Framework for Community-based Cage Aquaculture (FCCA)

Aquaculture Business Development Programme (ABDP)

SEPTEMBER 2022

DECLARATION

Participants herein include experts sourced from the Kenya Marine and Fisheries Research Institute (KMFRI), the Aquaculture Business Development Programme (ABDP), the Kenya Fisheries Service (KeFS), the State Department of Fisheries, Aquaculture, and Blue Economy (SDFA & BE) and University of Eldoret (UoE).

ACKNOWLEDGEMENT

The Framework for Community-based Cage Aquaculture (FCCA) was funded by the International Fund for Agricultural Development (IFAD) and The Government of Kenya (GoK) through the Aquaculture Business Development Programme (ABDP).

CITATION

ABDP-FCCA 2022. The Framework for Community-based Cage Aquaculture (FCCA). Aquaculture Business Development Programme (ABDP), IFAD Building, Kamakwa Road (Opp. Nyeri Club), P.O Box 904-10100, Nyeri, Kenya. 68pp.

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LETTER OF SUBMISSION

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RE: SUBMISSION OF FINALIZED FRAMEWORKS ON COMMUNITY DAM AQUACULTURE AND COMMUNITY AND COMMUNITY CAGE FISH FARMING FOR AQUACULTURE BUSINESS DEVELOPMENT PROGRAMME

This is in reference to your letter with reference number MOALF/SDFA&BE/ABDP/KMFRI/RL/09-02 and dated 9th September 2022.

In-line with the aforementioned, Kenya Marine and Fisheries Research Institute (KMFRI) led participants from ABDP, Kenya Fisheries Service (KeFS), SDFA & BE, and Universities in the development of following frameworks:

i) Framework for Community-based Dam Aquaculture; and
ii) Framework for Community Cage Fish Farming.

The purpose of this letter is therefore to submit the aforementioned frameworks to your office for further actions.

Thank you.

Dr. Christopher M. Aura (PhD)
Director, Freshwater Systems Research
FOR: CHIEF EXECUTIVE OFFICER-KMFRI

FOREWORD

The Framework for Community-based Cage Aquaculture (FCCA) is herein developed in line with existing Government policies and development plans, Kenya's Blue Economy strategy and Vision 2030, and in consideration of the provisions and expectations of the Constitution of Kenya 2010 as well as the Government Manifesto. It was developed through the support provided by the Aquaculture Business Development Programme (ABDP) in order to provide a clear road-map to guide the implementation of the best management practices in the cage aquaculture sector for improved governance to increase fish production and income for local communities.

During the implementation of the FCCA, and under the guidance of the National and County Governments and in consultation with the cage aquaculture farmers, the sector is envisioned to continue to provide quality fish and fish products, and data and knowledge required for the advancement of the Blue Economy agenda. This is in line with increasing demand for fisheries products and other aquatic resources at the same time ensuring their sustainability for the present and future generations.

To enhance the cage's efficiency and improve service delivery, the framework proposes an improved governance structure. The current framework takes into consideration the needs of the National and Devolved Units, Blue Economy and emerging issues on the Ecosystem Approach to Aquaculture Management (EAAM). In the implementation of the FCCA, a participatory process involving all the relevant stakeholders for enhanced provision of effective and quality service to the Kenyan citizenry.

I have no doubt that with cooperation and support from other government ministries/agencies, development partners and stakeholders, the FCCA will greatly contribute towards transforming the Blue Economy sector into an innovative and commercially oriented sector in line with the aspirations of Vision 2030, and the Government manifesto by H.E The President.

HON.
CABINET SECRETAY,
MINISTRY OF AGRICULTURE, FISHERIES AND COOPERATIVES

PREFACE

Cage aquaculture is quickly expanding in our great lakes and dams, with the potential to boost fish output and act as a source of food security, poverty reduction, and job creation. However, with the growing concern of the proliferation of fish cages in such systems, there is need for a road-map to guide investment, development and practices.

The Framework for Community-based Cage Aquaculture (FCCA) lays a firm foundation for fulfilling the mandate of National and County Governments which is anchored on poverty alleviation and food security with increased incomes. In order to achieve various targets, the State Department, together with her stakeholders, will focus on environmental, economic and social considerations, which are critical for sustainable development of the Blue Economy.

The FCCA was developed to align it to the Kenya Blue Economy strategy, fisheries and aquaculture policies and agenda. This new Framework focuses on four key result areas, namely: (i) sustainable community-based cage aquaculture production and productivity; (ii) infrastructural, institutional and human resource capacity building; (iii) enabling environment for sustainable community-based cage aquaculture development; and (iv) resource mobilization, partnership and collaboration.

This framework sets out strategies and interventions that seek to address the context of promoting quality cage fish farming service delivery, efficiency and effectiveness, development of alternative financing options, development of human capacity and enhancement of the sector's capacity, support systems and good governance. The FCCA could form the basis for formulation of National and County Governments annual work plans, resource bidding and performance contract targets.

I, therefore, call upon all relevant stakeholders to work together for the realization of the strategic objectives contained in this Framework. With its effective implementation, I am confident that cage aquaculture industry will realize optimum outputs in investments in either stocking and restocking using sound scientific recommendations and decisions.

DR…….
PRINCIPAL SECRETARY,
STATE DEPARTMENT FOR FISHERIES, AQUACULTURE AND THE BLUE ECONOMY

DEFINITION OF TERMS

Aquacage: Refers to an aggregation of production systems where several smallholder cage farms are grouped together in an eco-region and resources pooled together for the management of the cages in order to reduce the individual farmer's cost of production and maximize profit.

Key Results Areas/Strategic Focus Areas: This is an outline of the organization's areas of focus. It also refers to the general areas of outputs or outcomes for which an organization's role is responsible.

PESTEL Analysis: It is a framework or tool used to analyse and monitor the environmental (external) factors that have an impact on an organization.

Programme: A grouping of similar projects and/or services performed by a Ministry or Department to achieve a specific objective; the programmes must be mapped to strategic objectives.

Project: A project is a set of coordinated activities implemented to meet specific objectives within defined time, cost and performance parameters. Projects aimed at achieving a common goal form a programme.

Strategic Objectives: These are what the organization commits itself to accomplish in the long term; they establish performance levels to be achieved on priority issues and measures of success in fulfilling critical mission statement elements.

SWOT Analysis: It is used for understanding the strengths and weaknesses (internal factors) of the organization and for identifying both the opportunities open to the organization and the threats it faces (external factors).

Target: A target refers to planned level of an indicator achievement.

ACRONYMS AND ABBREVIATIONS

AAK	Aquaculture Association of Kenya
ABDP	Aquaculture Business Development Programme
AMIP	Aquaculture Market Information Platforms
ASDSP	Agricultural Sector Development Support Programme
AZCA	Allocated Zones for Cage Aquaculture
BMU	Beach Management Unit
CCADC	Community-Based Cage Aquaculture Demonstration Centers
CDIP	County Integrated Development Plan
CFFAK	Cage Fish Farmers Association of Kenya
CSR	Corporate Social Responsibility
EAC	East African Community
EEZ	Exclusive Economic Zone
EFMIS	Electronic Fish Marketing Information Service
FCCA	Framework for Community-based Cage Aquaculture
FLTF	Fish Levy Trust Fund
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HH	House Hold
IEC	Information, Education and Communication
ISP	Internet Service Providers
JASCOM	Joint Agricultural Sector Consultation and Cooperation Mechanism
KEBS	Kenya Bureau of Standards
KeFS	Kenya Fisheries Service
KFMA	Kenya Fish Marketing Authority
KMA	Kenya Maritime Authority
KMFRI	Kenya Marine and Fisheries Research Institute
KPA	Kenya Ports Authority
KRAs	Key Result Areas
KCSAP	Kenya Climate Smart Agriculture Project
LBDA	Lake Basin Development Authority
LREB	Lake Region Economic Bloc
M&E	Monitoring and Evaluation
MCS	Monitoring, Control and Surveillance
MTER	Mid-Term Evaluation and Review
MTP	Medium Term Plan
NACOSTI	National Commission for Science, Technology and Innovations
NEMA	National Environmental Management Authority
NRF	National Research Fund
PESTEL	Political, Economic, Social, Technological, Environmental and Legal
PS	Principal Secretary
PPP	Public-Private-Partnership

S&NSAs	State and non-state Agencies
SBCC	Social Behavior Change Communication strategies
SDFA&BE	State Department for Fisheries, Aquaculture and the Blue Economy
SDG	State Department for Gender
SDGs	Sustainable Development Goals
SMEs	Small and Medium Enterprises
SWOT	Strengths, Weaknesses, Opportunities, and Threats
ToT	Trainer of Trainers
VC	Value Chain
VMGs	Vulnerable and Marginalized Groups

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EXECUTIVE SUMMARY

The Framework for Community-based Cage Aquaculture (FCCA) herein gives a road-map on best management practices and cage husbandry which is anchored on poverty alleviation and food security with increased incomes. This FCCA is guided by the Constitution of Kenya 2010, the Kenya Vision 2030, The Fourth Medium Term Plan (MTP IV), the Blue Economy Policies Executive Orders, the National Oceans and Fisheries Policy draft 2022, the African Agenda 2063 and United Nations Sustainable Development Goals (SDGs) and other government policy documents. The Framework is also guided by lessons learnt, constraints and challenges encountered in the implementation of cage aquaculture husbandry practices.

The Framework is structured into five chapters. Chapter one gives the background information on the FCCA; sector development challenges at the global, regional and national levels; rationale; the development process of the framework; and its structure. Given that this is a preliminary framework, chapter two provides a brief valuation the Political, Economic, Social, Technological, Environmental and Legal (PESTEL) analysis; Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis; and the stakeholders' analysis. Chapter three gives the Key Result Areas (KRAs), strategic focus areas, strategic objectives and the strategic interventions for the framework. Chapter four documents the implementation and coordination context of the framework including the governance structure, staff, financial resource requirements, and risk analysis and mitigation measures. Chapter five provides the monitoring, evaluation and reporting of the framework. The chapter also provides the implementation matrix containing the strategic actions to be undertaken, and budget estimates to implement the framework.

The KRAs of the framework are: (i) sustainable community-based cage aquaculture production and productivity; (ii) infrastructural, institutional and human resource capacity building; (iii) enabling environment for sustainable community-based cage aquaculture development; and (iv) resource mobilization, partnership and collaboration

To implement the framework, the resources required over the three-year period will be mobilized through ploughing back mechanisms, lobbying the development partners, Government for additional funding, and other stakeholders, utilization of the partnership arrangements, exercising prudence in financial management and establishing income generating activities by the farmers. To realize effective implementation of the framework, it is recommended that monitoring and evaluation to be undertaken periodically by extension officers.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Fisheries makes a significant contribution to global food systems, supplying millions of people with food and employment. However, there has been stagnation globally in fish production from natural fish stocks with most fisheries either fully exploited or over-exploited[1]. Aquaculture, a component of fisheries, is a vital pillar in the food production section and a significant contributor to wealth creation, food security, economic growth, and poverty reduction. With the adoption of sustainable policies, aquaculture has the potential to bridge the current deficit. Aquaculture has been the world's fastest-growing food production system for decades, and is now providing more fish than wild capture fisheries for human consumption[2]. Since 1970, aquaculture production grew at an average annual rate of 8.4% worldwide[3], exceeding the growth rate of any other food production system, including poultry, beef, pork, dairy or cereal crops[4]. This growth has been attributed to the growth of cage aquaculture[5].

Cage aquaculture is the practice of growing fish in existing water resources while enclosed in a net cage that permits free passage of water[6]. It is an established and profitable system in many countries and is considered one of the key interventions to increase fish supply in the face of declining wild fish stocks. Globally, cage aquaculture is hugely varied ranging from subsistence level holding of a few kilos of fish in small nets to salmon farms producing more than 5000 tonnes per year. In Asia, more than 50 species are reared in various forms of cage aquaculture[7]. While the financial success of the cage aquaculture has been demonstrated in Asia, Europe, North America and Latin America over the years, it is picking up in Africa and further growth is expected[8]. This is despite cage aquaculture being introduced in several African countries in the 1970s[3]. Since 1995,

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[1] Lake Victoria Fisheries Organization (2016). Draft guidelines for establishment and operation of cage fish farming in East African Community.

[2] Seafood Business for Ocean Stewardship (2022) Accessed on 23 September 2022. https://seabos.org/wp-content/uploads/2016/12/Brief4-Aquaculture.pdf

[3] Food and Agricultural Organization of the United Nations (2016). The State of World Fisheries and Aquaculture 2016. Contributing to food security and nutrition for all. Rome. 200 pp.

[4] Hall, S.J. (2011). Blue frontiers: managing the environmental costs of aquaculture. WorldFish.

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[8] Hamilton, S.E., Gallo, S.M., Krach, N., Nyamwea, C.S., Okechi, J.K., & Aura, C.M. (2020). The use of unmanned aircraft systems and high-resolution satellite imagery to monitor tilapia fish cage aquaculture expansion in Lake Victoria, Kenya. *Bulletin of Marine Science*, 96, 71-93.

the production of farmed fish in Sub-Saharan Africa has expanded more than sixteenfold[9], mostly due to the expansion of tilapia cage aquaculture[5]. Notable examples of rapid spread of cage aquaculture in Sub-Saharan Africa include Lake Victoria in Kenya[10], Lake Victoria in Uganda[11], Lake Volta in Ghana[12], Lake Kariba in Zimbabwe[13] and Lake Malawi in Malawi[11]. Despite the region's enormous fish market and the practice's proven potential, cage fish farming has not been widely practiced in East Africa[11] though it has shown potential to be more productive than pond culture[3].

Cage aquaculture was pioneered in Kenya by the Lake Basin Development Authority (LBDA) in 1988 with first trials around Dunga Beach. Dominion Group of Companies successfully harvested fish from cages at its Yala wetland farm in 2005[14]. Between 2008 and 2013, "BOMOSA," an EU-sponsored project, conducted trials on cage aquaculture in small water bodies within the Lake Victoria Basin. Cage aquaculture techniques have grown in popularity on the beaches of Obenge and Dunga in Siaya and Kisumu counties respectively, through efforts of the Fisheries Cooperative Society and Beach Management Units (BMUs)[15]. Despite initial setbacks, the cage aquaculture strategy was eventually adopted in 2010 at Dunga Beach in Kisumu County through collaborative work between Kenya Marine and Fisheries Research Institute (KMFRI) and the Dunga BMU. Cage aquaculture has evolved in recent years as a new source of income and livelihoods in Lake Victoria, in addition to protecting endangered wild fish species. Since then, the practice has expanded across Lake Victoria's five riparian counties: Busia, Siaya, Kisumu, Homa Bay, and Migori. Notably, between 2016 and 2022, the total number of cages in the Kenyan section of Lake Victoria rose from 1663 to more than 5242[8,10,16]. This expansion has resulted to

[9] Food and Agricultural Organization of the United Nations (FAO). (2018). The State of the World Fisheries and Aquaculture. http://www.fao.org/3/i9540en/I9540EN.pdf.

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[16] KMFRI-ABDP-CAGES (2022). Sustainable community-based cage aquaculture in Lake Victoria, Kenya. Kenya Marine and Fisheries Research Institute (KMFRI) Aquaculture Business Development Programme (ABDP), Kenya Fisheries Service (KeFS) and State Department for Fisheries, Aquaculture and the Blue Economy (SDFA & BE) for Cage Aquaculture technical report funded by the International Fund for Agricultural Development (IFAD), and The Government of Kenya through the Aquaculture Business Development Programme (ABDP). Submitted to The Programme Coordinator (PC), Aquaculture Business Development

ecological concerns on cage aquaculture sustainability in Lake Victoria. Cage aquaculture demands rigorous adherence to Best Management Practices (BMPs) for sustainability. Lack of adherence to the BMPs may lead to ecological degradation resulting in poor fish health, widespread mortalities and socioeconomic losses[10,16].

Experts from KMFRI, Aquaculture Business and Development Program (ABDP), Kenya Fisheries Service (KeFS) and State Department for Fisheries, Aquaculture and the Blue Economy (SDFA & BE), University of Eldoret (UoE) developed a Framework for Community-based Cage Aquaculture (FCCA) to give a road-map on BMPs and cage husbandry which is anchored on poverty alleviation and food security with increased incomes.

1.2 Aquaculture Sub-Sector Challenges

The sub-sector faces challenges around the world, limiting most governments' ability to assure its sustainability and profitability. Environmental, health, quality seed and feed challenges are more pronounced in Africa than Europe, Americas and Asia[3,17,18]. Cage aquaculture can be very profitable and should be approached as a business. Investment failures have been prevalent, particularly in government or donor-driven projects mainly due to lack of adherence to BMPs. The widespread use of antibiotics in animal farming globally poses a serious concern for human health and the environment. The production of aquaculture species still remains a cause of concern in relation to antibiotics use, but important segments of the industry have recently improved their practices, and now offer a source of animal protein with relatively limited use of antibiotics[19]. Increasing dependence on terrestrial crops (such as soybean) as a key ingredient in aquaculture feeds raises concerns from an environmental perspective. Recurring barriers to sustainability of cage aquaculture include fish diseases, high investment costs including materials for cage production combined with difficult access to credit, low availability of cost-effective high-quality fish feeds and water resource conflicts[3].

Poor governance has hampered aquaculture growth in Africa, resulting in insufficient transparency and accountability, laxity in enforcement of regulations, and little structured participation of resource users and non-state actors in policy formulation and resource management. The potential resource wealth of African fisheries is estimated at about US$ 2 billion per year. However, it is also estimated that between US$ 2 and 5 billion is lost annually due to mismanagement[17]. Cage aquaculture in Africa will only succeed when the five key constraints of seed, feed, finance, skills, knowledge and marketing are addressed comprehensively. Costs and logistical issues associated with delivering the proper quantity and quality of product to market at the right time are frequently underestimated[7]. Local factors such as predation, theft as well as wind

Programme (ABDP), IFAD Building, Kamakwa Road (Opp. Nyeri Club), P.O. Box 904-10100, Nyeri. 84 pp

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[19] Henriksson, P.J., Troell, M. & Rico, A. (2015). Antimicrobial use in aquaculture: Some complementing facts. *Proceedings of the National Academy of Sciences of the United States of America,* 112(26), p.E3317

and wave damage, can all impede success. In some areas, rapid cage aquaculture expansion coupled with poor site selection has resulted in environmental deterioration and increased disease outbreaks. While much can be learnt from elsewhere, there can be no simplistic technology transfer. Cage design, construction and siting in particular needs to be adapted to local conditions.

1.3 Role and Rationale of the Framework

Kenya has vast fish resources (in marine, inland capture and aquaculture) the exploitation of which is providing a wide variety of benefits to the country in terms of revenue, employment and general contribution to socio economic growth and development. However, the capture fisheries of the country have generally demonstrated oscillations in total catch with a general tendency of declining catches in recent years[17,15]. This variation appears to be due to changes in markets, fishing effort, the adoption of more conservative management measures, and environmentally-induced changes that have affected stock productivity. The significance of inland water fisheries to local populations is shown by the fact that they are particularly important for food security and income generation, especially for communities living near the water bodies. Most inland water fish in Kenya is consumed locally but products from inland water fisheries such as Nile perch and seafood can also be important export commodities. However, these opportunities are undermined by rapid population growth and increased demand for fish as a protein source[17].

Kenya stands to benefit from the increased demand by developing a FCCA while ensuring the health and productivity of fish stocks and ecosystems. Although policies aimed at regulating fishing capacity are critical for maintaining production and supply of fish products, policy makers have put little focus on the role of cage aquaculture in the national economic development strategy, food and nutrition security and the need to place the optimization of these benefits to the centre of national development planning. The sub-sector in Kenya has gone through significant developments and changes since the first trials in 1980s. Over the last few years, national and county governments have made significant investments in improving their fisheries policies and supportive sectors aquaculture. The results have not met expectations for a variety of reasons, but the most pressing overall issue is that the country has not adequately tackled cage aquaculture management[16]. To fully realize the potential of cage aquaculture in Kenya, developing FCCA is required, with practical implementation of this transformation at the community level.

The FCCA offers the country the opportunity to transition its aquaculture sub-sector to productivity, sustainability and profitability with options for enhanced multi-institutional collaborative management of shared waters. The main precondition for the FCCA to translate into development outcomes is a need for institutions to commit to reforming the cage aquaculture sector. The FCCA will enable both the national and county governments to develop cage aquaculture, with accompanied fiscal reforms that will result in the sustainable generation of benefits at the community level as well as creating wealth across the value chain.

The FCCA recognizes the potential for wealth creation by cage aquaculture and opportunities for livelihoods enhancement. The document provides for the guidelines on how the

country should better tap the wealth in cage aquaculture, reduce poverty, increase food and nutritional security and ensure equitable distribution of the benefits particularly for the poorest, marginalized and most vulnerable in society.

1.4 Development Processes of the Framework

The development of this framework underwent participatory and consultative process using primary and secondary information and expert opinions. Primary sources of information consisted of research findings from cage aquaculture operations, lessons learned, restrictions, and obstacles faced in the adoption of cage aquaculture husbandry techniques. Secondary information was sourced from the Fourth Medium Term Plan (MTP IV), Kenya Vision 2030, the Kenya Blue Economy Strategy, Executive Orders, the National Oceans and Fisheries Policy Draft 2022, and the regional and global policy documents such as African Agenda 2063, the United Nations Sustainable Development Goals (SDGs). The framework was guided by the Kenya Constitution of 2010 and experts' opinions.

CHAPTER TWO

2.0 SITUATIONAL ANALYSIS

2.1 Review of Existing Frameworks

2.1.1 Overview

To meet the ever-rising demand for aquatic products, various aquaculture production technologies such as use of cages among others have been embraced[14]. Cage aquaculture has grown rapidly and is undergoing swift changes in response to pressures such as limited suitable cage aquaculture areas. This has resulted in cage aquaculture accessing and expanding into new untapped open-water culture areas such as lakes, reservoirs, rivers and coastal brackish waters[20].

This situational analysis is established on preliminary FCCA. Indicating that any analysis herein on achievements, impacts, challenges and lessons learnt is not based on any previous FCCA but on cage aquaculture research surveys, husbandry and knowledge management founded on the planned Key Result Areas (KRAs) (Table 1). The KRAs include sustainable community cage aquaculture to increase productivity, strengthening infrastructural and human capacities, provision of an enabling environment for sustainable community cage aquaculture, and resource mobilization, collaborations and partnerships.

[20] Food and Agricultural Organization of the United Nations. (2007). Cage aquaculture: Regional reviews and global overview. Fisheries technical paper, *Food and Agriculture Organization of the United Nations*, Rome Italy

2.1.2 Key Result Areas, Achievements and Impacts

Table 1: Preliminary community-based cage aquaculture model key result areas, achievements and impacts based on research survey on existing cage aquaculture husbandry and knowledge management

	Key result areas/ Milestone	Achievement	Impacts
i.	Increased fish production through sustainable cage aquaculture	a. Implementation of donor funded programs that support cage aquaculture sub-sector (ABDP, KCSAP, GIZ, ASDSP and other donor funded projects) b. Increase in the number of farmers engaged in cage aquaculture c. Establishment of fish feed pelletizing machines distributed across counties, authenticated hatcheries and registered small-scale feed millers d. High annual production of fish seeds at over 50 million production of fingerlings	a. Enhanced BMPs b. Ecosystem approach to cage aquaculture operations enhanced c. Increased production and productivity d. Improved food and nutrition security
ii.	Strengthened infrastructural and human capacities	a. Recruitment and training of fisheries officers and inspectors. b. Recruitment and training of fish vets. c. Provision of motorbikes to fisheries officers and inspectors d. Capacity building for farmers e. Establishment of cold chain facilities	a. Increased production and productivity b. Improved food and nutrition security
iii.	Enabled environment for sustainable community cage aquaculture	a. Regular fish inspections b. Strong supervision and monitoring of aquaculture and fishery activities c. Increased awareness of existing and new policy, institutional and regulatory instruments. d. Enhanced spatial plans and zonation in aquatic resources e. Strengthened research capacity and collaborations	a. Enhanced BMPs b. Ecosystem approach to cage aquaculture operations enhanced c. Increased production and productivity d. Improved food and nutrition security

	Key result areas/ Milestone	Achievement	Impacts
iv.	Increased resource mobilization, collaborations and partnerships	a. Number of PPPs identified and enhanced b. Enhanced stakeholder collaborations and institutional linkages c. Enhanced knowledge generation, dissemination and technology transfer d. Increased access to grants	a. Increased production and productivity b. Improved food and nutrition security

2.1.3 Community-based Cage Aquaculture Challenges

The shortcomings on community-based aquaculture operations are sourced from research on the existing husbandry and knowledge management issues as follows:

a) Inadequate supply and access to quality and cost-effectiveness of fish seed and feed;
b) Weak coordination of activities in aquaculture sub sector;
c) Inadequate funds for cage aquaculture research;
d) Inadequate dissemination of research information and demand driven research;
e) Low adoption of efficient cage aquaculture production technologies;
f) Inadequate legal and institutional framework to regulate cage aquaculture;
g) Climate change impacts;
h) Inadequate entrepreneurial skills in cage aquaculture;
i) Unregulated introduction of new cage aquaculture technologies;
j) Weak market access and linkages;
k) Inadequate fish handling infrastructure/facilities;
l) Low value addition and poor market incentives to support fish and fisheries product development; and
m) Limited access to credit due to perceived high risks in the sector and weak collaboration and cooperation.

2.2 Environment Scan

2.2.1 Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis

The SWOT analysis is a strategic planning tool used by an enterprise to evaluate its prevailing internal strengths and weaknesses as well as external opportunities, and threats. The tool involves identifying the internal and external factors that are either favorable or unfavorable towards achieving of the set objectives. Strengths are characteristics (such as capabilities and resources) of an enterprise that give it competitive advantage over others. Weaknesses are internal characteristics that place an enterprise at a disadvantage relative to others (or in relation to set objectives) and must therefore be minimized to enable achievement of set objectives. Opportunities are external factors which give an enterprise a chance to enhance its ability to meet set objectives. Threats are external factors in the operating environment that reduce an enterprise's likelihood of meeting its set objectives and should therefore be mitigated. The successful

implementation of an enterprise's mandate will depend on the handling of the internal and external factors as indicated in Table 2.

Table 2**: SWOT Analysis**[21]**of Community-based Cage Aquaculture Enterprise**

Strengths	**Implications**
Devolved governance system	• County governments through county budgetary allocation have financial ability to support sector production and human resource development
Existing aquaculture stakeholder network	• Strengthened value chain networking • Informed production and productivity through real time quality data and information • Reduced resource use conflicts • Enhanced bargaining power
Existence of several small and large water bodies	• Most small and large water bodies ideal for cage aquaculture
Political goodwill	• National and County governments support
East Africa Cage aquaculture guidelines	• Regional recognition and support for cage aquaculture
Foundational selective breeding programme	• Uniformly fast growing and desisease resistant strains • Increased production and productivity • Increased incomes
Large endemic aquaculture potential fish species	• Genetic material conservation • Reduced wild species intra and interspecies competition • Enhanced aquaculture adoption • Increased per capita fish consumption
Increased number of quality fish seed hatcheries and feed producers/importers	• Affordable and accessible seed and feeds • Enhanced production and productivity • Increased investment and incomes • Gender inclusivity
Favourable environment and climate	• Year round warm tropical weather for warm water species • Water bodies supported by several rivers and streams inflow
Weaknesses	**Implications**

[21] Rimmer et al., 2013. A review and SWOT analysis of aquaculture development in Indonesia. Reviews in Aquaculture (2013) 5, 1–25.

Inadequate extension officers from national and county governments	• Gaps in extension services provided • Low morale among cage aquaculture operation staff
Poor national and county resource planning and zonation	• Unmonitored and unregulated cage investment • Environmental degradation
Inconsistencies in aquaculture policies	• Low compliance in aquaculture sub-sector • Unregulated aquaculture sub-sector operations
Uncoordinated and inconsistent cage aquaculture data	• Poor sector focus • Poor resource allocation
Low linkages with research and management institutions	• Untackled emerging issues (i.e. Climate change) • Disease outbreaks • Economic losses
Processing and marketing limitations	• Post-harvest losses • Low trade income • Low competition ability
Opportunities	**Implications**
Increased focus on the Blue Economy	• Increased support to the enterprise in information generation for the sustainable exploitation of the Blue Economy
Growing consumption trends	• Increased demand for fish • Expanded fish value chain • Gender inclusivity • Increased incomes
Increased demand for fisheries and other aquatic resources	• Need to explore and exploit untapped cage aquaculture zones and other aquatic resources • Increased demand for data and information on effective cage aquaculture • Increased demand for certified fish seed and feed
Recognition of climate change as a national challenge in Vision 2030	• Expanding Cage aquaculture installation sites in unexploited aquatic environments • Increased adoption of climate smart cage aquaculture technologies and innovations
Increased interest and training in aquatic fields	• More investment in Blue Economy literacy and awareness programmes
Enabling political and economic environment	• Increased support from both national and county governments • Increased private sector support and investments

Threats	Implications
Increasing cost of production	• Investment abandonment • Poor quality fish • Economic losses • Reduced county and national funds allocation
Water resource conflicts	• Competition for cage siting against navigation routes and traditional capture fisheries grounds • Invasion of fish breeding sites • Cage fish thefts
Disease outbreaks	• Increased mortalities • Reduced production and productivity • Loss of genetic material/reduced biodiversity
Markets	• Competition from importations and capture fisheries • Weak value chain
Environment	• Contamination of wild fish through escapees • Abandonment of cage material in water bodies • Excess fish feed discharge

2.2.2 Political, Economic, Social, Technological, Environmental and Legal (PESTEL) analysis

The analysis was done in the context of the PESTEL factors and their strategic implications and responses[22]. The analysis is presented in Table 3.

Table 3: Political, Economic, Social, Technological, Environmental and Legal (PESTEL) analysis

Political Factors		
Factor	**Strategic Implication**	**Strategic Response**
Political goodwill and Stability	• Conducive environment for cage aquaculture investment • Support from the County Governments • Favourable policies supporting Blue Economy	• Extension and Outreach programs to be enhanced • Strategic partnerships between National and County Governments with private sector. • Increased cage aquaculture investment through Blue Economy resource mobilization.

[22] Ministry of Agriculture, Livestock, Fisheries and Cooperatives Strategic Plan 2018-2022. Pp 62

		• Improved working environment and better output
Devolution as provided by the Constitution of Kenya 2010	• Opportunities for collaboration and mobilization of resources • Room for resource management and exploitation as enshrined in Chapter 11 Part 2 Section 185(4) (b) • Legislative harmony between national and county governments	• Develop strong engagement plans with county governments • Develop targeted programmes to address County Government priorities • Conducive aquaculture investment environment
Prioritization of the Blue Economy by the National Government	• Increased prominence of Blue Economy benefits • Strengthen regional formations such as the Lake Region Economic Bloc (LREB) • Blue Economy strategy and blue print	• Increased awareness of cage aquaculture role in Blue Economy • Increase collaborations and partnerships in cage aquaculture investment and management strategies • Blue Economy guided investment and resource exploitation
Favorable local and regional political agendas for emerging issues such as climate change, transboundary disputes under EAC Competition Act 2006 and alignment to the global SDGs	• Availability of financing from international organizations for relevant global issues of concern • Increased awareness and sensitization on emerging local, regional and global issues	• Increase collaborations and partnerships in cage aquaculture investment and management • Enhanced focus on climate resilient cage aquaculture approaches • Fair markets
Economic Factors		
Factor	**Strategic Implication**	**Strategic Response**
Projected economic growth from investments in cage aquaculture	• New opportunities for businesses, training, extension services and research • Demand for cage aquaculture space and investments	• Contribute data and information for the development of cage aquaculture • Enhance collaborations and linkages through investment and research to address opportunities in cage aquaculture

Research, Extension and liaison funding	• Increased research focus on cage aquaculture • Community driven participatory action research approach	• Increased lobbying for national and county governments funds allocation to support research as a driver of investments in the cage aquaculture • Partner with strategic collaborators and donors for research funding • Cage aquaculture sector players driven research and involvement
Kenya Vision 2030 and Kenya Kwanza Development Agenda	• Increased utilization of EEZ resources for cage aquaculture • Increase aquaculture production • Reduced fish post-harvest losses	• Acquisition of appropriate technologies to exploit EEZ resources through cage aquaculture • Public Private Partnership (PPP) • Develop and employ sustainable VC node specific technologies
Integration with regional bodies e.g. EAC	• Enhanced opportunities for collaborative water resources exploitation through cage aquaculture • Opportunities for larger market • Reduced cost for doing business • Free cross boarder movement • Common platforms for doing business • Common regional guidelines on cage aquaculture	• Integration of transboundary water resources cage aquaculture into EAC protocols • Expanded cage aquaculture products and services
Post-harvest fish losses	• Food insecurity and malnutrition • Investment economic losses • High prices for related protein sources • Increased cost of production	• Develop innovative technologies to reduce fish post-harvest losses • Formulation of value-added products • Capacity building on post-harvest management

		• Promote revival of aquaculture supportive VCs (soy bean, sunflower, cotton)
Social Factors		
Factor	**Strategic Implication**	**Strategic Response**
Indigenous Knowledge	• Need for research in indigenous knowledge • Create opportunities to use, develop and improve cage aquaculture technologies that are appropriate to the various communities • Informed cage aquaculture site selection • Expanded commercially important indigenous aquaculture species	• Documenting, validating, and protecting the indigenous knowledge and technologies • Provide opportunities to utilize the knowledge research process. Liaise with relevant ministries, departments and government agencies to safeguard bio-cultural heritage • Dissemination of information on indigenous knowledge
Diseases	• Reduced productivity of human resource • Lost opportunities • Increased wage bill • Reduced HH per capita income • High human resource turnover and skills loss • Reduced institutional memory	• Promote awareness and access to medical care for staff
Cultural Diversity	• Consumption cultural influence • Affects investment in cage aquaculture industry • Co-existence	• Value addition to promote fish consumption • Provision of data and information for sensitization on fish food diversity • Enhanced investment environment
Alcohol, Drug and Substance abuse	• Social degradation and reduced productivity	• Engage community and related cage aquaculture stakeholders, create awareness, and mainstream counseling and rehabilitation for staff
Rapid population growth	• Demand for research on alternative livelihoods	• Develop Blue Economy technologies and programmes

	• Reduced employment opportunities • Increased cage aquaculture fish demand	that create employment and improve food security • Promote Value-addition to enhance incomes and alternative source of community livelihoods • Provide data and information to contribute to improved cage aquaculture development and management
Technological Factors		
Factor	**Strategic Implication**	**Strategic Response**
Information and Communication Technology (ICT) and e-resources	• Better access to online information resources • Improved avenues for information dissemination • Increased to products and services	• Promote and upscale the use of aquaculture Electronic Fish Marketing Information Service (EFMIS) and Aquaculture Market Information Platforms (AMIP) • Link cage aquaculture platforms to related sector platforms
Security risk	• Potential for theft • Damage to cages • Un-authorized access to cage aquaculture protected area	• Improve security system • Training and sensitization on information security • Environmental monitoring systems (sensors)
Emerging technologies	• Inadequate cage aquaculture infrastructure and facilities	• Promote seed aggregation models along the shores • Promote community-based aquaculture laboratories • Capacity building of community cage staff on day to day monitoring and analysis • Community cage aquaculture collaboration with relevant institutions
Environmental Factors		
Factor	**Strategic Implication**	**Strategic Response**
Climate change and natural calamities	• Destruction of cages and land based (shoreline) aquaculture investment (hatcheries, offices, stores)	• Opportunity for research on climate mitigation and adaptation

	• Loss of field sensors and equipment • Shift of landing sites • Loss of fish	• Conduct research and disseminate information on Climate Change • Training and sensitization on climate change • Opportunity for mapping of potential natural calamity hotspots in aquatic systems • Opportunity to develop scenario models for extreme events
Pollution risk	• Abandoned cage material in water resource • Poor feeding strategies • Low quality cage material degradation • Loss of aquaculture genetic material (cage fish) to the environment • Poor harvested fish waste management	• Develop environmental monitoring strategy • Sensitization of cage investors and feed manufacturers on role of cage and fish feeds on the aquatic environment • Development of waste management protocols for adoption by sector players
Legal Factors		
Factor	**Strategic Implication**	**Strategic Response**
The Constitution of Kenya 2010	• Changed governance and operational environment including devolution, gender balance, bill of rights, affirmative action, leadership and integrity, and cost of compliance • Public participation has empowered and enlightened the citizenry who are demanding effective service delivery • Enhanced litigations processes	• Alignment of cage aquaculture operations with the Constitution • Inclusion of gender balance and focus on vulnerable and marginalized communities • Avail information to the public in line with requirements of the Constitution • Sensitization on constitutional and statutory requirements • Embrace public participation in cage aquaculture sector investment and decision-making • Improve services to reduce litigation

Science and Technology Act, Cap 250, repealed by the Science, Technology and Innovation Act No. 28 of 2013	• Provide scientifically sustainable approaches to Blue economy exploitation in collaboration with all stakeholders	• Review and recommend cage aquaculture sites • Review and recommend live fish handling and movement • Review and recommend waste management strategies
Fisheries Management and Development Act No. 35 of 2016	• Provides for consultation between KMFRI and KeFS, KFMA, Fish Levy Trust Fund and other players on matters of aquaculture investment, research and coordination	• To align with the provisions of this Law and collaborate with the relevant Fisheries agencies
International and regional conventions treaties and agreements	• Obligation to support the Government to comply with these conventions and agreements	• Collate and provide relevant information for compliance

2.3 Stakeholders' Analysis

The stakeholders' analysis was undertaken to identify the internal and external stakeholders that cage aquaculture investors collaborate or interact with for the efficient and effective delivery of products and services. Table 4 provides the key stakeholders, their expectations, and their potential contribution as well as cage aquaculture investors' expectations in the implementation of this framework.

Table 4**:** Stakeholders Analysis

Stakeholder category	Stakeholder expectations	Cage aquaculture investors' expectations from the stakeholder
The National and County Treasuries	• Investment information for contribution to GDP and socioeconomic development • Prudent management of resources	• Resource mobilization, adequate and timely funding and budget approval • Public Financial Policy Guidelines
Ministry responsible for fisheries, aquaculture and the Blue Economy	• High standards of professional ethics by cage aquaculture stakeholders • Accountability and transparency in provision of products and services • Compliance to statutory obligations • Provision of quality research and extension information to guide policy decisions	• Support funding requests • Timely communication • Lobby for additional funding on behalf of the cage aquaculture stakeholders • Clear definition of mandates • Policy formulation
State Department responsible for fisheries, aquaculture and the Blue Economy	• High standards of professional ethics by cage aquaculture stakeholders • Accountability and transparency in provision of products and services • Effectiveness, efficiency and economic use of resources • High levels of environmental management • Provision of data to guide resource management	• Utilization of research and extension findings for resource management • Policy formulation and aquaculture management guidelines • Resource management, enforcement and extension services • Provision of cage aquaculture national data to inform investment

Stakeholder category	Stakeholder expectations	Cage aquaculture investors' expectations from the stakeholder
		• Coordinate and assist in transfer of fish genetic material
National Commission for Science, Technology and Innovations (NACOSTI) and National Research Fund (NRF)	• Partnership and collaboration on research matters • High quality research output • Participatory action approach cage aquaculture research • Prudent utilization of research funds	• Funding and promoting of participatory technology and innovation advancement • Facilitate research permits acquisition where necessary
Ministries, Departments and Government Agencies	• Collaboration in development and implementation of Blue Economy activities through cage aquaculture	• Collaboration in program development, resource mobilization and law enforcement
Universities (International and National), tertiary training institutions and basic education learning institutions	• Collaborative cage investment research approach • Collaborative aquaculture curriculum development • Collaborative stakeholder training, sensitization and exhibition/field day programmes and projects (including student attachment and internships). • Mentorship for basic education units	• Aquaculture and environment capacity building in support of Blue Economy • Collaboration in sustainable cage aquaculture development and implementation • Production of quality graduates • Provision of skilled and knowledgeable graduates to aquaculture sector
Office of the Attorney General and Department of Justice	• Compliance with the law and legal issues on cage aquaculture operations	• Representation and advice on matters of the law
Law enforcement agencies	• Cooperation and compliance on relevant laws and regulations	• Safety and security • Regular sensitization of laws and regulations
County Governments	• Provision of technical support and capacity building	• Extension services • Provision of land for establishment of community-based aquaculture facilities

Stakeholder category	Stakeholder expectations	Cage aquaculture investors' expectations from the stakeholder
	• Support and co-operation when required on matters relating to aquaculture sub-sector and other marine resources through e.g., CIDPs • Dissemination of research output to the communities • Collaboration and partnership in development and implementation of Blue Economy activities through cage aquaculture	• Allocation of funds for support of the aquaculture sector development • Sharing of county policies, plans and programmes pertaining to utilization of aquatic resources • Upscale developed research technologies and extension models • Issuance of permits and other relevant documents
Development partners and financial institutions	• Prudent management of funds and other resources • Transparency and accountability • Timely provision of required products and services, information and reports • Generation of data and information to support informed management and development of marine resources	• Technical support/ capacity development • Funding of research projects • Cooperation in research in Blue Economy sectors • Regional research and extension coordination • Resource mobilization • International lobbying • Data and Information exchange • Grant leverage
Local and international Non-Governmental Organizations	• Support the implementation of Regional and International Organizations initiatives • Conducive political atmosphere	• Mobilization of resources • Community mobilization and sensitization • Up-scaling and out-scaling aquaculture technologies • Advocacy, networking and lobbying
Community-based organizations, Fisheries organizations, BMUs	• Technical and logistical support • Efficiency in delivery of services • High standards of professional ethics	• Sustainable resource management • Community empowerment • Awareness creation • Capacity building

Stakeholder category	Stakeholder expectations	Cage aquaculture investors' expectations from the stakeholder
	• Accountability and Transparency in provision of services	• Resource mobilization • Advocacy, networking and lobbying • Partnership in research and extension • Marketing groups • Transfer of indigenous knowledge • Technology adoption • Goodwill • Compliance with management regulations • Information and data sharing
Private sector such as fish processors, feed companies, traders	• Provide research output that will address their challenges • Technical support • High standards of professional ethics • Accountability and Transparency in provision of information • Spur growth of blue economy cottage industry	• Partnership in research and extension • Funding of research and support on extension services, • Adoption of sustainable aquaculture technologies • Compliance with aquaculture and other relevant quality assurance regulations
Regulatory bodies	• Collaboration in setting standards and compliance with the set standards	• Sub-sector supportive aquaculture standards • Utilization of research and extension data • Utilization of indigenous knowledge • Provision of advisory and regulatory services • Enforcement of relevant laws and regulations
National and County Legislative Assemblies	• Compliance with the Constitution, relevant policies, laws and regulations	• Enactment of laws and by-laws • Allocation of research, extension and sub-sector development funds

Stakeholder category	Stakeholder expectations	Cage aquaculture investors' expectations from the stakeholder
	• Provision of reliable and timely information on national and county assembly sub-sector enquiries	• Approval of budgets • Oversight authority
Media platforms i.e. Internet Service Providers (ISPs), Media Houses, printing firms	• Receive timely information • Access facts/information	• Information Technology services • Packaging and timely dissemination of information • Awareness creation • Effective coverage and accurate reporting on aquaculture sub-sector development
Maritime Agencies, KMA, Bandari College, KPA, Kenya Coast Guard Service	• Compliance with maritime regulations • Provision of reliable and timely information/ reports required from time to time for development of Blue Economy	• Provision of maritime standards • Capacity building • Safety regulations awareness and reinforcement
Labour relations stakeholders	• Support employee welfare • Meet employer obligations	• High productivity of staff • Mediation for conflict resolution
Employees	• Provision of tools for trade • Conducive work environment • Favourable terms and conditions of service	• Commitment to service delivery • Observance of work ethics

CHAPTER THREE

3.0 FRAMEWORK FOR COMMUNITY-BASED CAGE AQUACULTURE (FCCA)

This chapter outlines the vision, mission, and core values of the cage aquaculture framework model. It highlights the key results areas and strategic objectives to operationalize the vision and mission. Further, it outlines strategic actions to be applied to meet the strategic objectives during the FCCA implementation period.

3.1 Vision, Mission, and Core Values

Vision:

- A vibrant, inclusive, and sustainable community-based cage aquaculture for improved livelihoods.

Mission:

- To develop vibrant, gender-equitable, and profitable community-based cage aquaculture enterprises for improved incomes, economic growth, food, and nutrition security.

Core Values:

The plans within this FCCA will be guided by the following core values: -

- Professionalism
- Integrity
- Equity
- Equality
- Transparency
- Accountability

3.2 Key Result Areas and Strategic Objectives

Four key result areas (KRAs) have been identified based on the community cage aquaculture framework model. Strategic objectives have been formulated for each key result area to be implemented through prioritized actions, as set out in table 5.

1. Sustainable community cage aquaculture production and productivity
2. Infrastructural, institutional, and human resource capacity building
3. Enabling environment for sustainable community-based cage aquaculture development
4. Resource mobilization, partnership, and collaborations

Table 5: Key Result Areas, Strategic objectives and strategic actions

Key Results Areas	Strategic Objectives	Strategic Actions
KRA 1: Sustainable community cage aquaculture production and productivity	1.1 To increase fish production through climate smart aquaculture technologies and innovations	1.1.1 Support public and private sector authenticated hatcheries to produce quality seed and avail to cage farmers at affordable prices; 1.1.2 Conduct regular monitoring of water quality parameters in cage farms and routine biosecurity measures to promote best management cage aquaculture practices; 1.1.3 Establish community-based fish feed production demonstration units for youth and women groups 1.1.4 Develop the capacity of existing feed mill processing, potential of new mills and new feeding options
	1.2 To enhance food supply and food security through Value Creation and Markets for Nutritious Aquaculture Products	1.2.1 Sensitize communities on nutritional importance of cage fish consumption 1.2.2 Train youth and women on innovative fish post-harvest and value addition technologies and marketing strategies. 1.2.3 Support women groups with mini-food processing equipment 1.2.4 Assess the nutritional status and dietary diversity of fish farming households 1.2.5 Build capacity on fish-based recipes and dietary diversity using social behavior change communication (SBCC) strategies
	1.3 To monitor the sustainable production of safe and quality cage fish products in an effective and coordinated manner	1.3.1 Develop protocols for production, marketing and trade of safe fish and fishery products 1.3.2 Build capacity for cage aquaculture farmers in risk analysis, adaptive management, disease diagnosis, biosecurity measures, safety and food security
KRA 2: Strengthen infrastructural, institutional and human resource capacity building	2.1 To develop community-based cage aquaculture demonstration centers (CCADCs) along the riparian counties	2.1.1 Develop training manuals and modules for hatchery managers and feed producers 2.1.2 Develop an online training to provide free courses on techniques and technologies in cage aquaculture 2.1.3 Build capacity of cage aquaculture stakeholders through practical demonstration trainings within the BMUs

Key Results Areas	Strategic Objectives	Strategic Actions
	2.2 To strengthen research, training, extension linkage for effective generation, dissemination and utilization of knowledge and skills for increased cage fish production and productivity	2.2.1 Create multi-stakeholder platform for knowledge exchange 2.2.2 Develop a ToT module and manual for training of extension service providers 2.2.3 Build capacity of extension service providers on technical, market and regulatory aspects of cage farming; 2.2.4 Promote education and awareness creation on investment opportunities in the cage aquaculture 2.2.5 Undertake tailor-made training for community-based hatchery operators and associated extension service providers.
	2.3 To develop an inventory of existing cage infrastructure, facilities, and technical capacity of institutions and hatcheries	2.3.1 Assess the physical and technical capacity of institutions dealing in cage aquaculture operations 2.3.2 Develop technical guidance for responsible investment in cage aquaculture for small-scale farms 2.3.3 Develop and support community hatcheries and nurseries with basic seed production and rearing facilities based on needs assessment.
	2.4 Develop a system-wide framework for sharing information on aquaculture	2.4.1 Conduct Surveys to collect data for uploading into a cage aquaculture database 2.4.2 Develop a web-based and mobile based fish cage information sharing platform 2.4.3. Strengthen market linkages for aquaculture farmers and traders 2.4.4 Develop and publish IEC materials such as manuals, policy briefs, factsheet and brochures (translated into local languages)
	2.5 To promote gender mainstreaming in the aquaculture value chain	2.5.1 Conduct gender inclusive sensitization and awareness creation on youth and women inclusion in cage aquaculture activities 2.5.2. Strengthen youth associations and women groups in aquaculture value chains; 2.5.3 Facilitate social protection mechanisms to support marginalized and vulnerable persons in cage aquaculture value chain
KRA 3: Enabling environment for sustainable community cage aquaculture models	3.1 Adaptation intervention to enhance farming communities' resilience to climate change induced effect	3.1.1 Build capacity and sensitize cage aquaculture farmers on disaster risk management in aquaculture 3.1.2 Promote development of locally available climate smart technologies and innovations

Key Results Areas	Strategic Objectives	Strategic Actions
(social, economic, ecological and institutional)		3.1.3 Undertake risk and vulnerability assessment of the cage aquaculture value chain
	3.2 To improve market access and trade	3.2.1 Train and build capacity for cage farmers on market requirements and innovation on cage aquaculture value chains 3.2.2 Upscale use of cost-effective aquaculture market information systems among cage farmers; 3.2.3 Promote responsible fish handling and preservation measures and technologies to minimize post-harvest losses; 3.2.4 Conduct multi-agency stakeholder meetings to initiate certification and standardization processes for cage production.
	3.3 To develop a spatial plan for aquaculture zoning, site selection and design of aquaculture management areas	3.3.1 Provide technical support for the establishment of allocated zones for cage aquaculture (AZCA); 3.3.2 Undertake zoning and carrying capacity assessments of inland water bodies for cage fish farming; 3.3.3 Strengthen research capacity to undertake spatial planning within inland fisheries resources
	3.4 An integrated environment monitoring system is put in place to ensure cage aquaculture safety and to minimize aquaculture impacts on surrounding ecosystems.	3.4.1 Conduct regular environmental monitoring and social impact assessment; 3.4.2 Establish a core team for cage aquaculture risk analysis, focusing on the control of pathologies and including prevention aspects and biosecurity; 3.4.3 Foster institutional collaboration in undertaking conservation, management and improvement of reference broodstock genetic resources; 3.4.4 Support to increase the participation of cage aquaculture farmers' organizations (CFFAKs) in sector governance and decision-making processes
	3.5 To establish and operationalize an Aquacage Model within the riparian counties	3.5.1 Conduct an assessment of the cage aquaculture model and establish aggregated cage parks in the riparian regions 3.5.2 Sensitize farmers on the model framework 3.5.3 Support the development of an aquacage infrastructure for cage fish farmers

Key Results Areas	Strategic Objectives	Strategic Actions
		3.5.4 Creation and dissemination of practical knowledge tools to facilitate the understanding and use of aquacage across the riparian regions
KRA 4: Resource mobilization, partnership, and collaboration	4.1 To mobilize and manage financial and human resources in cage aquaculture	4.1.1 Encourage investment in small, medium and large-scale commercial cage aquaculture for domestic markets through linkages with affordable microfinance 4.1.2 Develop a resource mobilization strategy for aquaculture development and marketing 4.1.3. Improve farmer access to capital and credit facilities by promoting the establishment of financing schemes in existing monetary banks and financial institutions by issuing long-term credits and low repayment rates; 4.1.4. Sensitize and incentivize local investors, and attract local, regional, and foreign partners to invest in fish feed production, cage materials, and equipment.
	4.2 To promote collaboration and partnership in community cage aquaculture research and development	4.2.1 Establish and maintain collaborations and partnerships in cage aquaculture research and development with partners including research institutions, County Governments and local communities 4.2.2 Support joint ventures through Public Private Sector Partnerships (PPP) in cage aquaculture
	4.3 Promote Corporate Social Responsibility initiatives in cage aquaculture ventures	4.3.1 Assess the level of social acceptability of cage aquaculture in the riparian regions 4.3.2 Conduct best community-based cage aquaculture certification programmes for farmers who meet the strict standards and social accountability 4.3.3 Strengthen existing collaborative network of government agencies, civil society, academia and research, private sector and international organizations

CHAPTER FOUR

4.0 IMPLEMENTATION AND COORDINATION FRAMEWORK

4.1 Overview

Aquaculture developments worldwide are regulated to ensure adherence to the Ecosystem Approach to Aquaculture of which the implementation of FCCA will adopt. The implementation of the FCCA will be done through collaboration and partnerships. During its three (3) year implementation, various stakeholder groups and institutions will be involved. This section sets out the implementation arrangements for the framework, and identifies roles and responsibilities of the various stakeholder groups and/or institutions. The overall strategy for the implementation of the framework will include a budget line.

4.2 Organizational Structure

The National Government is responsible for Policy formulation, regulations and standard setting for aquaculture. The County Governments are responsible for the implementation of both National and County policies, regulations and implementation of functions outlined in Kenya Gazette notice No. 116 of August 2013, and any other function as outlined in Article 186 and 187. This FCCA model will be implemented by National and County Governments through existing organization structure as shown in table 6.

Table 6**:** Agencies under National and County Governments and their functions in relation to cage aquaculture

Organization	Organization Functions
State Department for Fisheries, Aquaculture and the Blue Economy	*The functions of the SDFA&BE are:* • Co-ordination of development of policy, legal, regulatory and institutional framework for the fisheries industry and the blue economy • Enhancement of technical cooperation with partner states • Capacity building for sustainable exploitation of aquaculture resources
Kenya Fisheries Service (KeFS)	*Established under the Fisheries Management and Development Act No. 35 of 2016 to:* • Conserve, Manage and Develop Kenya Fisheries and Aquaculture Resources for enhanced livelihoods of communities dependent on fisheries and aquaculture. • Fishing licensing, Development of fisheries and promotion of fish production, and promotion of fish quality safety an trade.
Kenya Fish Marketing Authority (KFMA)	• Market Kenyan fish and fisheries products, locally, regionally and internationally • Search and research for potential markets for Kenya's fish and fisheries product
Kenya Marine and Fisheries Research Institute (KMFRI)	*A State Corporation established by the Science and Technology Act, Cap 250 of the Laws of Kenya, currently repealed by the Science, Technology and Innovation Act No. 28 of 2013, with the mandate to:*

Organization	Organization Functions
	• Undertake research in "marine and freshwater fisheries, aquaculture, environmental and ecological studies, and marine research including chemical and physical oceanography", in order to provide scientific data and information for sustainable development of the Blue Economy
Kenya Fish Levy Trust Fund	• The Fish Levy Trust Fund is established under Part IV, Section 28 of the Fisheries Management and Development Act, 2016 and its mandate is to: • Provide supplementary funding of activities geared towards management, development and capacity building, awards and urgent mitigation to ensure sustainability of the fisheries resource.
National Environment Management Authority (NEMA)	• Coordination of all matters relating to the environment
Ministry of interior and coordination of national government	• Community law and order
County Governments	• Implement the National Aquaculture Sector Strategy and Plan • Develop and implement county Aquaculture Sector Strategy and Plan • Implement aquaculture guidelines and regulations • Promote research in aquaculture • Establish and build capacity of staff responsible for aquaculture activities in the county
Beach/ Dam Management Units	• Aquaculture production • Community policing/ patrols and cage security • Enrolment for cage fish farming
Farmers groups/ organizations/committees	• Aquaculture production • Aquaculture marketing • Aquaculture consumption • Community dam management

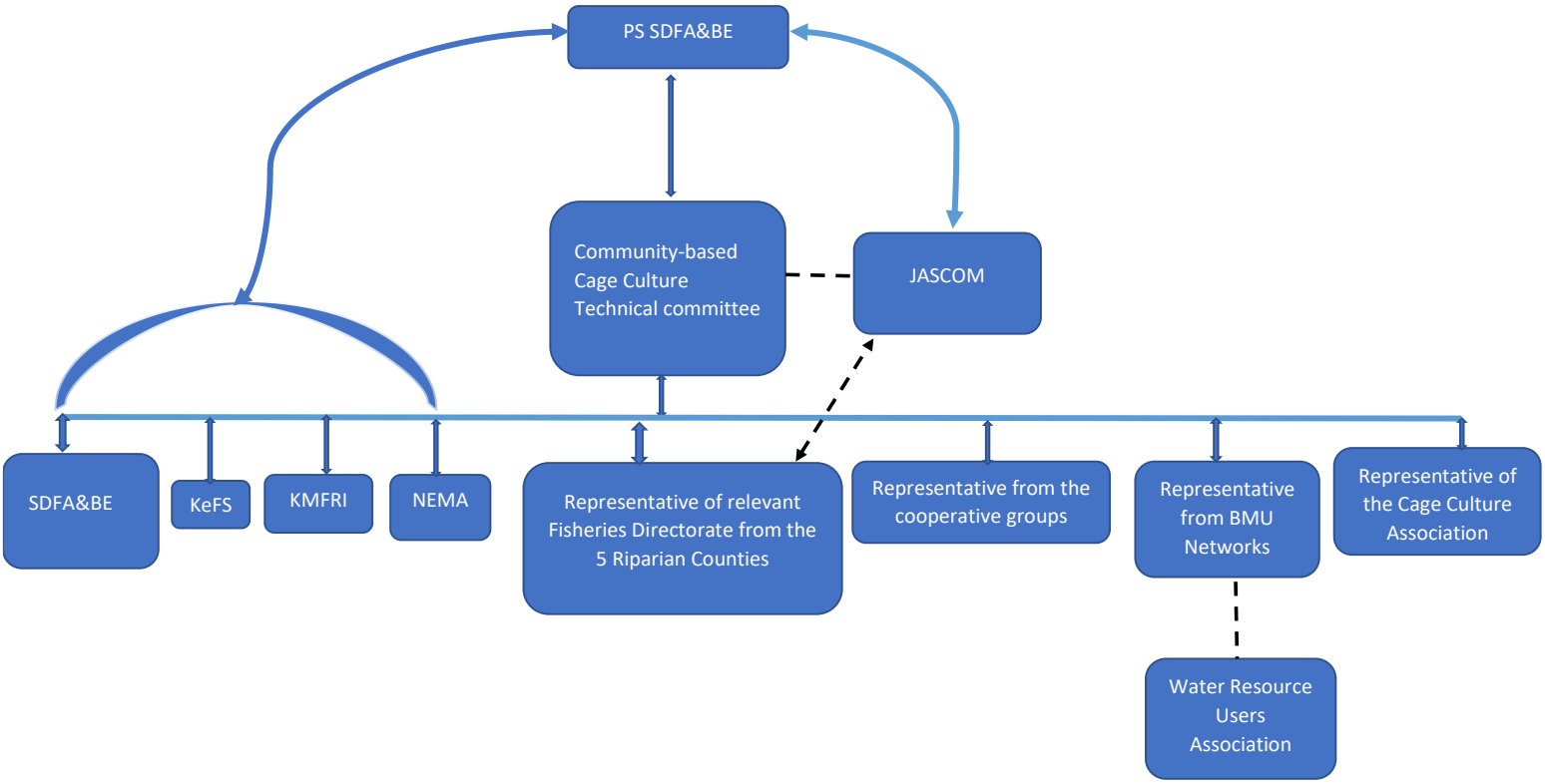

Figure 1**:** Schematic representation of organizations involved in cage aquaculture governance

The organizations involved in the implementation of the FCCA are indicated. Activities between the National and County Governments are coordinated by the Joint Agricultural Sector Consultation and Cooperation Mechanism (JASCOM) where necessary (Figure 1).

4.3 Personnel to Run the Community-based Cage Aquaculture Establishment

The FCCA model will be run through the existing national and county government structures in collaboration and partnerships with elected cage aquaculture community leaders, cage aquaculture farmer organizations/ associations, beach management units and dam management units where applicable. Personnel to run the establishment will include officers from the SDFA&BE including officers from KeFS and KMFRI, NEMA and county government department responsible for fisheries and aquaculture management and development. The community-based cage aquaculture groups will be involved as the primary implementers of the model to achieve sustainable fish production and productivity for increased incomes, improved livelihoods, food nutrition and security.

4.4 Financial Resources

To realize the objectives and strategies outlined in the FCCA, the national and the County governments in collaboration with community organizations and relevant development partners will require to mobilize financial resources as shown in Table 7. The funds will be generated through both internal and external sources.

Table 7: Cost of Implementation of FCCA in KES Millions

Key Result Areas	Cost of Implementation (KES Million)			
	Y1	Y2	Y3	Responsible Institution
Result Area 1: Sustainable community cage aquaculture production and productivity				
1.1 To increase fish production through climate smart aquaculture technologies and innovations				
1.1.1 Support public and private sector authenticated hatcheries to produce quality seed and avail to cage farmers at affordable prices;	20.0	22	24.2	SDFA&BE, KeFS, KMFRI, County Governments, TVETs, Academia, CFFA, BMUs, WRUAs, AAK
1.1.2 Promote best cage aquaculture management practices;	50.0	55	60.5	
1.1.3 Support public and private sector certified feed processors to produce quality feed and avail to cage farmers at affordable prices.	20.0	22	24.2	
1.1.4 Promote fish feed supportive value chain	30.0	33	36.3	
1.1.5 Establish community-based fish feed production demonstration units for women, youth, marginalized and vulnerable groups	10.0	5.0	5.0	
1.2 To enhance food supply and food security through Value Creation and Markets for Nutritious Aquaculture products				
1.2.1 Sensitize communities on nutritional importance of cage fish consumption	20.0	22	24.2	SDFA&BE, KeFS, KMFRI, County Governments, TVETs, Academia, CFFA, BMUs, WRUAs, AAK
1.2.2 Train women, youth, marginalized and vulnerable groups on innovative fish post-harvest and value addition technologies and marketing strategies.	20.0	22	24.2	
1.2.3 Support women, youth, marginalized and vulnerable groups with mini-food processing equipment, post-harvest loss reduction and value addition technologies	200.0	220	242	
1.2.4 Assess the nutritional status and dietary diversity of fish farming households	15.0	16.5	18.15	

Key Result Areas	Cost of Implementation (KES Million)			
	Y1	Y2	Y3	Responsible Institution
1.2.5 Build capacity on fish-based recipes and dietary diversity using social behavior change communication (SBCC) strategies	10.0	11	12.1	
1.3 To monitor the sustainable production of safe and quality cage fish products in an effective and coordinated manner				
1.3.1 Develop protocols for production, marketing and trade of safe fish and fishery products	15.0	5.0	5	SDFA&BE, KeFS, KMFRI, County Governments, TVETs, Academia, CFFA, BMUs, WRUAs, AAK
1.3.2 Build capacity for cage aquaculture farmers in risk analysis, adaptive management, disease diagnosis, biosecurity measures, safety and food security	30.0	33	36.3	
Result Area 2: To strengthen infrastructural and human capacities				
2.1 To develop community-based cage aquaculture demonstration centers (CCADCs) along the riparian counties				
2.1.1 Develop training manuals and modules for hatchery managers and feed producers	10.0	5.0	5.0	SDFA&BE, KeFS, KMFRI, County Governments, TVETs, Academia, CFFA, BMUs, WRUAs, AAK
2.1.2 Develop an online training to provide free courses on techniques and technologies in cage aquaculture	15.0	5.0	5.0	
2.1.3 Build capacity of cage aquaculture stakeholders through practical demonstration trainings within the Beach Management Units and Water Resources Users Associations (WRUAs)	30.0	33	36.3	
2.2 To strengthen research, training, extension linkage for effective generation, dissemination and utilization of knowledge and skills for increased cage fish production and productivity				
2.2.1 Create multi-stakeholder platform for knowledge exchange	5.0	5.5	6.05	SDFA&BE, KeFS, KMFRI, County Governments, TVETs, Academia, CFFA, BMUs, WRUAs, AAK
2.2.2 Develop a ToT module and manual for training of extension service providers	10.0	5.0	5.5	
2.2.3 Build capacity of extension service providers on technical, market and regulatory aspects of cage farming;	20.0	22	24.2	

Key Result Areas	Cost of Implementation (KES Million)			
	Y1	Y2	Y3	Responsible Institution
2.2.4 Promote education and awareness creation on investment opportunities in the cage aquaculture	20.0	22	24.2	
2.2.5 Undertake tailor-made training for community-based hatchery operators and associated service providers.	15.0	16.5	18.15	
2.3 To develop an inventory of existing cage infrastructure, facilities, and technical capacity of institutions and hatcheries				
2.3.1 Assess the physical and technical capacity of institutions dealing in cage aquaculture operations and mitigations	10.0	5.0	5.0	SDFA&BE, KeFS, KMFRI, County Governments, TVETs, Academia, CFFA, BMUs, WRUAs, AAK
2.3.2 Develop technical guidelines for responsible investment in cage aquaculture for small-scale farms	10.0	5.0	5.5	
2.3.3 Develop and support community hatcheries and nurseries with basic seed production and rearing facilities based on needs assessment	200.0	50.0	55	
2.4 Develop a system-wide framework for sharing information on aquaculture				
2.4.1 Conduct Surveys to collect data for uploading into a cage aquaculture database	12.0	13.2	14.52	SDFA&BE, KeFS, KMFRI, County Governments, TVETs, Academia, CFFA, BMUs, WRUAs, AAK
2.4.2 Develop a web-based and mobile based fish cage information sharing platform	50.0	10.0	11	
2.4.3. Strengthen market linkages for cage aquaculture farmers and traders	10.0	11	12.1	
2.4.4 Develop and publish IEC materials such as manuals, policy briefs, factsheet and brochures (translated into local languages)	15.0	16.5	18.15	
2.5 To promote gender mainstreaming in the aquaculture value chain				
2.5.1 Conduct gender inclusive sensitization and awareness creation on youth, women, marginalized and vulnerable groups inclusion in cage aquaculture activities	20.0	22	24.2	SDFA&BE, KeFS, KMFRI, County Governments, CFFA, BMUs, WRUAs, State Department for Gender
2.5.2. Strengthen youth, women, marginalized and vulnerable groups associations and groups in aquaculture value chains;	15.0	16.5	18.15	

Key Result Areas	Cost of Implementation (KES Million)			
	Y1	Y2	Y3	Responsible Institution
2.5.3 Facilitate social protection mechanisms to support marginalized and vulnerable persons in cage aquaculture value chain	10.0	11	12.1	
Result Area 3: To provide an enabling environment for sustainable CCAMF				
3.1 Adaptation intervention to enhance farming communities' resilience to climate change induced effect				
3.1.1 Undertake risk and vulnerability assessment of the cage aquaculture value chain	10.0	11	12.1	SDFA&BE, KeFS, KMFRI, County Governments, CFFA, BMUs, WRUAs
3.1.2 Build capacity and sensitize cage aquaculture farmers on disaster risk management in aquaculture	12.5	13.75	15.125	
3.1.3 Promote development of locally available climate smart technologies and innovations	10.0	11	12.1	
3.2 To improve market access and trade				
3.2.1 Build capacity of cage farmers and traders on market requirements for cage aquaculture products	8.0	8.8	9.68	SDFA&BE, KeFS, KMFRI, County Governments, Academia, CFFA, BMUs, WRUAs, KFMA, State Department for Cooperatives
3.2.2 Upscale use of cost-effective aquaculture market information systems among cage farmers;	5.1	5.61	6.171	
3.2.3 Promote responsible fish handling and preservation measures and technologies to minimize post-harvest losses;	5.0	5.5	6.05	
3.2.4 Development of national cage aquaculture guidelines to inform policy	15.0	5.0	5.5	
3.3 To develop a spatial plan for aquaculture zoning, site selection and design of aquaculture management areas				
3.3.1 Provide technical support for the establishment of allocated zones for cage aquaculture (AZCA);	8.0	4.0	4.4	SDFA&BE, KeFS, KMFRI, County Governments, KMA, NEMA, CFFA, BMUs, WRUAs
3.3.2 Undertake zoning and carrying capacity assessments of inland water bodies for cage fish farming;	10.0	3.0	3.3	

Key Result Areas	Cost of Implementation (KES Million)			
	Y1	Y2	Y3	Responsible Institution
3.3.3 Strengthen research capacity to undertake spatial planning within inland fisheries resources to support community-based cage aquaculture development	30.0	33	36.3	
3.4 An integrated environment monitoring system is put in place to ensure cage aquaculture safety and to minimize aquaculture impacts on surrounding ecosystems.				
3.4.1 Support bi-annual and emergency environmental monitoring and social impact assessment;	15.0	16.5	18.15	SDFA&BE, KeFS, KMFRI, County Governments, CFFA, BMUs, WRUAs, KMA, NEMA
3.4.2 Establish a core team and training of ToTs for cage aquaculture disease risk analysis, management and prevention	10.0	5.0	5.5	
3.4.3 Foster institutional collaboration in undertaking Community-based conservation, management and improvement of broodstock genetic resources;	10.0	11	12.1	
3.4.4 Increase participation of Cage Aquaculture Farmers' Organizations (CFFAKs) in decision-making processes	15.0	16.5	18.15	
3.5 To establish and operationalize an Aquacage Model				
3.5.1 Assess potential sites and identify cage aquaculture community groups for establishment of aggregated aquacage	5.5	6.05	6.655	SDFA&BE, KeFS, KMFRI, County Governments, CFFA, BMUs, WRUAs, AAK
3.5.2 Sensitize community-based cage farmers on the aquacage model framework	2.0	2.2	2.42	
3.5.3 Support the development of an aquacage infrastructure for cage fish farmers	50.0	55	60.5	
3.5.4 Facilitate practical information exchange through benchmarking of existing aquaparks	20.0	22	24.2	
KRA 4: Resource mobilization, partnership, and collaboration				
4.1 To mobilize and manage financial and human resources in cage aquaculture				

Key Result Areas	Cost of Implementation (KES Million)			
	Y1	Y2	Y3	Responsible Institution
4.1.1 Encourage investment in small, medium and large-scale commercial cage aquaculture for domestic markets through linkages with affordable microfinance	2.0	2.2	2.42	SDFA&BE, KeFS, KMFRI, County Governments, CFFA, BMUs, WRUAs, AAK, Financial Institutions
4.1.2 Develop a resource mobilization strategies for aquaculture development and marketing	1.0	1.1	1.21	
4.1.3. Promote access to capital and credit facilities by promoting the establishment of financing schemes in existing financial institutions by issuing long-term credits and low repayment rates;	1.5	1.65	1.815	
4.1.4. Sensitize and incentivize local investors, and attract local, regional, and foreign partners to invest in fish feed production, cage materials, and equipment.	5.0	5.5	6.05	
4.1.5 Conduct stakeholder forums to create awareness on business planning and financial management in community cage-based investments	3.0	3.3	3.63	
4.2 To promote collaboration and partnership in community cage aquaculture research and development				
4.2.1 Establish and maintain collaborations and partnerships in cage aquaculture research and development with partners including research institutions, County Governments and local communities	10.0	11	12.1	SDFA&BE, KeFS, KMFRI, County Governments, TVETs, Academia, CFFA, BMUs, WRUAs, AAK, KMA, NEMA
4.2.2 Support joint ventures through Public Private Sector Partnerships (PPP) in cage aquaculture	30.0	33	36.3	
4.3 Promote Corporate Social Responsibility initiatives in cage aquaculture ventures				
4.3.1 Assess the level of social acceptability of cage aquaculture in the riparian regions	3.0	3.3	3.63	SDFA&BE, KeFS, KMFRI, County Governments, CFFA, BMUs, WRUAs, AAK
4.3.2 Conduct best community-based cage aquaculture certification programmes for farmers who meet the set standards and social accountability	8.0	8.8	9.68	

Key Result Areas	Cost of Implementation (KES Million)			
	Y1	Y2	Y3	Responsible Institution
4.3.3 Strengthen existing collaborative network of government agencies, civil society, academia and research, private sector and international organizations	50.0	55	60.5	
TOTAL	**1271.6**	**1100.46**	**1208.006**	

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CHAPTER FIVE

5.0 MONITORING AND EVALUATION OF THE FRAMEWORK

5.1 Monitoring and Evaluation Institutional Framework

Monitoring is a continuous function that uses systematic data collection on specified indicators to provide the State Department with indications of the extent of progress toward and achievement of stated strategic objectives, as well as progress in the use of allocated funds. The effective monitoring and evaluation of strategic actions is critical to the framework's successful implementation. The FCCA will be evaluated both during and after implementation to determine its feasibility and likelihood of producing the desired results. This will be due to relevance, cost effectiveness, efficiency, and long-term viability. In this regard, efficiency will assess the extent to which the intended outputs are met in comparison to the annual targets. Sustainability will address whether there is capacity for follow-up implementation plan.

To spearhead M&E activities in regard to this strategy, the relevant sub-sectors within the parent Ministry will form an M&E committee with members drawn from all relevant departments moderated by a chair who will be elected at the inception meeting. Membership shall be drawn from the representatives from SDFA&BE, KeFS, KMFRI, NEMA, a representative from relevant Fisheries Directorate from the five riparian Counties, a member from the relevant cooperative Society, BMU Networks and Cage aquaculture Association. This committee will prepare annual M&E reports and submit them to the SDFA&BE and other relevant institutions to assess the Plan's implementation. The State Department will conduct internal performance monitoring of strategic actions using the existing organizational structure outlined in the M&E performance framework. Appendix 1 gives the logical framework tool for monitoring including key performance indicators and means of verification.

The mechanisms for performance monitoring will include:

- Supervision
- Service delivery surveys
- Annual review meetings

The Community-based Cage Aquaculture Framework will be subjected to four evaluations, which are two (2) Annual Evaluations; a Mid-Term Evaluation and Review; and a Final Evaluation. The evaluations will be done using the indicator-monitoring tool provided in Appendix 1. The M&E structure and reporting mechanism is provided in figure 2;

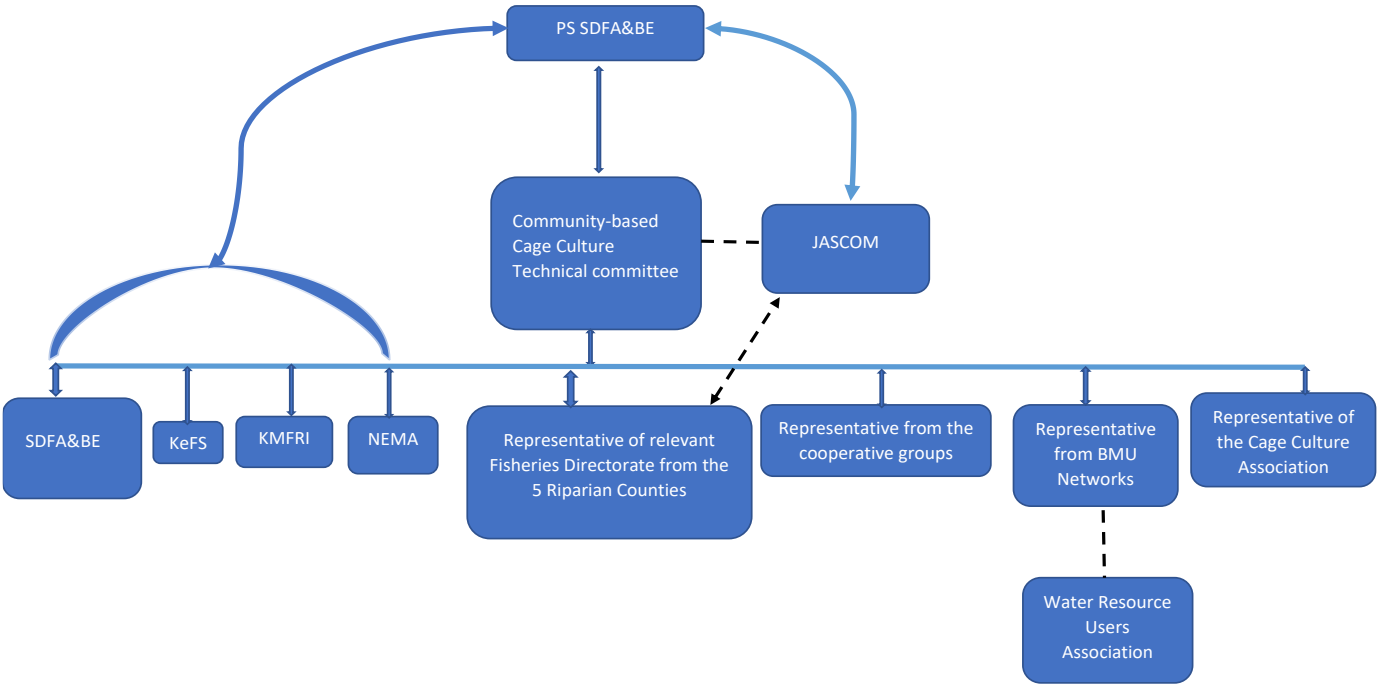

Figure 2: M&E structure and reporting mechanism

5.1.1 Annual Performance Review

The ABDP will conduct two (2) annual performance assessments. The first annual performance review will take place at the end of the 2023/24 fiscal year. The second annual review will take place at the end of the 2024/25 fiscal year. External independent experts with experience in strategic and business planning will conduct the annual performance review. The recommendations of the annual performance review will be used to guide the plan's execution as needed.

5.1.2 Mid-Term Evaluation and Review (MTER)

The State Department will conduct a Mid-Term Evaluation and Review (MTER) of the Plan to assess the extent to which strategic goals and objectives have been met. An independent expert will conduct the MTER at the end of the planning year 2025/2026. The MTER results will be used to guide the plan's implementation.

5.1.3 Evaluation

The Plan will be evaluated to determine its impact, efficiency, effectiveness, and long-term viability, as well as to document lessons learnt.

5.2 Monitoring and Evaluation Reporting

The purpose of M&E is to facilitate the tracking of progress towards realization of the FCCA at National and County levels. Monitoring will entail collecting and analysing data on the Plan's implementation progress on a regular basis. The analysis results will then be used to inform

decision-making. The M&E technical committee will report on the performance indicators and progress on quarterly and annual basis. During monitoring the following should be considered as the roles of the Government and the private sector in line with the FCCA;

Government will:

i. Monitor the local and imported live fish
ii. Define a standard system for data collection
iii. Collect and publish reliable and up-to-date statistics on the Community-based cage aquaculture
iv. Ensure that environmental impact assessment studies are properly conducted before licensing and installation of the cages in the water body
v. Regularly evaluate the sector development level to generate quarterly reports on the progress
vi. Have one inter-agency monitoring unit through the M&E technical team and set up a database

The enterprise will:

i. Regularly provide reliable and up-to-date data on their investments
ii. Have self-monitoring mechanisms to ensure seed and feed quality and aquaculture products quality
iii. Comply to existing laws and regulations governing cage aquaculture in the country and the region

The reporting of the progress shall be done by the community-based cage aquaculture operators through the County Directorate of Fisheries who is a member of the M&E technical committee. The technical committee will report to the SDFA & BE.

CHAPTER SIX

6.0 RISK ANALYSIS

If not mitigated, a number of risks could have an effect on community-based cage aquaculture. Risk management will be a continuous, proactive, and systematic process aimed at understanding, communicating and managing potential risk in the community-based cage aquaculture. Table 8 lists the risks, their degree of impact, and suggested mitigating actions to guarantee that the strategic goals for community-based cage aquaculture are attained.

Table 8: Potential risks, occurrence and mitigation measures for community-based cage aquaculture

Risk	Likelihood it will occur	Consequences of the risk	Impact	Risk mitigation
Pandemics (e.g., covid-19, ebola etc.,)	Medium	• Loss of personnel/workforce • Economic losses to aquaculture enterprises due to closure of business e.g. restaurants • Low supply of ingredients • Low supply of fish feeds due to low importation • Low fish production • Increasing food insecurity	Medium	• Develop early warning systems and preventive measures • Risk planning
Inadequate quality seed and feed	High	• Low fish production • Increasing food insecurity • Economic losses to aquaculture enterprises • Environmental degradation • Economic and environmental unsustainable enterprise • Exit of old practitioners and entry of new, but suspicious adopters • Cage aquaculture seen as a risky and marginal investment	High	• Authentication of hatcheries and feed producers • Periodic assessment of the hatcheries • Regulating importation • Standardization • Traceability
High cost of feed	High	• Adulteration of inputs • Economic losses • Exit of old practitioners and entry of new, but suspicious adopters • Cage aquaculture seen as a risky and marginal investment	High	• Supporting local value chain for aquaculture • Allocation of funds for research
Limited zoning and delineation of cage sites	High	• Resource-user conflicts • Environmental degradation • Low yields • Low productivity	High	• Zoning for particular activities and delineation of cage site

Risk	Likelihood it will occur	Consequences of the risk	Impact	Risk mitigation
Inadequate human resource	High	• Inadequate capacity to conduct extension in aquaculture • Poor quality feed and seed • Massive fish kills due to fish diseases	High	• Hands-on training
Poor record keeping culture	High	• lack of information on the economic performance of the enterprise • Unable to secure loan or insurance of the enterprise • Economically unsustainable enterprise	Medium	• Capacity building on record keeping and entrepreneurship
Inadequate infrastructure e.g. cold chain, ice making machine, feed mill	High	• Post-harvest losses • Economic losses	High	• Cage aquaculture farmers association/groups
Un-harmonized and institutional processes	Medium	• Uncoordinated processes • Increased conflicts between the two levels of government • Double charges hence increased start-up cost	Medium	• Sensitize and create awareness among all the stakeholders involved. • Align the cage management structure to the current constitutional dispensation and use the structure in planning, budgeting, monitoring and supervision for efficient and effective resource use. • Harmonize processes
Limited awareness on BMPs	High	• Environmental degradation • Low fish production • Massive fish kills • economic losses to aquaculture enterprises	High	• Capacity building on BMPs
Environmental changes (e.g., lake upwelling, water level fluctuations)	Low	• Massive fish kills • Economic losses to aquaculture enterprises	High	• Move cages to deeper waters

Risk	Likelihood it will occur	Consequences of the risk	Impact	Risk mitigation
				• Plan operations taking into account the periodic upwelling of the lake • Insurance of enterprise • Fallowing
Lack of adherence to standards	High	• Low fish production and productivity • Environmental degradation	High	• Establishment, enforcement and adherence to standards
Climate change e.g. flooding, drought, etc.	High	• Caged fish escapes • Genetic contamination • Transfer of diseases	High	• Use climate smart technologies • Monitoring, control and surveillance (MCS) of cage aquaculture in lakes • Development of genetic markers for identification of endemic species to facilitate MCS.
Invasive species (e.g. Water hyacinth, hippo grass)	Medium	• Damage to cages • Escape of fish • Genetic contamination • Introduction of diseases from caged to wild fish • Fish kills due to anoxia	High	• Designate hotspots • Regulate movement of genetic material
Environmental pollution	High	• Eutrophication • Anoxic conditions in sediment • Alters species abundance and biomass of macroinvertebrates • Low production • Massive fish kills • Affect the water quality in the region by reducing dissolved oxygen in the water column • Water resource use conflicts	High	• Use quality feeds • Fallowing • Proper waste management • Enforcement of cage aquaculture regulation

Risk	Likelihood it will occur	Consequences of the risk	Impact	Risk mitigation
Farmed fish escapees	Medium	• Genetic contamination • Transmission of pathogens • Replacement of wild by farmed fish in the short term	High	• Use endemic species • BMPs
Theft	High	• Low productivity	High	• Provision of security
Low fish prices as a result of competition from fish imports	High	• Low productivity • Exit of fish farmers • Economic losses	High	• Regulating importation • Standardization • Traceability • Benchmarking • Subsidies for farmers, especially for feeds
Emergence/outbreaks of diseases	High	• Fish mortality • Low fish production and productivity • Cross pathogenic contamination • Genetic contamination	High	• Enforcement of bio-security measures • Selective breeding • General fish health management
Lack of market information	Medium	• Exploitation by middlemen • Post-harvest losses • Lower profit margin	High	• Aggressive marketing • Organize themselves into cooperative associations to increase bargaining power
Inconsistencies in aquaculture policies	Low	• Cage fish farming expanding in an ad hoc and unregulated manner • Reduced productivity • Unsustainable use of water resource • Wider environmental footprint	High	• Development and operationalization of aquaculture regulations

ANNEX 1: M& E Implementation Matrix

Key Results Areas	Strategic Objectives	Strategic Actions	Expected Output	Indicators
KRA 1: Sustainable community cage aquaculture production and productivity	1.1 To increase fish production through climate smart aquaculture technologies and innovations	1.1.1 Support public and private sector authenticated hatcheries to produce quality seed and avail to cage farmers at affordable prices; 1.1.2 Promote best cage aquaculture management practices; 1.1.3 Support public and private sector certified feed processors to produce quality feed and avail to cage farmers at affordable prices. 1.1.4 Promote fish feed supportive value chain 1.1.5 Establish community-based fish feed production demonstration units for women, youth, marginalized and vulnerable groups.	• An inventory of seed and seed producers developed • Development of new fish genetic strains • Linkages between cage farmers and hatchery operators • Protocol developed for best cage management practices. • An inventory of feed producers developed • Procurement of feed manufacturing machineries • Capacity building of feed producers • Community-based feed production demonstration points developed • Capacity building of the groups	• Number of hatcheries authenticated • % increase of improved fish strain • Improved % increase production • Number of feed manufacturing companies certified. • % increase of feed mill processors • Number of demonstration centers established

Key Results Areas	Strategic Objectives	Strategic Actions	Expected Output	Indicators
			• Capacity building of the existing feed producers on production of quality feeds	
	1.2 To enhance food supply and food security through Value Creation and Markets for Nutritious Aquaculture Products	1.2.1 Sensitize communities on nutritional importance of cage fish consumption 1.2.2 Train women, youth, marginalized and vulnerable groups on innovative fish post-harvest and value addition technologies and marketing strategies. 1.2.3 Support women, youth, marginalized and vulnerable groups with mini-food processing equipment, post-harvest loss reduction and value addition technologies 1.2.4 Assess the nutritional status and dietary diversity of fish farming households 1.2.5 Build capacity on fish-based recipes and dietary diversity using social behavior change communication (SBCC) strategies	• IEC materials developed • Inclusion of fish in school dietary programmes • Linkages of the groups to credit and service providers • Capacity building of women and youths on fish value addition and processing • Food processing equipment procured • Development of climate smart food processing technologies • Construction of fish eateries • Creation of employment for youths and women	• % increase in fish consumption per capita • Number of eat more fish campaigns organized • Number of individual groups trained on innovation and fish value addition • % increase in the number of fish value added products in the market • % reduction in fish post-harvest looses • % number of women and youth employment • Number of eateries constructed • Nutritional data on fish consumption index within the community • Number of dietary documentary materials produced • Number of fish recipe books developed

Key Results Areas	Strategic Objectives	Strategic Actions	Expected Output	Indicators
			• Health and nutrition survey conducted on households • Development of dietary awareness materials • Capacity building on nutrition status and dietary requirements of the community	• Number of awareness creation events conducted
	1.3 To monitor the sustainable production of safe and quality cage fish products in an effective and coordinated manner	1.3.1 Develop protocols for production, marketing and trade of safe fish and fishery products 1.3.2 Build capacity for cage aquaculture farmers in risk analysis, adaptive management, disease diagnosis, biosecurity measures, safety and food security	• Safety standards developed for the cage fish products • IEC materials developed • Capacity building of fish pathologists and laboratory technicians on fish diseases, safety and biosecurity • Training of cage fish farmers on fish health and disease control and preventions	• Annual review of safety standards developed • Number of workshops for development and review of standards conducted • Number of fish pathologists trained and empowered on fish health and diseases • Number of cage farmers trained
KRA 2: Strengthen infrastructural, institutional and human resource capacity building	2.1 To develop community-based cage aquaculture demonstration centers (CCADCs) along the riparian counties	2.1.1 Develop training manuals and modules for hatchery managers and feed producers 2.1.2 Develop an online training to provide free courses on	• Improved seeds and feeds productions and availability within the communities • Developed training curriculum	• Number of manuals developed for hatcheries and feed processing operations • Number of training workshops organized

Key Results Areas	Strategic Objectives	Strategic Actions	Expected Output	Indicators
		techniques and technologies in cage aquaculture 2.1.3 Build capacity of cage aquaculture stakeholders through practical demonstration trainings within the Beach Management Units and Water Resource Users Associations (WRUAs)	• Capacity building of the stakeholders on benefits of cage farming	• Number of curriculums developed • Number of individuals trained • % increase of cage farming technologies • Number of stakeholders trained trough practical demonstrations
	2.2 To strengthen research, training, extension linkage for effective generation, dissemination and utilization of knowledge and skills for increased cage fish production and productivity	2.2.1 Create multi-stakeholder platform for knowledge exchange 2.2.2 Develop a ToT module and manual for training of extension service providers 2.2.3 Build capacity of extension service providers on technical, market and regulatory aspects of cage farming; 2.2.4 Promote education and awareness creation on investment opportunities in the cage aquaculture 2.2.5 Undertake tailor-made training for community-based hatchery operators and associated service providers.	• Improved community-based cage aquaculture co-management • ToTs manuals developed • Improved market linkages and adhering of cage aquaculture regulations within the production areas • Creation of employment opportunities • Improved fish seed availability	• Annual consultancy • Number of training manuals and models developed • Number of extension officers trained • % increase in production and available market • Number of sensitization events conducted • Number of IEC materials developed • % increase in linkages of hatchery producers and the cage farmers • % increase in new business ventures along the value chain • Number of hatcheries operators and service providers trained

Key Results Areas	Strategic Objectives	Strategic Actions	Expected Output	Indicators
				• % increase in quality seed production
	2.3 To develop an inventory of existing cage infrastructure, facilities, and technical capacity of institutions and hatcheries	2.3.1 Assess the physical and technical capacity of institutions dealing in cage aquaculture operations and mitigations 2.3.2 Develop technical guidelines for responsible investment in cage aquaculture for small-scale farms 2.3.3 Develop and support community hatcheries and nurseries with basic seed production and rearing facilities based on needs assessment.	• Assessment report of the cage aquaculture institutions capacities • Development of investment models • Conduct the need assessment survey of seed producers • Procurement of equipment for the hatcheries • Increase fish seed availability	• Number of existing institutions assessed • Number of personnel capacity built • Number of financial institutions reached • % increase in number of hatcheries • Number of hatcheries supported

Key Results Areas	Strategic Objectives	Strategic Actions	Expected Output	Indicators
	2.4 Develop a system-wide framework for sharing information on aquaculture	2.4.1 Conduct Surveys to collect data for uploading into a cage aquaculture database 2.4.2 Develop a web-based and mobile based fish cage information sharing platform 2.4.3. Strengthen market linkages for aquaculture farmers and traders 2.4.4 Develop and publish IEC materials such as manuals, policy briefs, factsheet and brochures (translated into local languages)	• Conduct surveys • Develop cage aquaculture database • Cooperative groups developed for market linkages • Workshops, IEC materials, prints and translators	• Number of production data submissions from the counties • Number of databases developed and maintained • Number of cage fish farmers linked to the market • % increase in markets within the community • Number of workshops organized for policy briefs and material developments • Number of IEC materials developed and translated
	2.5 To promote gender mainstreaming in the aquaculture value chain	2.5.1 Conduct gender inclusive sensitization and awareness creation on youth, women, marginalized and vulnerable groups inclusion in cage aquaculture activities 2.5.2. Strengthen youth, women, marginalized and vulnerable groups in aquaculture value chains; 2.5.3 Facilitate social protection mechanisms to support marginalized and vulnerable	• Mainstreamed gender issues within the community-based age aquaculture • Capacity building and group formations dynamics • Group linkages along cage farming the value chain • Linkages to organizations for support e.g. financial institutions	• % increase in number of youths and women involved in cage aquaculture activities • Number of awareness creation campaigns organized • Number of workshops and seminars on gender mainstreaming conducted • Number of groups capacity built • % increase in number of youths, women, marginalized and

Key Results Areas	Strategic Objectives	Strategic Actions	Expected Output	Indicators
		persons in cage aquaculture value chain		vulnerable involvement in community-based fish farming • Number of VMGs supported in groups and linked to institutions
KRA 3: Sustainable community cage aquaculture production and productivity	3.1 Adaptation intervention to enhance farming communities' resilience to climate change induced effect	3.1.1 Undertake risk and vulnerability assessment of the cage aquaculture value chain 3.1.2 Build capacity and sensitize cage aquaculture farmers on disaster risk management in aquaculture 31.3 Promote development of locally available climate smart technologies and innovations	• Reports on risk and vulnerability assessment along the cage aquaculture value chain • Enhanced capacity on addressing climate change effects on cage aquaculture • Improved uptake of climate smart technologies and innovations	• Number of assessments conducted • Number of workshops to capacity build community-based cage aquaculture farmers conducted annually • Bi-annual workshop to roll out existing and new climate smart technologies to the farmers

Key Results Areas	Strategic Objectives	Strategic Actions	Expected Output	Indicators
	3.2 To improve market access and trade	3.2.1 Build capacity of cage farmers and traders on market requirements for cage aquaculture products 3.2.2 Upscale use of cost-effective aquaculture market information systems among cage farmers; 3.2.3 Promote responsible fish handling and preservation measures and technologies to minimize post-harvest losses; 3.2.3 Development of national cage aquaculture guidelines to inform policy	• Enhanced market access and trade locally, regionally and internationally • Better linkages along the value chain e.g. cooperatives • Enhanced post-harvest handling technologies for fish from the community-based cage aquaculture • National cage aquaculture guidelines developed	• Annual workshops to capacity build the farmers based on the changing market dynamics • Number of cooperative/associations formed • Number of running market information system running and regularly updated • Annual workshop to roll out existing fish preservation methods (e.g. smoking kilns) • Number of national cage aquaculture guideline developed
	3.3 To develop a spatial plan for aquaculture zoning, site selection and design of aquaculture management areas	3.3.1 Provide technical support for the establishment of allocated zones for cage aquaculture (AZCA); 3.3.2 Undertake zoning and carrying capacity assessments of inland water bodies for cage fish farming; 3.3.3 Strengthen research capacity to undertake spatial planning within inland fisheries resources to support	• Enhanced capacity on development AZCA • Development of gazetted zones that are suitable for cage aquaculture • Capacity building of the local expertise	• Number of capacity building workshops conducted • % zoned cage establishments • Annual assessment and update of the carrying capacity status • Number of capacity building workshops conducted

Key Results Areas	Strategic Objectives	Strategic Actions	Expected Output	Indicators
		community-based cage aquaculture development		
	3.4 An integrated environment monitoring system is put in place to ensure cage aquaculture safety and to minimize aquaculture impacts on surrounding ecosystems	3.4.1 Support bi-annual and emergency environmental monitoring and social impact assessment 3.4.2 Establish a core team and training of ToTs for cage aquaculture disease risk analysis, management and prevention 3.4.3 Foster institutional collaboration in undertaking community-based conservation, management and improvement of broodstock genetic resources; 3.4.4 Increase participation of Cage Aquaculture Farmers' Organizations (CFFAKs) in decision-making processes	• Emergency surveys for environmental and social impact assessment • Core team for disease risks in community-based cage aquaculture developed • Multi institutional teams formed • Capacity building workshops within the teams • Quarterly meetings of the CFFAKs with relevant stakeholders	• Number of integrated monitoring system developed and implemented • Number of environmental and social impact assessment reports submitted • Number of core teams developed • Quarterly meetings by the core team • Quarterly meetings conducted

Key Results Areas	Strategic Objectives	Strategic Actions	Expected Output	Indicators
	3.5 To establish and operationalize an Aquacage Model	3.5.1 Assess potential sites and identify cage aquaculture community groups for establishment of aggregated aquacage 3.5.2 Sensitize community-based cage farmers on the aquacage model framework 3.5.3 Support the development of an aquacage infrastructure for cage fish farmers 3.5.4 Facilitate practical information exchange through benchmarking of existing aquaparks	• Aquacage enterprises developed • Capacity building of the cage aquaculture farmers on the aquacage model • Aquacage infrastructure developed per county • Bench marking visits	• Bi-annual capacity building workshops conducted • Number of aquacage investment developed per county • Bi annual meetings • Number of benchmarking visits conducted

Key Results Areas	Strategic Objectives	Strategic Actions	Expected Output	Indicators
KRA 4: Resource mobilization, partnership, and collaboration	4.1 To mobilize and manage financial and human resources in cage aquaculture	4.1.1 Encourage investment in small, medium and large-scale commercial cage aquaculture for domestic markets through linkages with affordable microfinance 4.1.2 Develop resource mobilization strategies for aquaculture development and marketing 4.1.3 Promote access to capital and credit facilities by promoting the establishment of financing schemes in existing financial institutions by issuing long-term credits and low repayment rates; 4.1.4 Sensitize and incentivize local investors, and attract local, regional, and foreign partners to invest in fish feed production, cage materials, and equipment. 4.1.5 Conduct stakeholder forums to create awareness on business planning and financial management in cage-based investments	• Increased investments in community-based cage aquaculture • Resource mobilization strategy developed • Financing scheme specific for aquaculture developed • Enhanced investments locally, regionally and internationally • Capacity building workshops	• % of microfinance institutions linked to community-based aquaculture • Quarterly meetings undertaken • Number of financing schemes developed • Bi-annual sensitization workshops organized • Bi-annual workshops on capacity building

Key Results Areas	Strategic Objectives	Strategic Actions	Expected Output	Indicators
	4.2 To promote collaboration and partnership in community cage aquaculture research and development	4.2.1 Establish and maintain collaborations and partnerships in cage aquaculture research and development with partners including research institutions, County Governments and local communities 4.2.2 Support joint ventures through Public Private Sector Partnerships (PPP) in cage aquaculture	• Multi institutional networks engaged on research in community-based cage aquaculture developed • PPP networks created for community-based cage aquaculture	• Number of multi institutional collaborative research body created • Number of PPP network developed per county
	4.3 Promote Corporate Social Responsibility initiatives in cage aquaculture ventures	4.3.1 Assess the level of social acceptability of cage aquaculture in the riparian regions 4.3.2 Conduct best community-based cage aquaculture certification programmes for farmers who meet the set standards and social accountability 4.3.3 Strengthen existing collaborative network of government agencies, civil society, academia and research, private sector and international organizations	• Increased CSR activities on community-based cage aquaculture • Development of certification standards • Development of certification programs • Multi agency collaborative body created to specifically deal with community-based cage aquaculture	• Number of CSR activities conducted • Number of certification programmes developed • Annual certification of the community-based cage aquaculture farmers • Quarterly meetings organized for the multi-agency collaborative body