followed by camel meat at 9.4 percent, goat meat at 9.2 percent and sheep at 5.8 percent.

Production of meat from these animal species is currently constrained by various factors among them climate change, which has resulted in feed shortages and emerging and re-emerging livestock diseases.

Potential areas for intervention include (a) inappropriate breeds, (b) poor breeding practices, (c) slow growth rates, (d) inadequate quality feeds, (e) poor feeding practices, (f) diseases, (g) inadequate market infrastructure, (h) poor adherence to animal welfare (i) poor handling of carcasses, and (j) low levels of value addition. The red meats value chain was selected by a total of twelve Counties with the beef cattle value chain selected by five counties (Isiolo, Taita Taveta, Tana River and Wajir), the meat sheep value chain by six counties (Isiolo, Kajiado, Laikipia, Lamu, Taita Taveta, and West Pokot) and the

goat meat value chain by eight counties (Garissa, Isiolo, Kajiado, Lamu, Mandera, Marsabit, Taita Taveta, and West Pokot).

(c) **Research Focus:** Concept notes should focus on one or more of the areas listed below with regard to cattle, goat, sheep and camel meat production

- (i) Validate and promote climate smart forage varieties for growing and finishing animals for meat and develop their husbandry and conservation for dry season feeding.
- (ii) Selection of appropriate breeds for meat to satisfy market demands and develop conservation strategies for local breeds for posterity.
- (iii) Test and validate innovative breeding models /systems
- (iv) Test and validate finishing systems including on-pasture and feedlots with the aim of improved meat products quality and reduced GHG emission.
- (v) Validate and promote improved utilization of crop-residues and agro-industrial by-products as feed.
- (vi) Strategies for management of diseases including priority/emerging/re-emerging diseases as well as surveillance.
- (vii) Red meat products diversification for development of cottage industries.
- (viii) Appropriate and efficient manure management systems especially in feedlot finishing systems.
- (ix) Assessing appropriate markets and marketing systems for cattle, goat, sheep, camel and their products.

3.2.3. KCSAP CGS/CRGs-AD 2019/CSLA/02-3/ INDIGENOUS POULTRY

a) Objective: To enhance and sustain the indigenous poultry sub-sector for food and nutrition security; increased household incomes and improved livelihoods of the target communities through application of climate smart technologies and practices.

b) Background: Kenya has an estimated 37.3 million birds of which 84% is free ranging indigenous chicken. Poultry production and in particular indigenous chicken play a significant role in economic and social life of resource poor households contributing to cash and cheap source of animal protein. These birds are produced in different eco zones many of which severely affected by climate change. Climate change will not only affect

the scavenging resource but also occurrence and frequency of disease outbreaks. The management standards and biosecurity levels of the free range production systems of indigenous chicken are low, which hinders optimal exploitation. In order to improve their productivity, there is need for research to address the major constraints in the sub-sector. Potential areas of focus include availing improved breeds; improved housing; disease and pest management; improving feed rations and feeding strategies; improving post-harvest handling, preservation and value addition; improving food safety; and improving and market linkages.

c) Research Focus: Consider one or more of the areas listed below with regard to the indigenous chicken production:

(i) Conservation and selection of eco types for meat and/or egg line
(ii) Feed formulation for improved indigenous chicken using climate smart ingredients for sustainability.
(iii) Food safety to ensure animal health and safe products
(iv) Disease surveillance and health control for indigenous chicken to include priority/emerging/re-emerging diseases. Development of models for prediction of weather related disease occurrence.
(v) Climate smart housing, brooding and management technologies for indigenous chicken for different eco-zones
(vi) Post-harvest handling, preservation and value addition. This should include development of climate smart cottage industries for value addition of products from improved indigenous chicken
(vii) Effects of animal welfare on the birds, their products and marketing in changing climates

3.2.4. *KCSAP CGS/CRGs-AD 2019/CSLA/02-4/* AQUACULTURE

(a) Objective: To validate and adapt Aquaculture practices to the changing climate into a commercially viable industry to support food nutrition and improved livelihoods.

(b) Background: Kenya has a significant potential for development of a commercial aquaculture industry to meet the growing fish demand against declining wild fish catches. The country has fast growing fish species and other fresh and marine water resources suitable for varied aquaculture systems. The aquaculture industry has the potential of producing high-quality raw material for 'added value' products for local, regional and

international markets. Kenya's Vision 2030, and other policy frameworks recognize aquaculture as a source of food security, poverty reduction, and employment creation. The fisheries and aquaculture sub-sectors directly employ approximately125,000 fishers and fish farmers and support about 1.2 million people along the value chains. During the MTP II (2013–2017), the sub-sectors contributed an average of 0.6% (US $370 Million or approximately Kshs 37 billion) to the country's annual Gross Domestic Product (GDP) with a per capita fish consumption estimated at 4.5 kg/year. However, aquaculture production has continued to decline since 2014 due to major policy, socio-economic and environmental challenges.

The potential areas for intervention include; a) fish genetic improvement, (seed sourcing and breeding); b) fish feeds and production systems; c) surveillance for fish diseases and pests; d) improving sanitary and phyto-sanitary standards; e) reduction of post-harvest losses and f) value addition.

(c) **Research focus:** Consider one or more of the areas listed below with regard to aquaculture production:

- **(i)** Validate and disseminate fish species/strains for adaptability to changing climate.
- **(ii)** Formulate, test and disseminate safe climate smart feed rations for improvement of productivity and reduced GHG emission.
- **(iii)** Test and validate alternative but efficient aquaculture feed(s).
- **(iv)** Validate climate smart culture technologies, innovation and management practices that increase productivity.
- **(v)** Test and validate aquaculture disease surveillance and health control technologies.
- **(vi)** Validate climate smart water quality management practices.
- **(vii)** Validate climate smart technologies for value addition & product diversification.
- **(viii)** Test and disseminate appropriate and efficient fish waste management systems.

3.2.5. KCSAP CGS/CRGs-AD 2019/CSLA/02-5/ APICULTURE

c) **Objective:** To enhance high quality honey productivity through sustainable utilization of CSA beekeeping technologies, conservation of bee resources and establishment market linkages for increased food/nutrition security and income generation.

d) **Background**

Beekeeping is a climate Smart agricultural intervention that embraces sustainability, adaptation and mitigation of climate change and variability. Over 80 % of Kenya's land is favourable for beekeeping despite the observed low honey production in the country. Traditional beekeeping is the main form of beekeeping in Kenya among 80 % of small-scale farmers in the Arid and Semi-Arid areas in Kenya (ASALs). Beekeeping plays a key role in promoting food security through enhancing pollination services to crops and wild plants, production of hive products, income generation, and job creation as well as boosting manufacturing/textile industries that utilize hive products such as wax and propolis. However, optimal production of honey production in Kenya has not been achieved due to constraining factors such poor extension services delivery structures, huge knowledge gap in appropriate beekeeping skills and technologies, ineffective value chains, lack of access to appropriate equipment, unstructured and fragmented markets, inadequate bee forage availability and insufficient knowledge in bee pests and disease management. The Counties that have identified honey as one of the value chains for upgrading in order to enhance food security and resilience to climate change and variability include Kajiado, Nyandarua, Siaya, Lamu and Tana River.

Potential areas of focus include a) sustainable utilization of floral resources, b) honey production, c) housing; d) bee health and e) bee ecosystem management.

e) **Research Focus:** Consider one or more of the areas listed below with regard to promotion of apicultural productivity;

- **(i)** Test/validate interventions for identified bee pests and diseases
- **(ii)** Test and disseminate climate smart bee flora adaptable to specific eco-regions
- **(iii)** Adapt and promote habitat restoration approaches that protect bees and hive products from chemical exposure and other contaminants.
- **(iv)** Test and validate technologies for increased capacity building.
- **(v)** Identify market opportunities and linkages for honey and other products.

(vi) Test and promote TIMPs for increased hive occupancy and productivity

3.3 - *KCSAP CGS/CRGs-AD 2019/SER/03:* SOCIO-ECONOMICS RESEARCH

(a) Objective: To explore and improve the understanding and utilization of socio-economic opportunities, constraints and data related to adoption and impact of climate-smart TIMPs for the targeted value chains (crops, livestock, aquaculture, natural resources) in the different counties. Overall, the studies will generate information which researchers and other stakeholders will use to develop and promote client-focused, client-friendly CSA TIMPs (i.e. varieties, breeds, management practices, machinery and equipment), seed systems and policies.

(b) Background: The generation, dissemination, adoption and impacts of CSA TIMPs for improved livelihoods are highly influenced by the social, economic, cultural, gender, policy and political environment prevailing in the country. Availability of input and output markets, and conducive policies play a key role in influencing farmers and other value chains actors to adopt particular CSA TIMPs.

Ex ante cost-benefit analyses of the different value chain TIMPs and sectoral policies will be undertaken to understand the binding social, cultural, economic, and policy constraints to adoption and impacts of CSA TIMPs by farmers, fish folks, agro-pastoralists and pastoralists in the targeted counties. This will provide critical data and information required during the participatory R&D and delivery of CSA TIMPs for crops, livestock, aquaculture and natural resource management. The studies will also generate policy information to enhance policy advocacy for development, deployment, and adoption of CSA TIMPs.

(c) Research focus: The concept notes should focus on at least one of the following sub-themes:

3.3.1. *KCSAP CGS/CRGs-AD 2019/ SER/03-1 ADOPTION AND SUSTAINABILITY OF CSA TIMPs*

(a) Objective: To assess the economic viability (profitability), social acceptability and sustainability of the crops, livestock and natural resources CSA TIMPs for different value chains being promoted by the project in the 24 counties and collect/ manage relevant data for decision making.

(b) Background: Adoption and sustained use of TIMPs is highly influenced by the economic returns (cost-benefits) and social acceptability by the smallholder and other value chain actors. It is therefore important during the process of developing and promoting the adoption of various value chain TIMPs to understand their profitability and social acceptability for the different value chain actors involved the value chains. It is also important to identify the mechanisms that need to be put in place to ensure there is sustainability on the use of the TIMPs beyond the project period.

Collection, analysis and management of agricultural data is critical for decision making at various levels. More often production, marketing and trade decisions are made without appropriate information to back those decisions or predict the outcomes of the decisions. In order to ensure sustainability on continued use of the CSA TIMPs, there is need to develop and put in place mechanisms for collection, management and utilization of agricultural statistical data for decision making. For instance, various data collection and management tools (e.g. Open Data Kits – ODK, GIS, remote sensing) could be used to combine bio-physical and economic data to develop bio-economic models to enhance the prediction of productivity and production of various value chains for decision making. The information generated would assist in predicting the expected outputs (either surplus or deficits) in different seasons in different regions which could inform decision makers in taking appropriate actions. Such information would guide decision makers on issues such as input/output distribution networks, pricing, storage, provision of relief, importation and export of food stuffs in the country at different periods.

(c) Research Focus: Concept notes should focus on one or more of the following areas:

- **(i)** Assessing the profitability, social acceptability and sustainability of CSA TIMPs for crops, livestock and aquaculture value chains and natural resource management.
- **(ii)** Validation of mechanisms for collection, analysis and management of agricultural statistical data for decision making.
- **(iii)** Generation of information on dissemination, management, adoption and impacts of CSA TIMPs

3.3.2. *KCSAP CGS/CRGs-AD 2019/ SER/03-2 INPUT SUPPLY AND OUTPUT MARKETS*

(a) Objective: To determine the input supply and output markets required to support the adoption of CSA TIMPs of different value chains being promoted by the project.

(b) Background information: Availability of requisite input supply and reliable output markets are critical for agribusiness development. Once CSA TIMPs are developed, tested and validated, there is need to have a reliable and sustainable input supply system to ensure the CSA TIMPs are easily available, accessible and affordable. Most of the inputs are provided through a network of agro-vet retailers and other service providers. The distribution with counties and the technical capacity of the agro-vet retailers and other service providers is important to ensure the smallholder have access to the right inputs and receive the right technical advice on their use.

Value chain actors such as smallholder farmers, transporters, processors, wholesale/ retail traders, also require access to reliable output markets information to enable them get involved in a particular value chain as an economic activity. Such information is critical to enable them be effectively and efficiently involved in a particular value chain activity at reasonable economic returns.

(c) Research Focus: Concept notes should focus on conducting market research on one or more of the following areas:

(i) Assess the requisite input supply system for crop (seed, crop health interventions, fertilizers, water) CSA TIMPs and make actionable recommendations for improvement.

(ii) Assess the requisite input supply system for livestock (breeds, livestock health interventions, feeds) CSA TIMPs and make actionable recommendations for improvement.

(iii) Assess the requisite input supply system for aquaculture (fingerlings, feeds) CSA TIMPs and make actionable recommendations for improvement.

(iv) Assess the output markets for the targeted for CSA value chains (crops, livestock, and aquaculture) promoted in different counties through conducting market research to provide relevant market information and make actionable recommendations for agribusiness development.

3.3.3. *KCSAP CGS/CRGs-AD 2019/ SER/03-3: RURAL FINANCE MARKETS*

a) **Objective:** To assess rural finance markets for access to credit for CSA TIMPS

b) **Background information:** Access to capital to finance various value chain operations is critical for the adoption and sustainable use of CSA TIMPs. Value chain actors most often require access to finance the CSA TIMPs and also to meet the costs of output market operations. Apart from using own savings to finance various value chain activities, value chain actors can be encouraged to access credit from rural finance markets to finance their operations. The availability and access to credit at reasonable costs from rural finance markets would enable various value chain actors to finance the acquisition of the CSA TIMPs and access the output markets, thus supporting the sustainable use of the TIMPs and agribusiness development in the target counties.

c) **Research Focus:** Concept notes should focus on conducting research on the following areas:

   (i) Assessment of availability to various value chain actors and the effectiveness of rural formal and informal credit markets (including banks, SACCOs, savings and loan groups, table banking, welfare associations) to support the access to CSA TIMPs and output markets for agribusiness development.

3.3.4. KCSAP CGS/CRGs-AD 2019/ SER/03-4 POLICY, INSTITUTIONAL, AND REGULATORY FRAMEWORKS

(a) **Objective:** To evaluate the policy, institutional and regulatory frameworks to support the sustainable use of various value chains CSA TIMPs

(b) **Background information:** Every person has the right to be free from hunger, and to have adequate food of acceptable quality (Article 43 of the Constitution of Kenya (2010). In the effort to promote food security, Kenya has embraced an Agricultural Sector Transformation and Growth Strategy (ASTGS, 2019-2029) which envisions a vibrant, commercial and modern agricultural sector that sustainably support Kenya's

development in the context of devolution. Furthermore, one of the 'Big Four Agenda' of the Government is to ensure food and nutrition for all by the year 2022. KCSAP aims to achieve the 'triple-wins' - increasing agricultural productivity, building resilience to climate change and reducing greenhouse gas (GHG) emissions. The process of implementation of many development projects requires active participation involvement of stakeholders and establishment of community based institutions. It is important to ensure the continuity of these rural institutions after the end of projects for exit strategy.

Attainment of all these important development impacts will highly depend on having in place a conducive policy environment, appropriate institutional and regulatory frameworks that support adoption of CSA TIMPs. However, it is noted that there are many good agricultural policies developed in the country but their implementation has not always achieved the intended development outcomes, mainly due to lack of clearly time bound implementation frameworks.

(c) **Research Focus:** Concept notes should focus on conducting research on one or more of the following areas:

(i) Validate policy and institutional regulatory frameworks to provide information and enhance policy advocacy, development, and adoption of CSA TIMPs.

(ii) Validate policy, and institutional regulatory frameworks to provide information and enhance policy advocacy for marketing of produce from CSA TIMPs to enhance agri-business development

(iii) Evaluate policy and institutional frameworks to enhance collaboration among institutions (National and County Governments; national, regional and international research organizations; universities; NGOs, farmer groups and other CIGs) to enhance generation, dissemination and adoption of appropriate CSA TIMPs and agri-business development in different counties.

(iv) Validate and establish mechanisms for ensuring developed policies are systematically and effectively implemented to enhance impact of CSA, especially in the ASALs.

3.3.5. KCSAP CGS/CRGs-AD 2019/ SER/03-5 GENDER MAINSTREAMING AND SOCIAL INCLUSION

(a) **Objective:** To enhance gender mainstreaming and social inclusion in validation and adoption of CSA TIMPs

(b) **Background:** Gender affects individuals' and families' exposure to risk and their access to and control of resources (finance, land, technology, and services). Moreover, younger, vulnerable and marginalized groups (VMGs) may also suffer from poor access to critical agricultural resources. In most communities, food production is the responsibility of women and it has been observed that youth are involved in agricultural activities. However, CSA TIMPs may have undesired effects on relative workloads, assets, access to produce and incomes, food and nutrition security, access to inputs and services. Hence the need to establish interventions through a gender lens to ensure benefits are equitably accessed by women, men, vulnerable and marginalized groups in a society. Special attention should be taken into consideration to ensure that interventions help to reduce drudgery and the time burden on women famers and also attract more youth into agriculture. It is also important to ensure that nobody in a community is left behind in sharing development outcomes.

(c) **Research Focus:** Concept notes should focus on conducting research on one or more of the following areas:

- **(i)** Mainstreaming gender, youth and ensuring social inclusion (vulnerable and marginalized groups - VMGs) in the validation, dissemination and adoption of CSA TIMPs.
- **(ii)** Evaluate effectiveness of stakeholders' (including women, youth, VMGs) involvement in the validation, dissemination and adoption of CSA TIMPs.

3.4 - *KCSAP CGS/CRGs-AD 2019/LWA/04*: LAND, WATER MANAGEMENT AND AGROFORESTRY

Background:

Agriculture is the largest user of land and water resources in the Kenya, though majority of farmers still live in poverty. Improving their food and nutrition security and livelihoods would

be easier if more land were put under agriculture and there was an endless supply of clean water, but these resources are limited now more than ever. This implies that the sustainable management of agricultural land and water is fundamental to food and nutrition security, especially in the face of climate change and increasingly erratic weather, and their associated risks. Most of the soils are also depleted because of poor management and inappropriate farming practices; acidification of soils; and low soil organic matter. The soils are compacted by repeated ploughing and continuous growing of the same crops. The unsustainable use of water and uninformed land use changes are depleting the quantity and deteriorating the quality of groundwater and associated ecosystems, upon which livelihoods are dependent. In some instances, the water sources and ecosystems are also degraded and this needs to be addressed.

On the other hand, land and water management is a key element of CSA. More productive and more resilient agriculture requires a major shift in the way land and water are managed to ensure that these resources are used more efficiently. There is a need to develop and or promote CSA TIMPs that lead to better agricultural practices that increase yields with limited land and water resources. Agricultural land and water management includes a broad range of practices and methods including the restoration of degraded lands; appropriate irrigation methods; soil fertility management; water harvesting and conservation; ecosystem management; erosion control measures; agroforestry practices; rangeland reseeding etc. These practices increase the amount of carbon sequestered in the soil, enhances the soil nutrients and its water retention capacity. Other benefits include increased soil organic matter, improved soil structure, reduced soil erosion, increased water infiltration, increased efficiency of water use, increased efficiency in nutrient uptake and improvement in ecosystem services. Improved land and water management practices will help farmers and pastoralists realize higher agricultural commodity yields; increased supplies of valuable goods; increased income and employment opportunities; and increased resilience to climate change.

The priority thematic areas to be addressed are a) assessment and/or promotion of land and water TIMPs in selected ASAL counties for integrated soil fertility management practices; b) the rehabilitation of arid and semi-arid rangelands; c) promotion of simple mechanization technologies (such as rippers and planters) for CSA in target counties; d) introduction and evaluation of agroforestry tree species suitable for soil health restoration and livestock feed in selected ASAL counties; assessment of rangeland species dynamics (including invasive species) in response to climate variability and management practices and development of

appropriate interventions; e) determination of the carbon sequestration capacity of grassland, planted forages, and crops and their effects on climate variables with the objective to restore and maintain land and soil productivity; and f) ecosystem integrity in smallholder farming and pastoral systems.

3.4.1 KCSAP CGS/CRGs-AD 2019/LWA/04-1 REHABILITATION AND RESTORATION OF DEGRADED LANDS

(a) **Objective:** To develop and validate context specific CSA TIMPs that sustainably restore degraded lands in the target counties for increased productivity, resilience and reduction of GHG emissions

(b) **Background**: A key challenge to the attainment of Kenya climate smart agriculture project (KCSAP) development objective is land degradation. Land degradation is attributed to various factors which include: inappropriate land uses, unsuitable agricultural practices, overstocking and over-exploitation of the available pastures, high population growth encroaching on wet-season grazing reserves as well as intrusion of agriculture into marginal land. These anthropogenic disturbances coupled with the impacts of climate variability and change have further destabilized the livelihoods of pastoral and agro-pastoral communities. Ultimately, land degradation leads to decline in agricultural productivity, environmental degradation, and food insecurity.

Of all the constraints in ASAL livestock production, feed is the most important as it constitutes 60-70% of the production cost. The challenge is more pronounced since livestock production in the ASALs depends on degraded natural pastures and decreasing grazing land, compounded by inadequate technologies. With the continued increase in the demand for meat, there is also an increased demand for livestock forage. This calls for initiatives for increased fodder production.

Agriculture contribute about 58.6 percent to total emissions and counting but must now convert to becoming a solution through sequestering carbon in the soil and trees on-farm and through improved soil management techniques. Restoring carbon to the soil will not only sequester carbon from the atmosphere but boost pasture and crop productivity, increase water retention, return land to production, and ultimately raise incomes. To rehabilitate degraded landscapes various technologies and practices are viable such as grass reseeding and agroforestry. Additionally, water harvesting structures can be used

to control surface run-off, gulley expansion, soil erosion and enhance regeneration of vegetation.

Potential areas of intervention include; a) promotion of appropriate land uses, b) good agricultural practices, c) soil and water management strategies, d) appropriate pasture management, e) sustainable protection of water catchments, f) management of environmental degradation and invasive species; and g) appropriate market linkages along the livestock/crop product value chain;

(c) Focal areas

Concept notes should focus on conducting research on one or more of the following areas:

(i) Validate and disseminate grass-legume mixtures to reduce nitrous oxide emissions

(ii) Validate and disseminate appropriate livestock carrying capacity and cropping density

(iii) Evaluate adoption of indigenous technologies for restoration of degraded areas

(iv) Evaluate suitable water harvesting and agro forestry technologies for rangeland rehabilitation

(v) Evaluate existing feed resources for rehabilitation and management of severely degraded lands

(vi) Validate and promote conservancy approach in rangeland rehabilitation and restoration

(vii) Validate and establish county/ecosystem-specific seed system model for purposes of range resources seed bulking

(viii) Assess the status of rangeland degradation

3.4.2 KCSAP CGS/CRGs-AD 2019/LWA/04-2 WATER HARVESTING AND MANAGEMENT

a) **Objective:** To develop and validate context specific CSA TIMPs in water harvesting and management, for livestock and crop production, environmental protection, employment creation and improved livelihoods of target smallholder communities in the project counties.

b) **Background**: Water availability in quantity and quality remains a key constraint to sustainable agriculture in the ASALs of Kenya. This is due to highly variable rainfall, long dry seasons, floods, salinity and low aquifer recharge due to land degradation. It is indicated that up to 85 percent of rainfall may be lost in the drylands of Sub-Saharan Africa through evaporation from the soil surface, surface runoff and through deep percolation. In areas with low and erratic rainfall, irrigation continues to play an important role in increasing crop and fodder production. In addition, land degradation resulting from poor land and water management contributes to low rainwater use efficiency. Water-management strategies are also severely constrained by salinity in the ASAL areas.

Many of the water harvesting and management practices have existed over a long time, but information to support site specific selection of those that are appropriate for the prevailing ecological and socio-economic conditions has not been readily available to farmers and extension services. Existing water harvesting systems have mainly focused on capture and storage of water. There exists a gap in water treatment, distribution, utilization and energy usage. There is need to view water harvesting systems as a chain ranging from the sources of water to be harvested up to the end user. Research is therefore required to develop new water harvesting systems, refine existing water harvesting systems and management TIMPS to suit the local ecological, socio-economic and cultural environments. To unlock the potential of agriculture, investments in better water harvesting technologies, water quality/purification, water distribution systems, use of renewable energy in water harvesting and water management strategies need to be emphasised.

Potential areas of intervention include but not limited to (a) appropriate systems for water capture and storage; (b) efficient water use systems; (c) water quality management, treatment and distribution systems; and (d) use of renewable energy in water harvesting systems.

c) **Research Focus:** Concept notes should focus on one or more of the following areas:

(i) Validate and/or promote site specific TIMPs for in situ water harvesting systems and conservation that reduce in sit*u* water loss, improve water infiltration and reduce evaporation.

(ii) Validate and or promotion of water harvesting and storage technologies for the ASALs

(iii) Validate and promote TIMPs that increase rainwater capture and availability.

(iv) Validate and promote efficient water use systems and methods for crop and livestock production.

(v) Validate and promote agronomical practices that enhance soil moisture retention.

(vi) Validate and or promote TIMPs for salinity management in agricultural water use.

(vii) Validate and promote TIMPs of water treatment and distribution systems targeting quality and quantity requirements for human, livestock and crop production

(viii) Validate and promote TIMPs for renewable energy system in water harvesting and distribution systems

3.4.3 KCSAP CGS/CRGs-AD 2019/LWA/04-3 PROTECTION OF WATER SOURCES

(a) Objective: - To improve and sustain soil and water management among smallholder agro-pastoral farmers in the ASALs by evaluating and adopting CSA TIMPs that ensure adequate water flow and natural ecosystems stability

(b) Background: Kenya is a water scarce country. This is compounded by the climate variability and change being experienced in the country. The most affected areas are mainly ASALs where land degradation is on the rise coupled with erratic rainfall patterns, droughts, low natural diversity, poor infrastructure and widespread poverty. The scarcity of water resources has been attributed to destruction of water catchments. Most springs are neither fenced nor protected. This has led to encroachment by both livestock and humans leading to reduced water availability and low water quality. Inappropriate irrigation methods used by farmers along water sources have significantly reduced water flow for downstream users. Besides, wetland areas have been encroached and drained to create room for farming activities. This has greatly interfered with the natural ecosystem thereby denying wildlife and livestock the much needed natural source of water and dry-season grazing area. As a result, there are increased wildlife-human conflict and conflict between crop cultivators and pastoralists. Further, majority

of women use most of their time looking for water denying them time to engage in other productive work.

Potential areas of intervention include; a) reducing surface runoff; b) improving water harvesting and storage technologies; c) interventions to minimize water loss; d) improving sanitation; protection of water sources; and e) increasing access to potable water.

(c) **Research Focus:** Concept notes will focus on one or more of the following areas:

- **(i)** Validation of efficient water use for optimized economic return in selected agricultural system(s)
- **(ii)** Validate strategies that enhances and restores species diversity in and along water sources ecosystems
- **(iii)** Validate new techniques for measuring water flows and water quality, including remote sensing and *in situ conservation*.
- **(iv)** Validate and promote TIMPs in ecosystem management for improved water resources development

3.4.4 KCSAP CGS/CRGs-AD 2019/LWA/04-4 CARBON SEQUESTRATION

(a) Objective: To validate, adopt and promote context specific carbon sequestration technologies, innovations and management practices (TIMPs) from agricultural land cover and land use types (crops, natural resource management and livestock sectors) for reduced emissions and increased ecosystem and community resilience in Kenya.

(b) Background information: Agriculture is the largest source of GHG emissions in Kenya, contributing about 58.6 percent to total emissions. It is estimated that agricultural emissions are likely to increase from 20 $MtCO_2e$ as recorded in the year 2010 to 27 $MtCO_2e$ in year 2030. Kenya has made national and global commitments to achieve a climate resilient and low carbon sustainable agriculture. There is potential for significant emission reduction through climate smart agricultural technologies that either capture, transport and store carbon at either on-farm or larger (forest and terrestrial habitats) scale. Land use (physical and biological cover over land surface) and cover (arrangements, activities, and inputs relating to people in land cover types to produce, change or maintain it) drivers in Kenyan agricultural landscape offer numerous opportunities for sequestering

carbon. For instance, improved soil management techniques have potential to offset and sequester about 20 percent of annual emissions. Soil carbon replenishment practices not only boost pasture and crop productivity but have multi benefits to improve soil physical and chemical characteristics, return arable land to production (reducing pressure on biodiversity and forests) while increasing the resilience of communities living in vulnerable ecosystems.

The potential for emission reduction in Kenya livestock systems, which globally rank among the highest, has opportunities in nutrient management practices that improve forage production and minimize losses and damage while protecting pastoralists' asset base. There are multiple benefits in design and adoption of CSA practices that mitigate land use and cover emission through agroforestry, conservation agriculture, improved crop management, improved fertilizer use management, rangeland management and soil and water conservation. The effectiveness of these CSA practices to mitigate GHG emissions will also vary in time and space.

Potential areas of intervention include but not limited to: a) assessment of soil organic Carbon (SOC) stocks and change over time; b) carbon sequestration and sustainable agriculture; c) emissions reduction through conservation of existing carbon stocks; d) land use systems (rangelands, agroforestry, wetlands, pasture production) and their impacts on carbon sequestration; e) rangeland rehabilitation and its impact on carbon sequestration; and g) management practices and their impact on carbon sequestration (improved manure handling and storage, grazing management, pasture management and nutrition).

(c) **Research Focus:** Concept notes should focus on conducting research on one or more of the following areas:

- **(i)** Validate and promote CSA TIMPs for improved land cover and reduced land use emissions
- **(ii)** Validate and promote CSA TIMPs for reduced GHG emissions in livestock
- **(iii)** Validate/test carbon accounting tools, methods and approaches
- **(iv)** Develop GHG emission factors for various agricultural production systems to inform climate smart practices

3.4.5 KCSAP CGS CRGS-AD 2019/LWA/04-5 RANGELAND ECOSYSTEM DISTURBANCE AND MANAGEMENT

(a) Objective: To identify and validate methodologies for assessing rangeland vegetation/species dynamics and context specific CSA TIMPs for improving ecosystem management under climate change for increased and sustained productivity and improved livelihoods of target pastoral communities.

(b) Background: Increasing use of land for human settlement and agriculture has greatly influenced natural ecosystem disturbance through alteration, suppression and even re-enforcement of natural disturbance regimes; resulting in, new disturbance regimes that are unsustainable. A major way that humans have affected biological diversity in ecosystems is through direct influences on the disturbance rate and intensity. For example, changes resulting from frequent fires and hydrological dynamics of flooding and drought are among universal influences caused by man. Many conservation and management problems associated with ecosystems are directly related to differences between management regimes imposed on the systems by man and those derived from natural disturbance regimes. Depletion of natural forest results in decreased biodiversity. Timber and non-timber forest products and services are weakened; and even more importantly, biological endemic species which have a potential for sustainable livelihoods among rural communities become highly vulnerable, if not extinct. On the whole, issues associated with ecosystems conservation are increasingly becoming complex. There is increasing concern for conservation efforts associated with a variety of issues from water quality, land degradation and soil fertility decline to endangered species.

An emerging cluster of concepts known as 'ecosystem management' embrace holistic rather than reductionist approach to ecosystem health; and, recognize a broader range of values in ecosystems compared to those acknowledged by past practices. It provides scientific, social, and institutional concepts that set contextual thinking more broadly around sustainability in land use planning and management.

Rangelands are the most common form of terrain around the world accounting for 60-70 percent of the entire land surface. They consist primarily of native plant communities managed, typically, for livestock production. Since they embrace extensive native plant communities; they, serve as biodiversity repositories. However, recent techniques for rangeland management have been developed under the paradigm of increasing sustainability of species for livestock production, which has been achieved by decreasing inherent species variability associated with the rangelands. This approach to rangelands management is not capable of providing an ecological framework for sustained biodiversity. Preservation of habitats biodiversity for many individual species is dependent on interspersion of diverse species types throughout a heterogeneous landscape. Thus, the goal of ecosystem management should be to manage for the long-term integrity of the whole ecosystems; and, not for production of single resources.

Thus, Ecosystem dynamics and patterns that maintained biological diversity and ecological function in the past are our best model for future ecosystem management. In Kenya, the fate of agricultural biodiversity is intimately tied to that of the agricultural sector as a whole, whose challenges are systemic in nature. Historical land use changes involving considerable increase in developed land (land under human settlement/urbanization); and, extensive grazing of rangelands resulting in loss of forest land in mid- to high- rainfall areas and loss of woodlands and scrubland in the dry midlands and lowlands, i.e. ASALs, with adverse climate change effects on local communities. Further, trends in agriculture over recent decades fuelled by commodity driven agricultural policies and strategies, that have led to commercial interests driving enterprise selection based on monoculture, have reduced farmers' interest in embracing sustainable farming systems involving crop rotations.

Potential areas of intervention include (a) identification of appropriate methodologies and approaches for assessing ecosystem disturbance (b) establishment of current levels of ecosystem disturbance (c) identification and promotion of suitable plant species for up-grading degraded ecosystems (d) identification and promotion of suitable systems for upgrading of degraded ecosystems (f) capacity building of communities in application of CSA TIMPs, and (g) conservation of suitable herbage materials for livestock feed. All project counties require improved

(c) **Areas of Research Focus:** Concept notes should focus on one or more of the following research areas/aspects:

(i) Identify and validate integrated methodologies for assessing ecosystem disturbance in the mid- to high-rainfall areas and the ASALs of Kenya.

(ii) Identify and evaluate various current rangeland ecosystems disturbances under livestock production in relation to disturbances associated with initial natural ecosystems.

(iii) Identify and assess current levels of land degradation associated with human influenced rangeland ecosystems disturbances and their impact on livestock production.

(iv) Identify and validate suitable methodologies/approached for assessing cost-effectiveness of CSA TIMPs for improved ecosystem management in the mid- to high-rainfall areas and the ASALs of Kenya.

(v) Identify, validate and promote context specific CSA TIMPs for improved ecosystem management in the mid- to high-rainfall areas and the ASALs of Kenya.

(vi) Identify, validate and promote CSA TIMPs for conserving vegetative/herbage materials as livestock feed.

3.4.6 KCSAP CGS/CRGs-AD 2019/LWA/04-6 EVALUATION OF CSA IRRIGATION TIMPS

(a) **Objective:** To develop and validate CSA irrigation TIMPs for enhanced and sustained agricultural productivity for income and food security targeting smallholder communities.

(b) **Background:** Kenya has more than 83% of its land classified as arid or semi-arid. Irrigation is therefore key to sustaining crop production. The irrigation potential is 540,000 ha but can be increased to 1.3 million hectares with water harvesting and use of efficient irrigation technologies. There has been focus on irrigation development especially through various government projects and programmes. Approximately 193,600 ha is currently under irrigation with performance that can be improved with appropriate interventions. Participatory rapid diagnosis and action planning methodology has enabled documentation and ranking of constraints affecting irrigation schemes performance. This was successfully applied in schemes such as Mwea, Yatta, South West Kano, Nakwamoru and Narumoru, leading to farm and scheme improvements. Farm centred improvements by smallholder farmers has included investment in water

harvesting, solar water pumps, improved water conveyances, drip irrigation, greenhouses and net-houses. In recent years ICT based farm advisories, such as Smart irrigator, and weather forecasting, such as KAOP, have provided opportunity for irrigation farmers that can be promoted.

Potential areas of intervention include a) promotion of appropriate irrigation technologies; b) improving water use efficiency, c) Enhance skills of irrigators and strengthen capacity of extension support systems, d) increasing land productivity.

c) Areas of focus.

(i) Test and disseminate climate smart irrigation TIMPs for increased productivity and resilience

(ii) Test and disseminate CSA TIMPs for soil fertility management in irrigated lands.

3.4.7 KCSAP CGS/CRGs-AD 2019/LWA/04-7 EVALUATION OF CSA MECHANIZATION TECHNOLOGIES

(a) Objective: Develop, validate and promote suitable, economically viable and socially acceptable CSA mechanization technologies including farm implements / equipment to increase land productivity, reduce post-harvest handling drudgery and enhance value addition for improved agricultural productivity and sustained livelihoods.

Background: In Kenya, most agricultural activities in rural areas; in particular, on-farm operations including land preparation, inputs application including seed and fertilizers, weed and pest control; as well as post-harvest handling and processing, remain labour intensive. This has serious implications with respect to timelines of the on-farm operations; cost-effectiveness in view of escalating labour costs; limited work output per unit of time; and, overall drudgery inflicted to the rural households and the on-farm labour force, in particular. This is a major factor contributing to the declining interest of the younger generation of Kenyans in agriculture. To achieve increased and sustainable productivity and meet increasing demand for food and industrial raw materials by the rapidly growing population in the country, appropriate mechanization technologies/innovations are required to ensure timelines of on-farm operations.

Mechanization is becoming even more important with increased climatic risks in the agricultural sector.

Suitable mechanization technologies focusing on appropriate CSA implements and equipment drawn by oxen and/or mounted on varied powered plant machinery are required for timely on-farm operations. Potential areas of interventions include (a) scaling up of suitable CSA mechanized farm operations and processes; (b) improving mechanized management of pre- and post- harvest activities/operations to reduce loses; (c) improving storage facilities through deployment of appropriate designs for enhancement of product quality and shelf life; (d) identifying appropriate farmer-creditor linkage mechanisms for accessing smallholder equipment; (e) value addition; and (f) identification and application of suitable water efficient irrigation systems.

(c) Research Focus: Concept notes should focus on one or more of the following areas:

- **(i)** Identify, validate and promote smallholder operations implements / equipment for increased agricultural productivity.
- **(ii)** Identify, test and promote minimum tillage implements and other management options suitable for conservation agriculture.
- **(iii)** Identify, validate and/or promote simple cost-effective tools for agricultural value addition, for increased incomes and improved livelihoods.
- **(iv)** Identify, validate and/or promote suitable harvesting, drying and storage equipment/facilities to reduce pre- and post- harvest losses and enhance product quality and shelf life.
- **(v)** Identify, test and promote renewable and cost-effective energy sources (solar, wind) for agricultural processing for enhanced product competitiveness and increased incomes.

3.4.8 KCSAP CGS/CRGS-AD 2019/LWA/04-8 INTEGRATED SOIL FERTILITY MANAGEMENT

(a) Objective: To develop and validate context specific Integrated Soil Fertility Management (ISFM) TIMPs for enhanced and sustained productivity for food and nutrition security, employment creation and improved livelihoods of target smallholder communities.

(b) **Background:** The agricultural sector in Kenya is dominated by smallholder farmers who account for about 80% of the country's total output. It is in these smallholder farms that poor soil health and in particular low and declining soil fertility is a major constraint limiting agricultural productivity. Continuous and imbalanced use of inorganic fertilizers without addition of organic resources has led to increased soil acidity, mining of nutrients not supplied in the applied fertilizers and lowering of the soil organic matter content. Nutrients such as nitrogen (N), phosphorus (P), potassium (K), sulphur (S) and micro-nutrients (zinc (Zn), Molybdenum (Mo) and boron (B) have been depleted in the soils of smallholder farms. Strategies to recapitalize the depleted soils to support agricultural intensification are therefore required. ISFM is a holistic approach to soil fertility management that embraces the full range of driving factors and consequences of soil degradation - biological, physical, chemical, social, cultural, economic and political.

ISFM offers one of the best options for concurrently improving soil fertility while allowing for adaptation to climate change. Productivity is substantially enhanced when ISFM is successfully adopted. Positive synergistic effects between organic and inorganic inputs are often observed leading to enhanced rainfall-use efficiency. ISFM promotes strategic timing and placement when using inorganic nitrogenous fertilizers, often at rates that are much lower than recommendations based on the sole use of inorganic fertilizers. This contributes to mitigation through reduced nitrous oxide emissions. Some of the ISFM TIMPs include: combination of fertilizer and manures; growing of nitrogen fixing legumes; use of crop residues; adoption of soil conservation measures; soil acidity correction; breaking soil hardpans; water harvesting; composting; and use of improved and stress-resilient varieties. However, a major obstacle for effective utilization of ISFM practices by smallholder farmers has been the failure to deliver appropriate recommendations and accompanying inputs in the right form to them.

Potential areas of intervention include: a) agronomy of crops and inorganic fertilizers; b) fertilizer use - formulation, placement, rate and timing of inorganic nutrient inputs; c) organic resource management; and d) soil amendments to correct limitations to productivity such as soil acidity, micronutrient deficiency, erosion, soil compaction or pests and diseases.

(c) **Research Focus:** Concept notes should focus on the following climate smart tailored specific research objectives both at farm and landscape levels:

(i) Adapt/validate and/or upscale gender responsive ISFM technologies and innovations in specific counties;

(ii) Enhance the capacity of stakeholders for adopting ISFM technologies and innovations;

(iii) Promote ISFM technologies and innovations through adoption of policy options and institutional arrangements;

(iv) Enhance the up-scaling and utilization of knowledge and information on ISFM technologies and innovations for food and nutrition security improvement through innovation platforms.

(v) Economic and ecological assessment of ISFM TIMPs in light of CSA triple wins - adaptation, increased incomes and mitigation

3.5 KCSAP CGS/CRGs-AD 2019/SBE/05: SUSTAINABLE BIO ENERGY INCLUDING CHARCOAL VALUE CHAIN

(a) **Objective:** To validate and promote sustainable bio energy TIMPs for increased access to energy, improved livelihoods and environmental sustainability

(b) **Background:** There is a growing demand for domestic energy, most of which is currently derived from fuel wood; hence, accelerated deforestation and land degradation which are major contributors biodiversity loss and climate change. Limited access to sustainable, affordable and reliable energy sources is a key constraint to attainment of sustainable development. This calls for the development and use of efficient low-carbon energy technologies to address the foregoing problems including reduction in GHG emissions.

The areas of intervention that create opportunities for poverty alleviation, employment creation and enhanced livelihoods include: a) promotion of simple low cost bio-digesters, b) conversion of agricultural waste into useful energy forms, and c) promotion of value chains for sustainable bio-energy production

(c) **Research Focus:** The concept notes should focus on at least one of the following sub-themes:

- **(i)** Identify and validate existing types and prototypes of simple bio-digesters, and promote the most appropriate technologies including development of bio fuel technologies with high conversion ratio
- **(ii)** Test, validate and/or promote efficient technologies for the conversion of agricultural waste into useful forms of energy
- **(iii)** Introduce, evaluate and promote improved kilns and jikos for the production and use of charcoal to reduce biomass consumption and determination of efficiency of various cook stoves
- **(iv)** Develop value chains that produce biofuel/biodiesel (charcoal, bio-ethanol, briquettes and other materials) and other sources of renewable energy
- **(v)** Identify and validate traditional methods of bio energy production and conservation practiced by rural communities.

5.0 SUBMISSION OF THE CONCEPT NOTES

The Concept Note should be prepared in accordance with the provided format which can be downloaded from the website. Typesetting should be in A4 page format, Time New Roman Print and Font 12. Applicants should submit two (2) hard copies of the concept note complete with attachments including CVs of the PI and collaborators and institutional letters of support to **KALRO-KSCAP, P.O. Box 57811 City Square 002000**.

In addition, the electronic copy should be emailed directly to **KCSAP.Grants@kalro.org** and copied to **kcsap.grants@gmail.com**

The KCSAP Research Grants Management Committee (RGMC) will process the review of the concept notes in accordance with its approved procedure as provided for in the Collaborative Research Grants Manual. The applicants will be notified of the RGMC decision in writing.

6.0 GRANT VALUE:

Successful projects may be funded up to a maximum KES 30 million each.

7.0 TIME FRAME:

The deadline for the submission of the application is 23rd July, 2019.

7.0 CALL REFERENCE: The call reference number for the thematic and specific research focal areas is as provided in the detailed call**.**

KALRO-KSCAP Project Coordinator,

KALRO HEADQUARTERS

Kaptagat road Loresho,

P.O Box 57811 – 00200,

NAIROBI.

Tel: +254-722 206988/0733 333223

Email: KCSAP.Grants@kalro.org / kcsap.grants@gmail.com