



Lamu Municipality Urban Economic Plan

Sustainable Urban Economic Development Programme SUED

March 2022





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This report was developed by Atkins.



Abbreviations and Acronyms

AAAP	Africa Adoption Acceleration Program	DEFRA	Department for Environment, Food and Rural Affairs	INDC	Intended National Determined Contributions
ACCF	African Climate Change Fund	EBRD	European Bank of Reconstruction and Development	IPCC	Intergovernmental Panel on Climate Change
ACTED	Agency for Transport Cooperation and Development	EIA	Environmental Impact Assessment	IT	Information Technology
AD	Anaerobic digester	ENSO	El Niño Southern Oscillation	IUCN	International Union for the Conservation of Nature
AF	Adaptation Fund	EU	European Union	IUU	Illegal, unreported and unregulated
AfDB	African Development Bank	FAO	Food and Agricultural Organisation	IWQPP	Integrated Water Quality Protection Plan
AFIPEK	Kenya Fish Processors and Exporters Association	FCDO	Foreign and Commonwealth Development Office	JKP	Jumuiya ya Kaunti za Pwani Economic Bloc
APFS	Agro-Pastoral Field School	FCWC	Fisheries Committee for the West Central Gulf of Guinea	JOYWO	Joyful Woman Organisation
ARAF	The ACUMEN Resilient Agriculture Fund	FDG	Focus Group Discussions	KEFRI	Kenya Forestry Research Institute
ARCAN	Africa Regional Climate and Nature Programme	FOG	Fats, oils, and grease	KEMFSED	Kenya Marine Fisheries and Socio-Economic Development Project
ASTGS	Agricultural Sector Transformation and Growth Strategy	FTE	Full-time equivalent	KENHA	Kenya National Highways Authority
ATC	Agricultural Training Centre	GBV	Gender-Based Violence	KEPSA	Kenya Privat Sector Alliance
BCC	Behavioural Change Communication	GCF	Green Climate Fund	KeRRA	Kenya Rural Roads Authority
BID	Business Improvement District	GCP	Gross County Product	KES	Kenya Shillings
BMU	Beach Management Units	GDP	Gross Domestic Product	KFS	Kenya Forest Service
BOD	Biological oxygen demand	GEF	Global Environment Facility	KIIs	Key Informant Interviews
BOQ	Bill of Quantities	GeSI	Gender and Social Inclusion	KMA	Kenya Maritime Authority
BSFL	Black soldier fly larvae	GHG	Greenhouse gas	KMD	Kenya Meteorological Department
CBO	Community-based organisation	GIS	Geographic Information System	KMEG	Kwa-Muhia Environmental Group
CCCF	County Climate Change Fund	GIZ	German Development Agency	KMFRI	Kenya Marine and Fishing Research Institute
CIDP	Lamu County Integrated Development Plan 2018 - 2022	GWT	Gross Weight Tonnage	KNBS	Kenya National Bureau of Statistics
COD	Chemical oxygen demand	HDL	High-density lipoprotein	KNCCI	Kenya National Chamber of Commerce and Industry
COP26	Conference of the Parties 26	HQ	Head Quarters	KOM	Kick-off Meeting
CSO	Civil Society Organisations	ICT	Internet, Communications and Technology	KPA	Kenya Port Authority
CSP	Lamu County Spatial Plan 2016 - 2026	IDeP	Draft Lamu Municipality integrated development Plan 2020 – 2025	KPLC	Kenya Power and Lighting Company
CSR	Corporate Social Responsibility	IFI	International Financial Institution	KURA	Kenya Urban Roads Authority
CTF	Clean Technology Fund	IGAD	Intergovernmental Authority on Development	KUSP	Kenya Urban Support Programme
DBOM	Design Build Operate Maintain	ILO	International Labour Organization	KWS	Kenya Wildlife Service

LAPSSET	Lamu Port-South Sudan-Ethiopia Transport
LAWASCO	Lamu Water and Sewerage Company Ltd.
LC	Lamu County
LCDA	LAPSSET Corridor Development Authority
LCT	Lamu Conservation Trust
LDCs	Least Developed Countries
LDCF	Least developed Countries Fund
LDL	Low-Density Lipoprotein
LED	Light-emitting diode
LIUDP	Draft Lamu Island Integrated Urban Development Plan 2020 - 2035
LM	Lamu Municipality
LOYD	Lamu Organisation for Youth and People with Disability
LTA	Lamu Tourism Association
MB	Municipal Board
MDB	Multi-lateral Development Banks
MRF	Materials Recovery Facility
MSP	Marine Spatial Plan
MW	Mega Watts
NAMARET	National Mariculture Resource and Training Centre
NAP	National Climate Change Action Plan
NAPA	National Adaptation Programs of Action
NCDF	National Constituency Development Fund
NCPB	National Cereals and Produce Board
NDA	National Designated Authority
NEMA	National Environmental Management Authority
NGO	Non-Government Organisations
NIE	National Implementation Entity
NLC	National Land Commission

NMC	National Mangrove Management Committee
NMK	National Museum of Kenya
NMT	Non-Motorised Transport
NRT	Northern Rangeland Trust
NRW	Non-Revenue Water
NSW	New South Wales
ODA	Official Development Agency
OUV	Outstanding Universal Value
PHP	Philippine Peso
PPCR	Pilot Program for Climate Resilience
PPP	Public-Private Partnership
PSG	Lamu UEP Project Steering Group
PV	Photovoltaic
PWD	People Living with Disabilities
QC	Quezon City
RAP	Resettlement Action Plan
REO	Rasini Environmental Organisation
RMCS	Regional, Monitoring, Control and Surveillance Centre
RMFL	Road Maintenance Fuel Levy Fund
SACCO	Savings and Credit Cooperative Organization
SCCF	Special Climate Change Fund
SCF	Strategic Climate Fund
SDC	Swiss Agency for Development and Cooperation
SDHUD	State Department for Housing and Urban Development
SEFA	Sustainable Energy Fund for Africa
SERG	Shela Environmental Resident Group
SEZ	Special Economic Zone
SIG	Special interest groups
SIMS	Sydney Institute of Marine Science

SME	Small to Medium Enterprises
SONEDE	Société Nationale d'Exploitation et de Distribution des Eaux
SPIS	Solar-Power Irrigation Systems
SSD	Small Scale Desalination
STW	Sewage Treatment Works
SuDS	Sustainable urban Drainage Systems
SUED	Sustainable Urban Economic Development Programme
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TBP	Technical Briefing Paper
TNC	The National Conservancy
TTS	Total suspended solids
TVET	Technical Vocational Education Training Centres
UEP	Urban Economic Plan
UK	United Kingdom
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPS	Uninterrupted Power Supply
US	United States
USA	United States of America
VC	Value chains
VSLA	Village Savings and Lending Associations
WASH	Water, Sanitation and Hygiene
WELASA	Weka Lamu Safi
WHC	World Heritage Centre
WHS	World Heritage Site
WRA	Water Resource Authority
ZUMC	Zanzibar Urban Municipal Council



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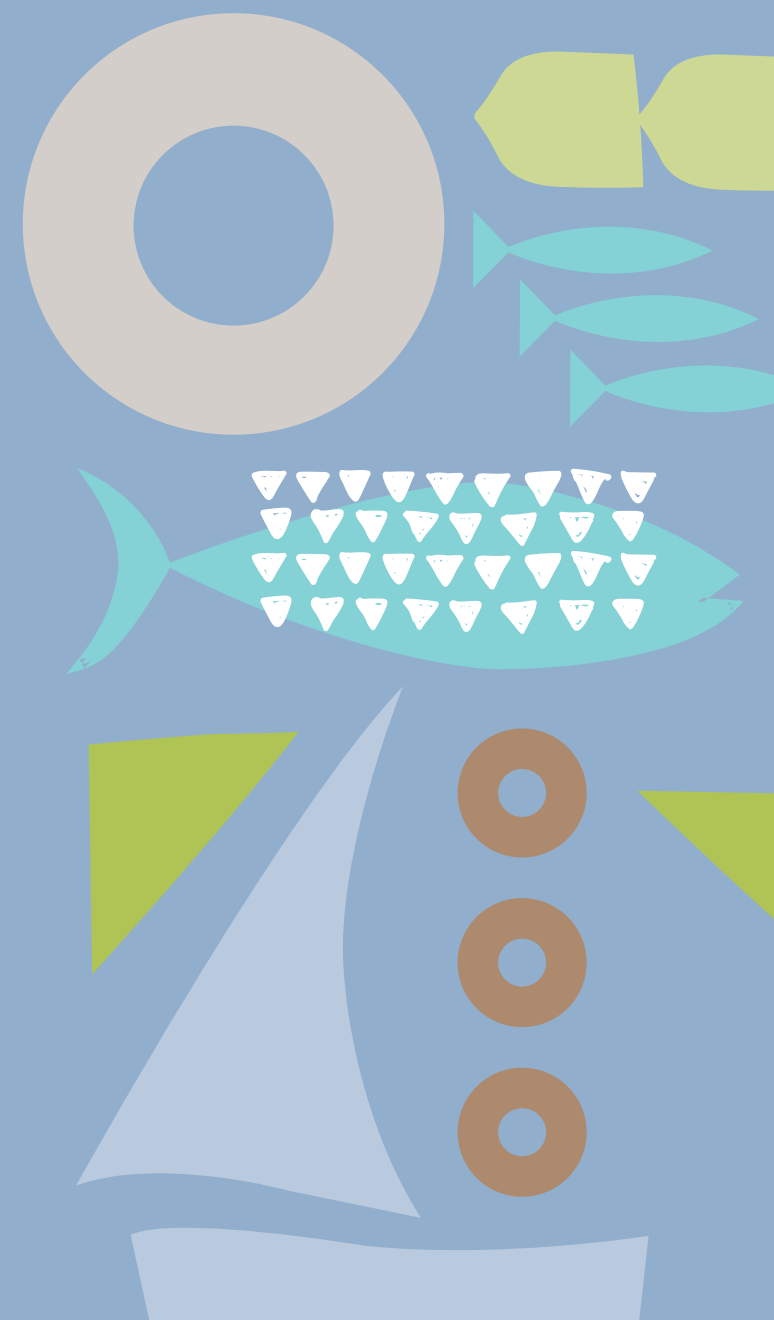
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KARIBU

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Welcome to Lamu a UNESCO world Heritage city

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Executive Summary

WS Atkins International Limited was commissioned to develop the Urban Economic Plan for Lamu Municipality (LM) as part of the UK's Foreign, Commonwealth and Development Office (FCDO) Sustainable Urban Economic Development Programme (SUED). The aim of the programme is to support market-driven growth in emerging towns and cities in Kenya.

The UEP is an advisory document that builds on existing work and priorities identified under the Lamu County Integrated Development Plan 2018-2022 (CIDP), Lamu County Spatial Plan 2016-2026 (CSP), the Draft Lamu Municipality Integrated Development Plan 2020-2025 (IDeP) and Draft Lamu Island Integrated Urban Development Plan 2020-2035 (LIUDP), Integrated Transport Infrastructure Master Plan for Lamu Port City (2018), as well as aligning and complementing work done by other donors. In doing so, it will provide a focused economic plan for the Municipal Board (MB) and Municipal Departments to enable them to deliver economic development within the Municipality and the County.

The purpose of the plan is to:

- > Provide an inclusive economic strategy that can guide future development towards increasing prosperity in LM;
- > Prioritise Blue Economy activities and climate resilient infrastructure that can maximise benefits and support the development of a sustainable economic future for LM;
- > Bring together stakeholders on deciding the economic future of LM and implementing it; and
- > Identify and prepare value chain (VC) projects that can be considered further in terms of their feasibility and bankability before SUED seed financing is committed.

Stakeholders' interests and insights have been considered throughout the development of the UEP.

Chapter 2 sets out the diagnostic assessment of LM, where the social, economic, planning, infrastructure, environmental and climate risk baseline, has provided an understanding of the barriers and drivers to sustainable economic growth.

LM is made up of a vast mainland and Lamu Island. The mainland has two major urban centres, Mokowe and Hindi. Mokowe is currently a market centre, however, it is planned to become the future administrative centre of the Municipality in order to relieve development pressure off Lamu Island. While Hindi is the hosting town of LAPSSSET development, the mainland is mainly covered by agricultural land uses including pasture for livestock.

Lamu Island is found in the south-east corner of the Municipality and takes up a relatively small area of the land mass, however, the majority of the population of the Municipality live on the island. Lamu Town is the main urban centre and the current administrative centre of the County. The historic centre of the town is a UNESCO World Heritage Site as it is the oldest and best-preserved Swahili settlement in East Africa. Poor implementation of plans and the lack of enforcement of regulations have led to uncontrolled urbanisation and lack of public utilities and infrastructure provisions.

Lamu County has a relatively small population compared with other coastal region counties estimated to be 143,920, as well as a relatively low population density. About 27% of the County's population is classified as urban which equates to 38,466 inhabitants with the majority living in Lamu Town Mpeketoni, Mokowe and Faza.

The Gender and Social Inclusion Study (GeSI) was a key part of the diagnostic, providing recommendations for meeting the aims of the SUED Programme to advance inclusion of people. Key informant interviews (KIIs), focus group discussions (FGDs) and observation conducted at the Municipality level established that PWD, youth, women, and elderly people feel excluded from socio-economic activities in the area. This can take the form of exclusion from local decision-making process, restricted employment opportunities and a lack of access to basic infrastructure.

The County's economy remains small compared with other Jumuiya ya Kaunti za Pwani (JKP) counties like Mombasa. While LC is a small economy in absolute terms, its GCP relative to its size, per capita, is higher than the Kenyan average. Agriculture, forestry and fishing dominate the economic output of LC, accounting for 44% of County GCP. The sector is the backbone of the County's economy.

The diagnostic stage identified key economic sectors that LM should prioritise for development:

- > **Agriculture livestock and processing:** the local population largely rely on this sector as the main economic subsistence activity;
- > **Fishing and marine:** building upon the existing fishing sector by supporting the provision of processing facilities;
- > **Tourism and heritage:** capitilising on the unique cultural heritage of the Lamu Old Town and the endemic marine and land-based biodiversity of the County; and
- > **Emerging maritime trade and transport and future industries:** reflecting the existing commercial activity in LM and its strategic location, as well as the future growth opportunities presented by LAPSSET.

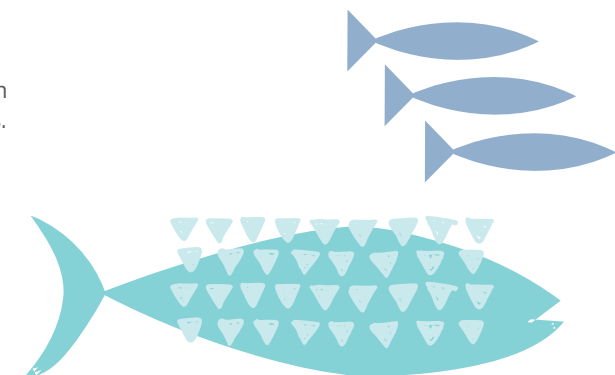
Critical for the development of the economy, through these key sectors, will be the improvement of infrastructure particularly in areas affecting production potential such as roads and transport accessibility, insufficient water supply and unaffordable electricity to support the growing population and businesses, poor solid waste management, sanitation and drainage. Lamu County is well-endowed with natural resources including sensitive terrestrial and marine ecosystems. LC has four distinctive agro-ecological zones which are highly influenced by the rainfall variability pattern experienced across the County. LC has gazetted terrestrial biodiversity spaces, including Boni and Dadori National Reserves, Witu Forest Reserve, Lungi Forest Reserve and Pandanguo forests.

Furthermore, the marine environment along the Lamu coast is rich in mangroves, seagrass beds, sandy beaches, coral reefs, fish and marine wildlife. Over 60% of all mangrove forests in Kenya are found in LC. These resources support important artisanal and commercial fisheries, as well as local livelihoods and the local tourism industry. Kiunga National Marine Reserve is a gazetted area found in the northeast of the County.

The flat topography makes the County prone to flooding during the rainy seasons and periods of high tides. Key climate risks are increased temperatures and prolonged periods of heat stress, droughts and rainfall variability, flooding due to increased intensity of rainstorms, and sea level rise.

Chapter 3 presents the development framework to provide the spatial elements and broad future direction for development which promotes sustainable and inclusive green growth whilst addressing infrastructure gaps and constraints. The urban economic development of Lamu is built upon the following main priorities:

- > **Blue Economy potential** - is essential to promote economic growth by positioning the economy beyond land-based economic activities, such as agriculture, while enhancing the protection and sustainability of the sensitive marine and terrestrial ecosystems around Lamu.
- > **LAPSSET potential** - the LAPSSET development is a nationally-significant economic programme under Vision 2030, including seven major infrastructure projects around Lamu node. If well-managed, these flagship projects represent a significant opportunity to leverage support, contribute to the Blue Economy potential and generate a range of employment opportunities for the local population.
- > **Lamu Municipality Spatial Strategy** - is critical to manage and guide urban and economic growth and development should be layered as follows:
 - > Ensuring that Lamu Island, including Lamu Town, is sustainable, self-sufficient, well managed and grounded on circular economy principles.
 - > Steering future urban growth towards Mokowe premised by the potential employment generation opportunities from LAPSSET and the future relocation of the County Head Quarters.
 - > Improving connectivity within the rest of the County to strengthening urban - rural linkages to foster economic growth.



This is driven by the UEP economic vision that has been developed with key stakeholders for Lamu:

“Lamu shall be a model Municipality fostering sustainable, inclusive and community driven economic transformation governed by Blue Economy principles, safeguarding its unique natural, cultural and heritage assets while improving local livelihoods.”



Lamu Economic Vision

Chapter 4 sets out the Economic Development Plan in response to the economic vision and the sectoral SWOT assessment undertaken at diagnostic stage. The Economic Development Plan for LM, identifies specific development interventions for the key economic sectors of Agriculture, livestock and processing; Fisheries and marine; Tourism and heritage which are grounded on the Blue Economy principles. Each Sector Action Plan include economic ambitions, soft initiatives, interventions, and climate resilient infrastructure proposals as well as the priority VC project to catalyse development.

The **Agriculture, Livestock and Agri-Processing Sector Action Plan** includes a series of actions to support the development of the sector and to best position Lamu's agricultural and pastoralist communities to benefit from the inclusive and climate resilient infrastructure proposals. A land-based aggregation model is proposed to enable agricultural development and sector growth across LC. The VC opportunity of coconut processing is presented as a potential pilot scheme for the sector to catalyse development.

The **Fishing and Marine Sector Action Plan** offers noteworthy opportunities for the development of Blue Economy activities to further strengthen the role of the Municipality as a fishing and marine centre. Similarly, a series of interventions and climate resilient projects are proposed to benefit the fishing communities. The VC opportunity of fish processing is presented as an anchor project to catalyse development, and it is relying on a sea-based aggregation model to enable the sector.

The **Tourism and Heritage Sector Action Plan** is principally founded on the UNESCO World Heritage Site of Lamu Old Town and its wide array of marine and terrestrial wildlife. The plan also encapsulates soft interventions, community initiatives, training and capacity building recommendations, and climate resilient infrastructure proposals focused on the objectives of developing Lamu's tourism offer and enhancing community involvement, and the beautification and decongestion of the Municipality. The holistic approach to solid

waste management is then presented as a circular economy VC and as an opportunity for an early win to catalyse tourism development and heritage protection, as well as creating employment. In addition, several key recommendations for standards and guidelines have been outlined for the sustainable development of the **emerging sector of maritime trade, transport and future industries** on the back of LAPSET future potential.

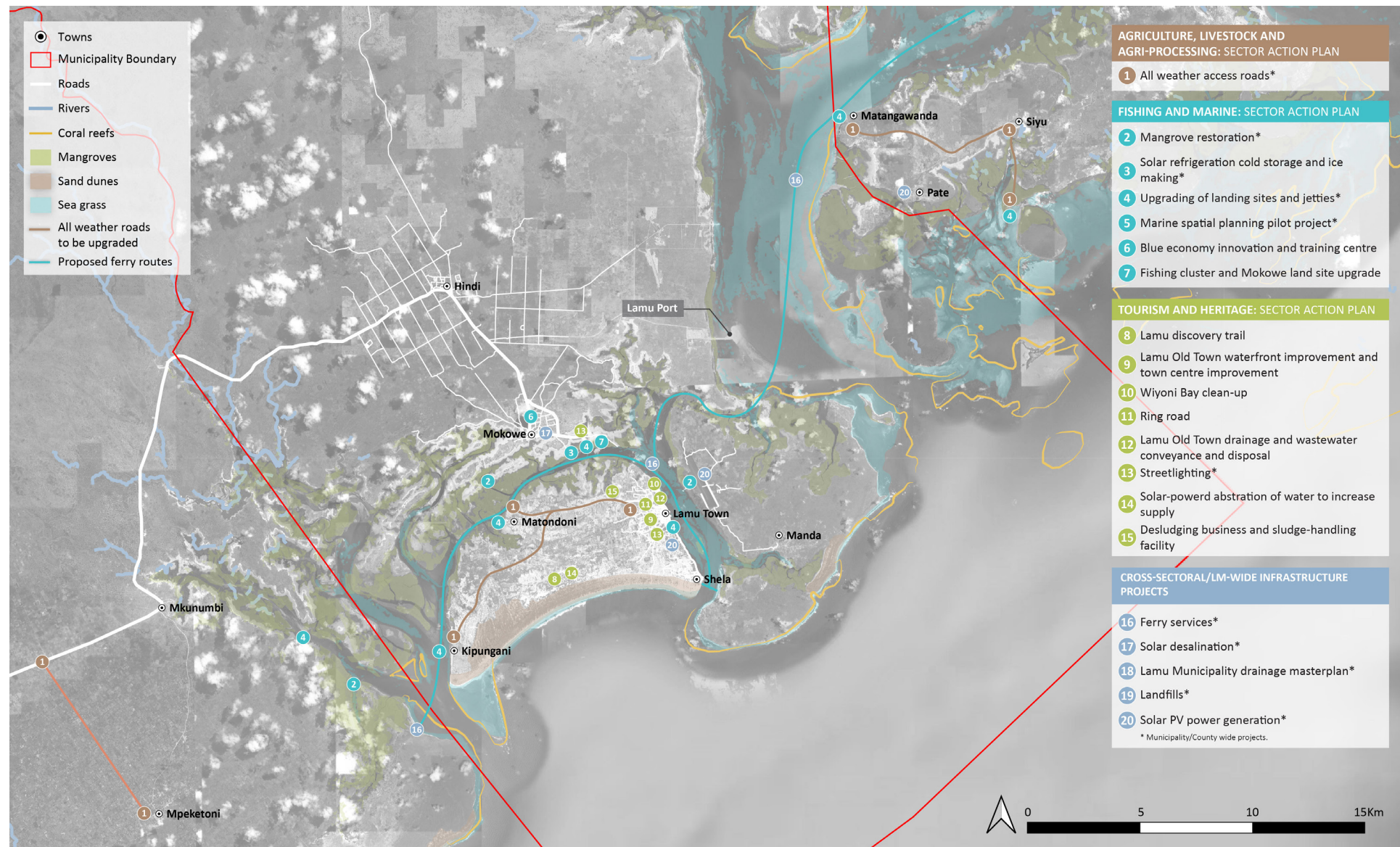
Finally, a series of cross-sectoral interventions are identified with benefits for all the core economic sector and to support the Municipality development beyond Lamu Island and Mokowe and to enable key urban nodes.

Chapter 5 provides the Implementation Plan, which presents relevant considerations across partnerships with key stakeholders such as the active NGOs operating in Lamu, and scheduling for the proposed VC and climate resilient and inclusive infrastructure projects, including estimated capital costs. This section also presents potential Blue Economy and climate action funds and some recommendations for social inclusion and climate resilience, as crucial elements for implementing the UEP. The UEP is an advisory document owned and administered by the Municipality, the main responsible authority for its future implementation. Similarly, the Municipality is responsible to agree appropriate funding from the County budget as well as seeking any additional funding from IFIs, donors, and/or private sector to support the implementation of the VC and climate resilient infrastructure projects.

Following the completion of the UEP, during the next phase of the SUED programme, the identified projects will be developed further by:

- > Capacity building specialists to enhance the local capacity to implement the projects and ensure revenue generation;
- > Investment climate experts to address policy and regulatory constraints; and
- > Investment experts to develop feasibility studies, business cases and investment promotion strategies for the projects.

Figure - Climate resilient infrastructure projects map



Source: Atkins analysis



1. Introduction

1.1 Background

WS Atkins International Limited was commissioned to develop the Urban Economic Plan (UEP) for Lamu Municipality (LM) as part of the UK's Foreign, Commonwealth and Development Office (FCDO) Sustainable Urban Economic Development Programme (SUED).

The aim of the programme is to support market-driven growth in emerging towns and cities in Kenya. Supporting these smaller centres provides an environment to create economic opportunities and job creation in a way that balances growth across the country, develops economic sectors that can contribute towards increasing the national output, and provides an incentive for minimising uncontrolled migration.



1.2 Purpose of the Plan

Combining local knowledge and international expertise, The UEP is an advisory document that builds on existing work and priorities identified under the Lamu County Integrated Development Plan (CIDP), Lamu County Spatial Plan (CSP), Draft Lamu Municipality Integrated Development Plan (IDeP) and the Draft Lamu Island Integrated Urban Development Plan (LIIDUP), Lamu Port-South Sudan-Ethiopia Corridor Programme (LAPSSET) as well as aligning and complementing work done by other donors. In doing so, it will provide a focused economic strategy for the Municipal Board and Municipal Departments to enable them to deliver economic development within the Municipality.

Figure 1.1 Purpose of the Plan

	Provides an inclusive economic strategy that can guide future development towards increasing prosperity in Lamu;
	Prioritises economic activities and climate resilient infrastructure that can maximise benefits and support the development of a sustainable economic future of Lamu and introduce international best practice and innovation;
	Brings together stakeholders on deciding the economic future of Lamu and implementing it; and
	Identifies and prepares value chain projects that can be considered further in terms of their feasibility and bankability before SUED seed financing is committed.

Source: Atkins

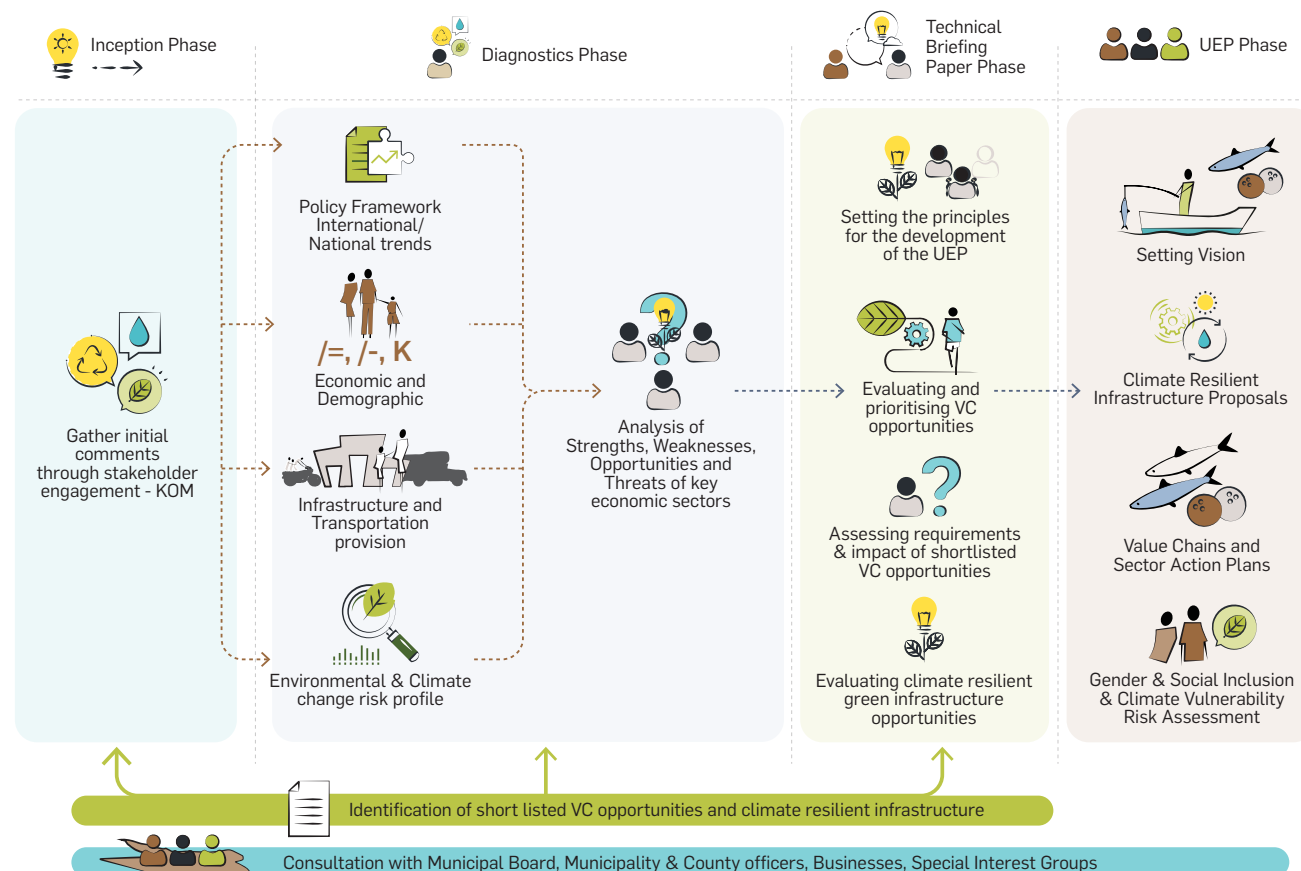
1.3 Approach

The approach and methodology have been developed in response to the FCDO terms of reference and in consultation with the SUED Team and FCDO and have been tailored to consider local conditions in LM. The aim was to enable a collaborative approach between different local stakeholders and the consultant team to assess LMs' economy in a systematic way, develop an agreed economic vision and prioritise actions that will have maximum impact and are ready to attract donor co-financing. The preparation of the UEP comprised four main phases:

- > **Phase 1 – Inception phase:** which focused on the Kick-off Meeting. The aim was to present the approach of the UEP and capture key opportunities and challenges affecting economic growth in LM as defined by local stakeholders
- > **Phase 2 – Diagnostics phase:** this was undertaken to provide a comprehensive and wide-ranging assessment of LMs' economy, demographics, infrastructure, environment and climate change risk profile against national and international context.
- > **Phase 3 – Technical briefing paper:** this set out a development framework for LM and identified, assessed and prioritised urban and economic growth opportunities and their requirements.
- > **Phase 4 – Development of the final UEP:** which sets out in detail economic opportunities and actions and prioritises inclusive climate-resilient infrastructure projects for implementation.

The LM UEP has been developed utilising primary and secondary research and analysis, ranging from the review of local and national strategies, and international studies to statistical analyses, to focus group discussions with a wide range of local stakeholders, business surveys and site assessments.

Figure 1.2 UEP process



Source: Atkins

Stakeholder Engagement

The purpose of stakeholder engagement was to ensure that stakeholders' interests are taken into consideration throughout development and reflected in the LM Urban Economic Plan.

More specifically, the aims were:

- > To ensure that the development of the UEP is inclusive and is undertaken in a manner that fits with LM's business and community culture;
- > To ensure that all stakeholders are clear on the purpose, scope, recommendations and outcomes of the Urban Economic Plan as well as meeting key stakeholders' aspirations and gain buy-in from them;
- > To understand better the interests of specific groups and how the Urban Economic Plan can benefit them; and
- > To provide a regular flow of information to and from key stakeholders.

The LM stakeholders include:

- > **County Government** including the County Director; CECM Lands and Physical Planning; Chief Officers, County Administration and County Assembly members;
- > **Municipal Board** including Chairperson, Vice-Chair, Municipal Manager and Board Members;
- > **Business Representatives** including Chamber of Commerce (KNCCI), organised business groups, traders and Jua Kali, SACCOs, banks and finance organisations, Lamu Tourism Association (LTA), LAPSET Corridor Development Authority, fisherfolks and farmers;
- > **Utilities and Service Providers** including the Water Resource Authority (WRA), LAWASCO, boda boda associations; KURA, KENHA, KPLC; and
- > **Special Interest Groups (SIGs)** including representatives for women, youth, the elderly and people living with disability (PWD).
- > **NGOs and CBOs** such as Lamu Organization for Youth & People with Disability, Lamu Women Alliance, Shela Environment Resident Group, Old is Gold, Flipflop and Takataka Heroes, Mtangwanda Restoration Group and Save Lamu.

A critical process in developing the UEP report has been stakeholder management including:

- > Project Steering Group meetings;
- > Stakeholder workshops;
- > Formal social inclusion consultations with SIGs; and
- > Business consultations.

A Project Steering Group (PSG) was formed to enable the exchange of ideas and information between the Municipal Board and the SUED technical team. The PSG was formed of the following members:

- > Municipal Manager;
- > County Governor's Office Representative;
- > County Physical Planner;
- > County Engineer;
- > County Economist;
- > Special Interest Group's Representative;
- > Chamber of Commerce Representative;
- > Climate Change Champion;
- > Municipal Board Representatives.

The aim is to ensure the PSG is representative of the needs and challenges associated with the Municipality whilst being aligned and familiar with existing County and Municipal policies and regulations.

The PSG, under an elected representative, also facilitated the dissemination of information on the various components and progress of the UEP and the broader SUED programme, including liaison with the County Government, the Municipality and the Municipal Board. It includes champions on SUED's key themes of climate change and social inclusion. The PSG was also tasked with arranging meetings and workshops as and when required by the SUED team, as part of the overall programme roll out. The PSG was updated on a bi-weekly basis on progress in the UEP process and the following meetings between the PSG and the SUED team took place.

Virtual and physical stakeholder workshops were undertaken depending on the COVID-19 restrictions in place at the time, including the Kick-off Meeting (KOM) to gather feedback from stakeholders throughout the project. The first workshop KOM, in March 2021, presented the project and process and collated information from 78 stakeholders in terms of key characteristics, strengths and challenges (captured within the Inception Report). Stakeholders included the Municipal Board, Municipality and County officers, the private sector, civil society groups and non-government organisations and representatives from SIGs.

A site visit and workshop with the PSG and Municipal Board (MB) in June 2021 included discussions on the sectoral SWOTs and identification of emerging economic opportunities. A further site visit in July 2021, focusing on conducting business surveys, was undertaken. A virtual workshop was conducted in October 2021 to focus on gathering feedback from the PSG and wider stakeholders on the findings of the diagnostics assessment. A wider stakeholder workshop in November 2021 comprised a visioning exercise for the UEP, emerging development concept and development framework, and reaching consensus with the PSG, Municipality and key stakeholders on the way forward for the final UEP.

A business consultation was also undertaken to understand how businesses operate in LM and their views on future growth opportunities and constraints. This consultation was composed of one-to-one interviews with 60 businesses, reflecting LM's main sectoral activities. Many of these were small businesses or independent workers – given the nature of the local economy. Each interview was supported with a detailed questionnaire. The Gender and Social Inclusion study (GeSI) involved a related literature review and primary research, covering interviews with key project informants and four focus group discussions. This resulted in the identification of socially excluded groups, of how their exclusion manifests, and processes that perpetuate their exclusion and development of the gender and social inclusion interventions as proposed in this UEP.

1.4 SUED principles

The development of the UEP and identification and prioritisation of proposed projects are grounded on key principles that support the programme's aim to create market driven growth and build resilience. The Atkins SUED team has defined these principles as:

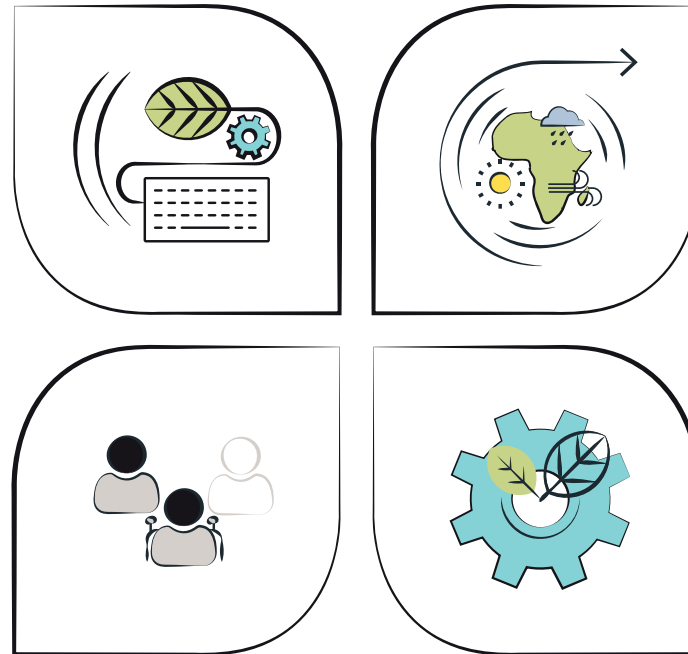
Figure 1.3 SUED Principles

Resilient:

Shifts in the economy
Adaptive infrastructure to climate change
Smart solutions

Resource Efficient:

Circular economy and zero water
Water and energy management
Rural - urban linkages



Socially Inclusive:

Socio-economic trends
Vulnerable groups
Immigration/migration

Sustainable:

Low carbon development
Green energy
Green infrastructure

Source: Atkins



Sustainable: The UEP will promote sustainable infrastructure that supports the development of LM while minimising the environmental impacts of increased population and economic activity in the future, as well as protecting the abundant natural resources within the County.

Socially inclusive: The GeSI study has identified social groups that are excluded from the socio-economic activities within Lamu Municipality (i.e.: elderly people, youth, PWD, and women). The UEP aims at including these groups in the decision and development process, VCs' development, and infrastructure projects, to ensure that their benefits are equitable and accessible to all.

Resilience: The prioritised projects will have to be resilient against shifts in the economy, both for domestic and international markets, to remain competitive. They will also need to be adaptive to the climate change impacts specific to the area such as lesser rainfalls and higher temperatures, while ensuring technological advancement through smart solutions which can be introduced where possible.

Resource efficiency: To preserve the environmental and marine assets and agricultural land, the UEP will be directing economic growth towards resource efficiency, by integrating the VCs to establish a circular economy promoting minimisation of waste and optimising water and energy use, whilst aiming to promote rural - urban linkages (including island-mainland).

While these principles are closely linked and overlap in their definition, each one of them emphasises a different aspect that is not fully captured by the others. Thus, it is important that all four principles are embedded and balanced in the UEP and its implementation. In addition to these principles, it is critical to ensure the UEP develops the competitiveness of the Municipality.

At its core the UEP seeks to create employment opportunities that are accessible to all and set out economic measures with supporting actions and projects that can help directly or indirectly lift the local population out of poverty, whilst supporting crucial livelihoods such as the informal sector. All proposed projects (VCs and infrastructure projects) contained within the UEP have been screened and refined for their contribution to improving livelihoods by considering availability; accessibility; affordability; acceptability; and adaptability, across special interest groups as well as low-income groups, the urban poor and informal sector. The aim is to minimize inequalities and improve access to job opportunities for optimum benefits to the overall Municipal communities.

Social exclusion makes it difficult to achieve social objectives, such as reducing poverty, due to often hidden barriers in reaching those who are socially marginalised. Exclusion also causes conflict, and it is almost impossible to achieve economic gains in such conflict environments.

PWD, women, the elderly, and youth in LM face challenges that are either caused by, or lead to, exclusion, and recommendations for their inclusion are fully integrated in the UEP. People who are excluded are not 'just like' the rest of the poor, only poorer. They are also disadvantaged by who they are or where they live, and as a result are locked out of the benefits of development and economic growth.



1.5 Climate Change, Social Exclusion and Poverty

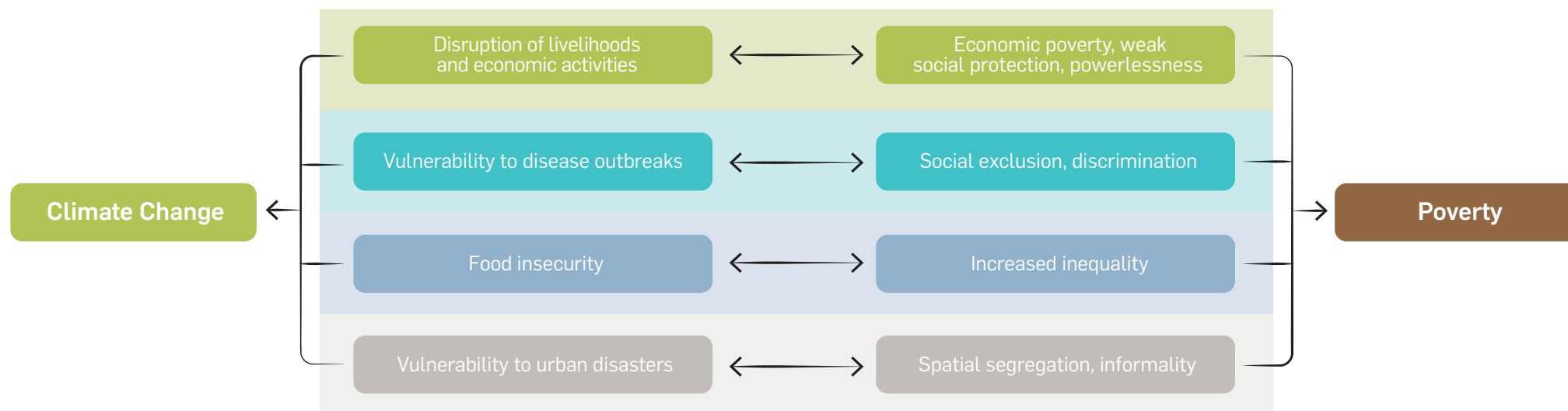
At the time of preparing this UEP, the COVID-19 pandemic continues to disrupt societies and economies around the globe. The negative impacts, both health and economic, have been felt across different geographies and locally in LM.

While governments are trying to address current challenges, this pandemic has brought to the fore the need to understand better the connection between vulnerable groups, livelihoods, and shocks from critical events such as climate change.

Climate change poses a serious risk to livelihoods and poverty reduction efforts. Climate hazards and the depletion of natural resources disproportionately affect women, PWD, elderly people, and people with chronic illnesses. Low-income households that rely on weather-sensitive subsistence livelihoods such as agriculture are especially vulnerable. Harmful social norms pose additional challenges, by limiting the participation of these groups in formal risk reduction and climate adaptation programmes.

In LM, youths, elderly people, women and PWD are often excluded from socio-economic activities; they lack access to information, assets, and finance; and they do not participate in decision-making processes. This makes them more vulnerable to the impacts of climate change and other shocks such as the COVID-19 pandemic.

Figure 1.4 UEP Process



Source: Atkins

Statistically, PWD are more likely to have lower levels of education, be illiterate or unemployed. Due to discrimination, they usually have less access to support networks and social capital than their able-bodied counterparts. These social networks are recognised as a key factor that enables groups to prepare for, respond to, and recover from, climate variability and shocks, and this lack of access increases the vulnerability of PWD to climate change. In Lamu, PWD often operate small businesses, yet they lack access to finance to develop their economic activities and to invest in measures that would better-prepare their businesses for extreme events and climate hazards. Due to the complex landscape, restricted mobility and lack of accessible transportation and infrastructure make PWD particularly vulnerable to climate events such as flooding, severely affecting their livelihoods and daily routines. Elderly people face similar situations, which have an impact on their access to social infrastructure such as healthcare services.

Women and young people in LM often lack access to capital or assets to manage the impacts of climate change and other similar shocks. While these groups are heavily engaged in agricultural livelihoods, their work is often considered as family work and unpaid. Lack of land ownership limits their access to credit and financial resources. This situation, paired with reduced social safety nets, critically affects their ability to recover from disasters such as floods or droughts. Young people who engage in transportation services or own businesses also see their access to markets and their sales or income disrupted when there are extreme weather events. Similarly, the COVID-19 pandemic has critically affected women and youth-owned businesses.

People who live in informal settlements are also identified as a vulnerable group within this context in LM and especially on Lamu Island. Rapid, unplanned urbanisation increases the vulnerability to climate hazards for the urban poor. Informal settlements are often located in hazard-prone areas and are excluded from formal risk reduction and climate adaptation programmes. They are often settled on marginal land and have limited drainage and sanitation infrastructure.

Flooding is a significant issue, in particular, regarding contamination of water sources, and associated health impacts. Their livelihoods, most often in the informal sector, are reliant on being able to trade every day and are more vulnerable to disruption, be it a pandemic, or an environmental disaster. In addition, they face similar problems with access to credit and financial resources as youth, women, and PWD, which limits their ability to proactively adapt to climate variability and change.

Consequently, it is imperative to understand exposure, and vulnerabilities, to build resilience into future projects through appropriate adaptation measures. In particular, it is important to ensure that adaptation measures do not act to reinforce or deepen existing inequalities, but need to be accessible to groups that are already marginalised. For example, climate-resilient technologies need to be affordable, accessible to all, and culturally appropriate. Their implementation needs to be accompanied by capacity building and technical support. As well as considering inclusion and poverty elements of all adaptation and climate risk management measures, excluded groups may require targeted interventions that are designed to help build their resilience to climate change.

When implementing this UEP, it is important to consult and understand the needs and expectations of local communities, and particularly SIGs, who have wealth of knowledge for local environmental conservation and are already powerful agents for climate action. In Lamu, for example, there are several organisations that should be actively included in the UEP project cycle, such as Flipflop, Taka Taka, Lamu Youth Alliance, and Mtangawanda Mangrove Restoration Women's Group, among others.

Increasing the resilience of current and future livelihoods and infrastructure is key to poverty reduction and has been addressed systematically throughout the UEP to avoid creating polarisation and further exclusion. Similarly, ensuring that infrastructure projects, VC opportunities and development policies are climate-resilient will not only help the built environment to better respond to future climate risk but also communities and excluded groups to be less affected by climate change events.





1.6 COVID-19 Impacts in Kenya

In Kenya, the impact of COVID-19 has been real and devastating. The pandemic has significantly had an impact on all aspects of life such as health, institutional revenues and livelihoods. COVID-19 has hit the most vulnerable the hardest, particularly the densely-populated informal settlements, as well as other people who lack access to adequate housing and basic services.

The informal economy, employing about 70% of Kenyans has been drastically affected as lockdowns and curfews were introduced to curb the transmission of the virus. Low wage earners have been hit the hardest because they rely on the informal sector and daily wages. Mostly they lack the option to work from home as they are mostly in the service industries and more exposed to the virus. Despite the low wages, some have also received pay cuts, and some have lost their jobs all together. There has also been loss of revenue due to reduced activities in other sectors like industry, commerce and hospitality with the effects felt throughout their supply chains.

Travel restrictions have led to a sharp and substantial fall in demand for movement and subsequent impacts on supply chains:

- > Road freight and logistics have been interrupted as long-distance truck drivers are suspected to be a major source of imported infections and transmission. This has had implications for trade and cross-border activities. Goods take longer to reach destinations. For perishable agricultural commodities, post-harvest losses become rampant;
- > Disruptions in global supply chains have also led to shortages or delays for critical inputs for agriculture ultimately disrupting production and food supply and manufacturing, leading to price increases; and
- > Increased awareness of hygiene signifies increased demand for limited resources like water, as well as increased demand for disinfectant used for hand cleaning and sanitization, with additional costs to society, particularly where access is not straightforward.

The COVID-19 pandemic has affected people differently based on their age, gender, ability or disability, sexual orientation, health status, migrant status, and ethnicity, among other aspects. Crises exacerbate existing gender inequalities, exclusion, and discriminative practices, and vulnerable groups are likely to be more adversely affected by the outbreak and the consequences of the response.

Emerging evidence on the impact of COVID-19 suggests that women's economic and productive lives have been affected disproportionately by comparison with men. This is because women earn less, save less, and are more likely to be employed in the informal sector. Their capacity to absorb economic shocks is therefore less than that of men. Women are also the majority of the frontline healthcare workforce and caregivers, putting them at higher risk. Cultural factors may restrict women's access to information and services, and some women may be particularly affected, e.g. older women living alone, and isolation may lead to an increased risk of violence in the home.

Young people are already among the most affected by the socio-economic impacts of COVID-19. In addition to losing employment, the closure of businesses, and the need to keep away from schools and universities, youth are also at high risk of increased anxiety and mental health problems. Additionally, youth make up more than 30% of the migrant and refugee population who are likely disproportionately affected due to limited movement and fewer employment opportunities caused by the pandemic. Young women and girls are also at high risk of many forms of domestic and gender-based violence during the pandemic.

Persons with disability have been left without vital support and advocacy due to social distancing. The majority of PWD in SUED municipalities operate small businesses in market centres, which have been adversely affected therefore they have experienced loss of livelihood. For PWD that rely on their hands for walking and are sole breadwinners, the question of not touching surfaces is not applicable and they therefore are at high risk of being infected with COVID-19.

Street families are also highly exposed to the danger of the virus because they lack shelter. Many of them rely on market centres where they ferry goods for a wage, and with the closure of markets they have lost livelihoods.

1.6.1 COVID-19 Impacts in Lamu Municipality

Business surveys and engagement with local stakeholders revealed that COVID-19 has had an impact on the local economy. During the worst months, mainly from March to August 2020, there was a drop in sales and commercial activity with some businesses forced to close down. The local economy largely depends on tourism and the lack of international tourists impacted the sector on a large scale. Regional tourists from the rest of Kenya, e.g. Nairobi, still travel to Lamu for the tourist offering. However, they tend to have lower budgets and therefore spend less on artisan goods such as Lamu hats and craft-ware. The hotel industry has continued to operate due to increased numbers of local tourists to Lamu.

The education sector was also significantly hit by COVID-19, with schools having to shut and students not being able to complete their study programmes. Once schools re-opened, there was lower demand due to parents being hit by hardship caused by COVID-19, and so not being able to afford to send their children away for education.

An overarching theme of the pandemic has been low income for the businesses of Lamu, this caused many businesses to cut staff numbers and limit trading hours in order to stay in business. However, most have a positive outlook for the future, especially with borders now being reopened and the vaccination programme underway.

1.6.2 Lessons from COVID-19

Drawing upon the lessons learned from the current COVID-19 crisis, these have informed the proposed development framework (section 3) and Sector Action Plans (section 4) to ensure long-term planning, green recovery and resilience is embedded in the UEP. This is an opportunity to get insights into a future fully-fledged climate change crisis and LM has a critical role to play in addressing these challenges. Some initial key lessons include:

- > Emphasising the need for adaptive, urban integrated plans to ensure sustainable urban development and infrastructure provision, including appropriate housing for all that can help minimise impact from high risks;
- > Redefining green spaces and the way town centres are designed for business;
- > Strengthening preparedness and emergency response capacity is critical. This means better preparedness in terms of financing, service delivery and business continuity, including budgeting for future crises, emergency operations centres, capacity building, drills, and human resources redeployment plans;
- > Prioritising policies to confront spatial, social and economic exclusion with the aim of cushioning the vulnerable in the face of another shock;
- > Continuing to mobilise and empower women, youth, and other vulnerable groups by creating new employment opportunities and engaging them in economic activities through technical support and financing;
- > Ensuring resilient supply chains for agricultural, fisheries and manufacturing sectors focusing on local inputs to ensure food security, and safeguard export-oriented products;
- > Improving marketing efficiency through the adoption of innovative processes that connect buyers and sellers. This may include the adoption of technology to promote marketing and information sharing, formalizing product delivery services etc;
- > Leveraging information technology (IT) systems to better-match the required transport demand with excess supply in real time and provide travel pattern visibility, helping passenger and logistics operations become nimbler in considering a quickly-evolving context; and
- > Making sure public awareness campaigns are consistently available to all in a format and language understandable to all.

1.7 Structure of this Report

Following this introduction, the report is structured as follows:

- > **Section 2** provides a summary of key findings from the Diagnostics Report, which forms the baseline for the development of the UEP. Summaries of the planning context, the demographic and economic profiles and the infrastructure and environmental assessments are presented. The section details the key challenges and drivers for growth, identifying LMs' key sectors.
- > **Section 3** introduces the LM development framework and how it aligns to existing planning documents and the development priorities of Blue Economy potential, LAPSET potential and the overall UEP spatial strategy. It is supported by the economic vision considered and developed by the local stakeholders.
- > **Section 4** set outs the Economic Development Plan. Each of the key economic sectors is presented with a summary of the SWOT analysis and a Sector Action Plan alongside the proposed climate resilient infrastructure projects. The priority Value Chain (VC) projects are also set out in detail.
- > **Section 5** presents a range of implementation considerations to support the next stages of the SUED programme and the Blue Economy roadmap.

The report is supported by a series of appendices and an annex, in which:

UEP list of references

Appendix A - Lamu Municipality Diagnostic Report

The purpose of the report is to assess the current position of the economy and state of infrastructure, alongside the regional, national and international context, before the consideration of emerging economic growth opportunities and infrastructure needs.

Appendix B - Lamu Municipality Technical Briefing Paper

This captures the process followed from identification to assessment of growth opportunities for LM and provides recommendations on those with the greatest potential to maximise benefits and be developed further. The contents of this report form the backbone of the final UEP.

Appendix C - Lamu Municipality Gender and Social Inclusion Study

This study was a key part of the diagnostic process and engaged with special interest groups through interviews and focus group discussions. The study identified the groups that are excluded in socio-economic activities in LM and explored how and why they are excluded. The Study then made a series of recommendations for the SUED programme to ensure future inclusion and to address the multiple barriers (communication, physical, attitudinal and organisational) that these groups face..

Appendix D - Lamu Municipality Climate Vulnerability Assessment

This has been undertaken to outline the climate vulnerability context for the selected economic sector plans and infrastructure projects to be developed in LM.

Appendix E - Swahili Heritage Guide



2. Lamu Urban Diagnostics

Before any proposed interventions are developed it is important to understand the local development context and potential opportunities and barriers to growth. The Municipality's assessment has been undertaken in the UEP diagnostic process, as presented in Appendix A.

The diagnostics phase was a critical process to establish a foundation for identifying solutions that can deliver economic, social and environmental benefits. This section provides a summary of the diagnostic report's assessment of:

- > LMs' planning and regional context, its socio-economic profile, with urban and economic conditions and trends;
- > The state of existing infrastructure;
- > Environmental and climate risks; and
- > Barriers and drivers for growth.



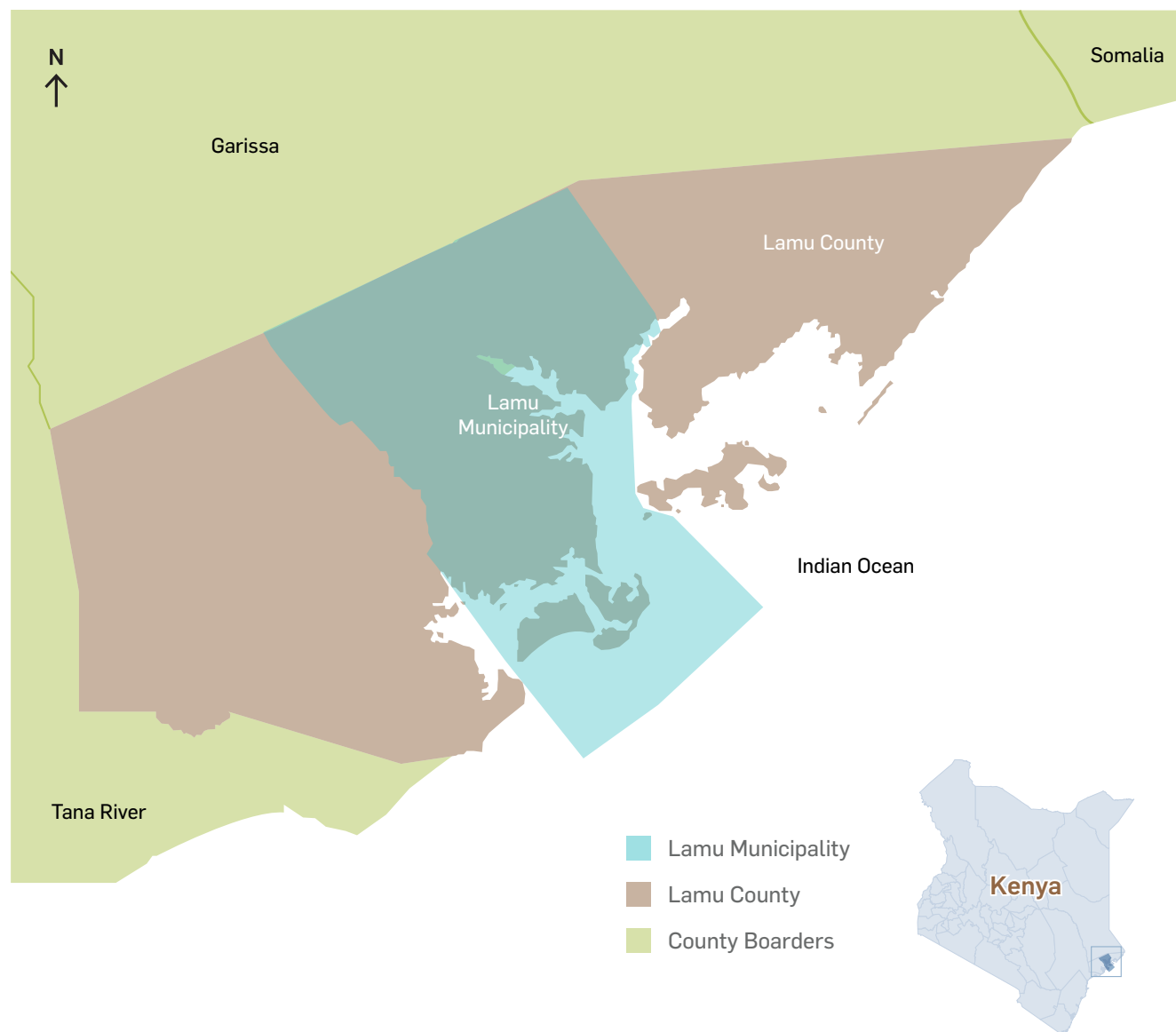
2.1 Study Area

The geographical focus of the UEP is LM, whose boundary has recently been expanded to encompass the LAPSSET programme area. The administrative boundary of the Municipality was previously contained within Lamu Island but now lies within the wards of Hindi, Mkomani, Shela and Basuba, as shown in Figure 2.1. The newly-adopted boundary of the Municipality covers an area of approximately 1,860 km² on land and an area of 800 km² underwater, this makes up around 28% of the land in the County¹.

LM is the headquarters and administrative centre of Lamu County (LC). The County is located on the south-east coast of Kenya and is one of the six coastal counties in Kenya. The County borders Tana River County in the southwest, Garissa County to the north, Republic of Somalia to the northeast and the Indian Ocean to the south. The County covers an approximate area of 6,607 km². Lamu County sits within Jumuiya ya Kaunti za Pwani (JKP) economic bloc.

It is important to note that there is a lack of planning documents and sectoral plans covering the entire Municipality area, there are only documents at County-level or Lamu Island. Therefore, the spatial analysis was limited to these geographical units due to the availability of information and data.

Figure 2.1 Study area



1 Advisory Plan, Department of Land, Physical Planning, Infrastructure and Urban Development (2018).

Source: Atkins

2.2 Planning Context

The Planning Context sets the basis for the development of the UEP. The Diagnostic Report in Appendix A covers key international and national trends likely to influence the sustainable growth trajectory of LM; national strategies and policies, and; LM's own priorities and ambitions.

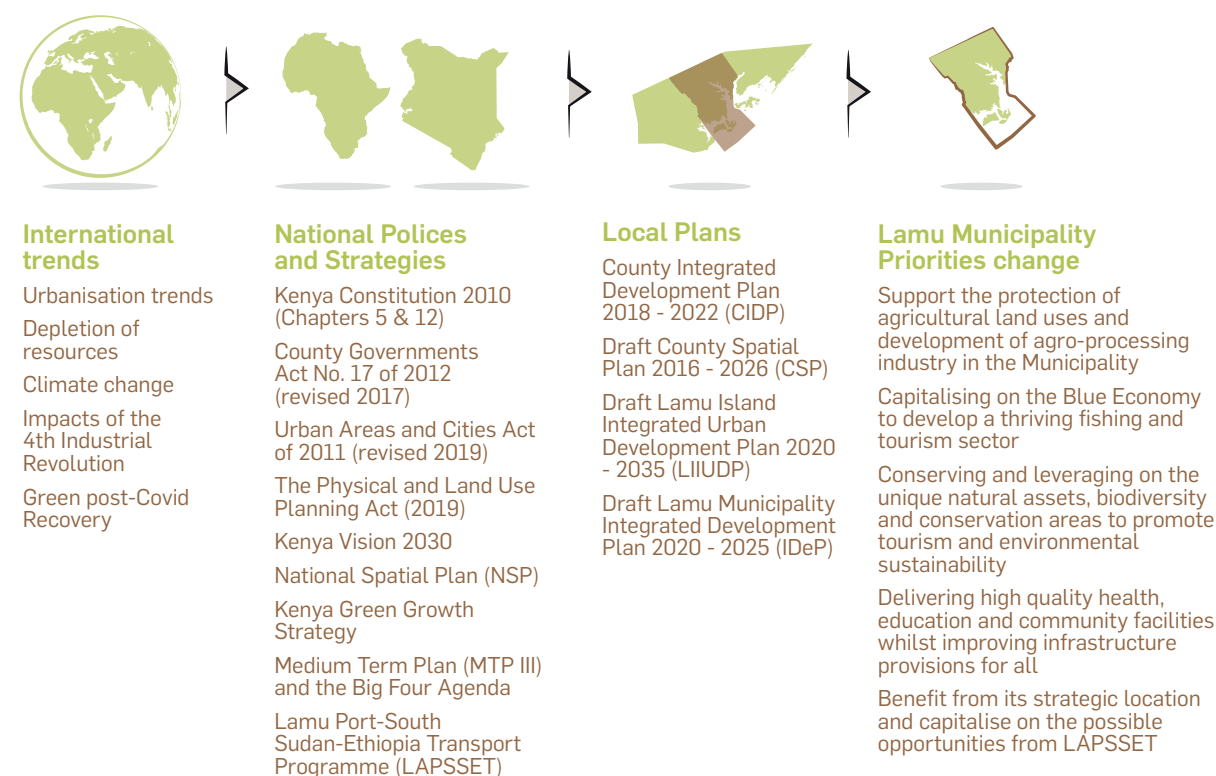
The Lamu County Integrated Development Plan 2018-2022 (CIDP) is grounded upon the Vision 2030, the MTP III, the NSP, Lamu Port-South Sudan-Ethiopia Transport (LAPSSET) Corridor and international targets such as the Sustainable Development Goals. The CIDP is one of the most important documents at County level, which aims to coordinate development and allocate budgets. The strategic goals of the CIDP are: i) eliminating poverty and increasing food/water security, ii) ensuring access to high-quality health and education facilities, iii) increasing industrial and economic activity, iv) delivering resilient infrastructure and managed urban growth, and v) tackling climate change by using technology and raising public awareness.

The Lamu County Spatial Plan 2016-2026 (CSP) is the long-term land use and spatial planning framework that aims to guide the allocation and distribution of resources including policy statements and proposals to promote growth in a coordinated and sustainable manner. The plan identifies the town of Lamu as the main urban centre and its respective development plans should be aligned with the provisions in the CSP (2017). The plan has earmarked the vision for Lamu County to become: "A planned, well governed, secure and healthy County that is economically vibrant and affords a high quality of life for its citizens through sustainable use of its natural resources, promotion of local culture and livelihoods and conservation of its unique heritage and biodiversity".

At the local level there is a **Draft Lamu Island Integrated Urban Development Plan 2020-2035 (LIIUDP)**. The Draft LIIUDP assesses the constraints and development potentials on the island and provides a spatial framework for its future development and growth in a sustainable manner. In addition, the plan provides a basis for public and private investment, the coordination of programmes and projects as well as land development management.

The Draft Lamu Municipality Integrated Development Plan 2020-2025 (IDeP) is expected to describe and integrate urban area policies, development programmes and financial abilities to manage the investment needs of associated spatial development within the Municipality. Furthermore, it sets out the priorities of the Municipality during the current government period. At the time of writing the UEP, the Draft IDeP has undergone stakeholder engagement within the Municipality in order to understand the local needs and constraints.

Figure 2.2 Planning Context



Source: Atkins

2.3 State of Lamu

2.3.1 Regional Context

Lamu County has a land surface area of 6,607 km² composed of 5,517 km² of arable land 650 km² of non-arable land, 130 km² of coastline and 308 km² under water mass². The County lies between zero and 50 metres above sea level average, and is generally quite flat, characterized by low plains with the exception of coastal sand dunes and sand hills. Because of the low-lying nature of the land, large parts of the County are susceptible to flooding, especially during high tides and the rainy seasons³.

Land uses within the County include agricultural (including pasture for livestock), residential, commercial, industrial and conservation. Agricultural land makes up the majority of the land use in LC of around 5,557 km², land to the north and west is used for pasture and livestock rearing, the agricultural sector accounts for 90% of rural household income.

Settlements comprise of residential, commercial and industrial uses, as well as agricultural uses found on the urban edges, they are mainly scattered along the coast of the County. Depending on grazing and climate patterns, temporary settlements can form in the north of the County.

The County is also recognised by its rich cultural and heritage assets, with Lamu Old Town being recognised and awarded by UNESCO as a World Heritage Site (WHS). The area was once the most important trade centre in East Africa and has exercised important influence in cultural, trade and religion in the region.

The County can be described as a biodiversity hotspot and is home to a variety of unique and indigenous terrestrial and marine ecosystems, for example, mangrove forests, coral reefs and seagrass beds spread across the archipelago. These ecosystems are regarded as some of Kenya's most valuable marine assets and are often gazetted areas within conservation areas and parks for example Witu forest,

Lungi Forest, Doodi National Reserve and Kiunga Marine National Reserve.

Historically the area has faced instability from conflict, most recently in the form of terrorism caused by Al-Shabab entering the Country via the border with Somalia. Disruption from terrorism has primarily affected the villages in the northeast region and parts of Lamu County in the area bordering Garissa County. The effect of terrorism on land use is evident and pushes human activities, particularly agriculture and human settlement to the south of the Garsen-Mokowe Highway⁴. This increased insecurity and pressure on land availability often causes conflict amongst landowners and pastoralists.

2.3.2 Municipal Context

LM is made up of a vast mainland covering an area of approximately 1,760 km² and Lamu Island which covers an area of approximately 100 km². The mainland has two major urban centres, those being Mokowe found to the South and Hindi found in the centre of the Municipality. Mokowe is currently a market centre, however, it is planned to become the future administrative centre of the Municipality in order to relieve development pressure off Lamu Island. The mainland is mainly covered by agricultural land uses including pasture for livestock.

The development of LAPSET has meant that the mainland of the Municipality has become home to the Lamu port area, with Hindi acting as its host city. Currently the port has three berths built out into the Indian Ocean, however, once complete it is anticipated that the port will have a total of 32 berths. Furthermore, the programme proposes the creation of an SEZ in the North of the Municipality to aid in economic and industrial activities.

² Lamu County, CSP (2017)

³ Lamu County, CSP (2017)

⁴ Lamu County, CSP (2017)

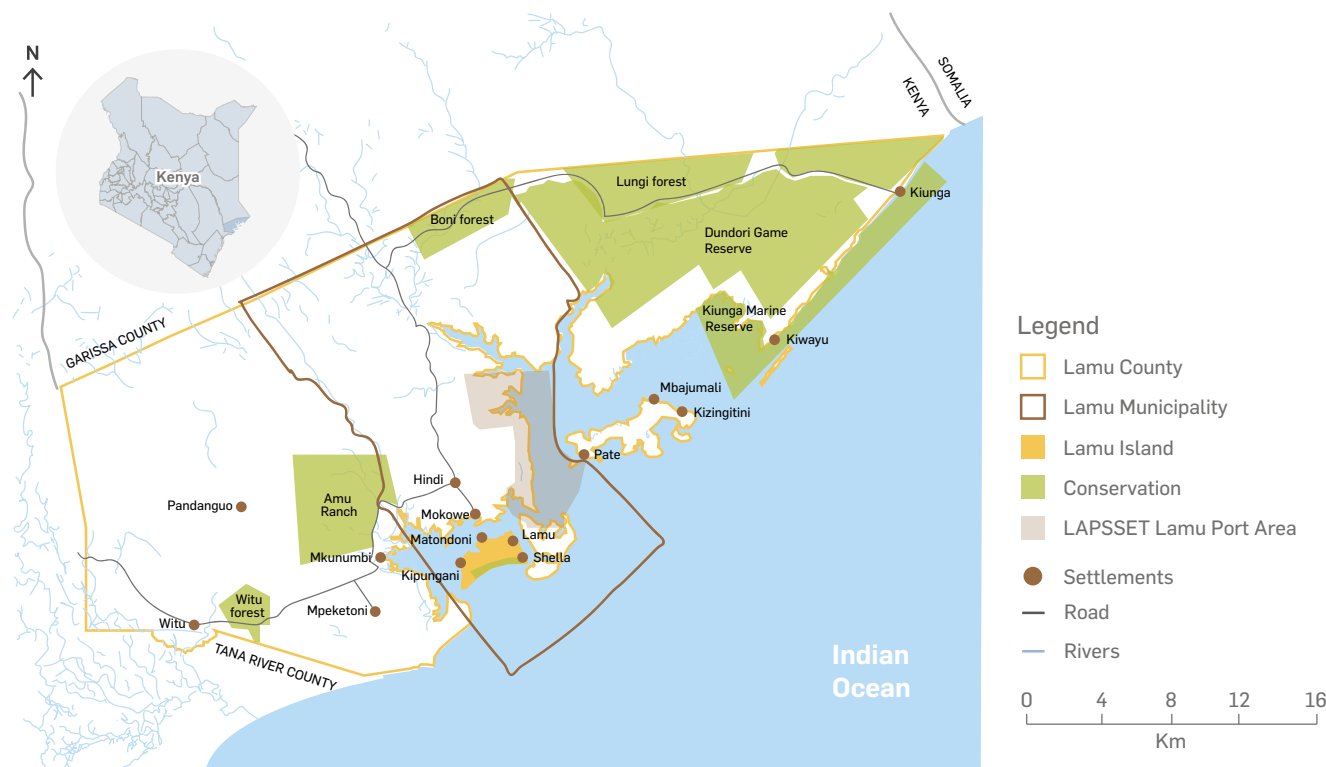
Lamu Island is found in the south-east corner of the Municipality and takes up a relatively small area of the land mass, however, the majority of the population of the Municipality live on the island. The Island is connected to the mainland road network as well as the Manda airport via a number of jetties found along sea front road.

There are four major urban centres on the island including Lamu Town, Shela, Matondoni, and Kipungani. Lamu Town is the main urban centre and the current administrative centre of the Municipality. Shella village is found in the southeast of the island, previously known as a fishing village, it is currently the main tourist centre on the island with its close proximity to the Lamu sand dunes, found at the south of the island; there are a number of hotels and resorts found there. Matondoni is a residential and commercial node on the island, and it is mainly known as a Dhow-making and fishing village. Kipungani is found in the southwest of the island and is known as a secondary tourist centre as the surrounding ocean is suitable for kite surfing, dolphin spotting and sports fishing.

Housing is represented by Swahili-type houses built using locally-available materials. There is an inadequate supply of quality and affordable housing which often leads to the creation and growth of informal settlements. These often lack access to public utilities such as electricity, piped water and sanitation provisions which are only found in well-established urban areas such as Lamu Town.

Lamu Town is the main urban centre of the island and the current administrative centre of the County. The historic centre of the town is a UNESCO World Heritage Site as it is the oldest and best-preserved Swahili settlement in East Africa. The townscape is characterised by narrow streets, which often terminate into house entrances or open spaces. Lamu Old Town plays a key role in providing social infrastructure, such as schools, mosques, administrative offices including the County fisheries office and police station, and cultural spaces to the island such as the Lamu Fort. The town lacks access routes and faces drainage and solid waste management issues.

Figure 2.3 Municipal context within the County



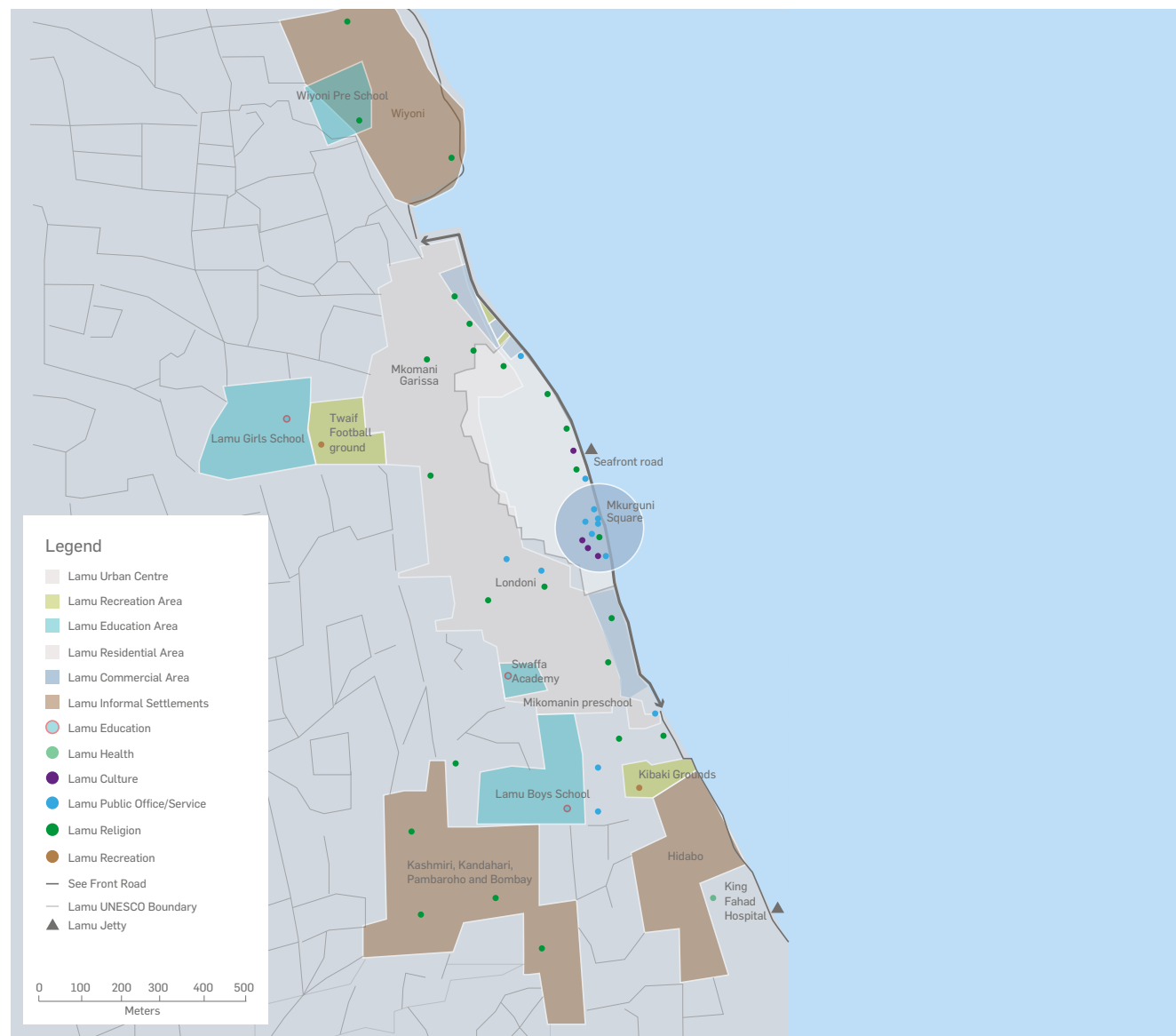
Source: Atkins

There are a number of informal settlements found around the outskirts of Lamu Town, these include Wiyoni in the North, and Kashmiri, Kandahari, Pambaroho and Bombay in the south. These are often irregularly shaped and can be constrained by natural features such as sand dunes or the Indian Ocean. Accessibility is limited due to poor road infrastructure. These settlements mostly serve a residential purpose as the majority of trade and commercial activity occurs in the Old Town. Poor implementation of plans and the lack of enforcement of regulations have led to uncontrolled urbanisation and lack of public utilities and infrastructure provisions.

Overall, there is a lack of public open spaces within the town. The Mkunguni square, located in front of Lamu Fort, is one of the only public open spaces in the town. Therefore, streets often serve as public social spaces for residents, one of the most vibrant social streets in Lamu Town is the sea front road.

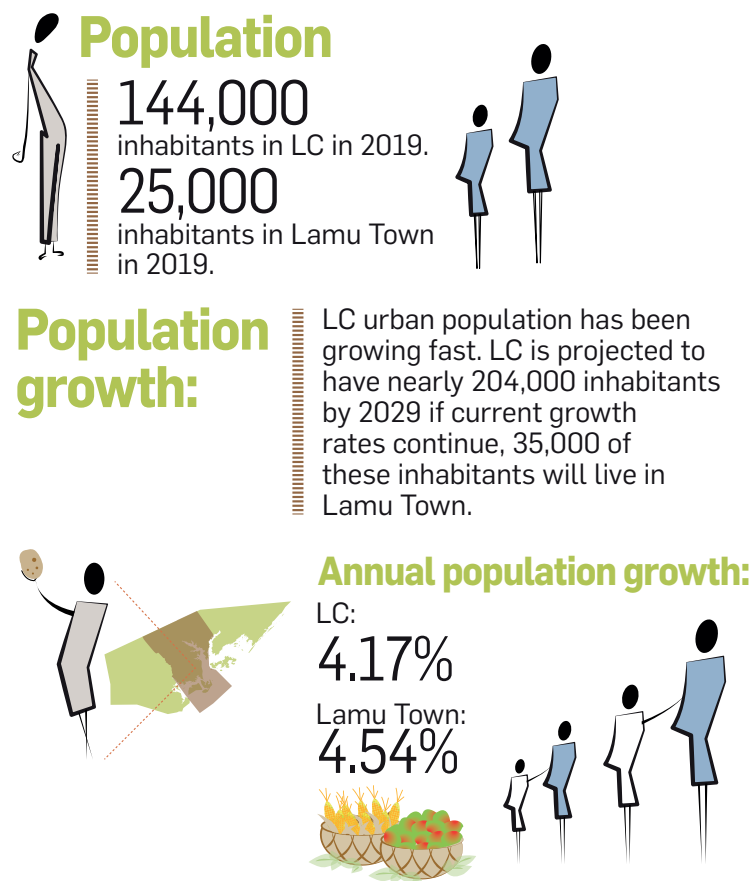
See Figure 2.4 for a map of Lamu Town with its informal settlements and key points of reference such as transport and social infrastructure.

Figure 2.4 Lamu Town character

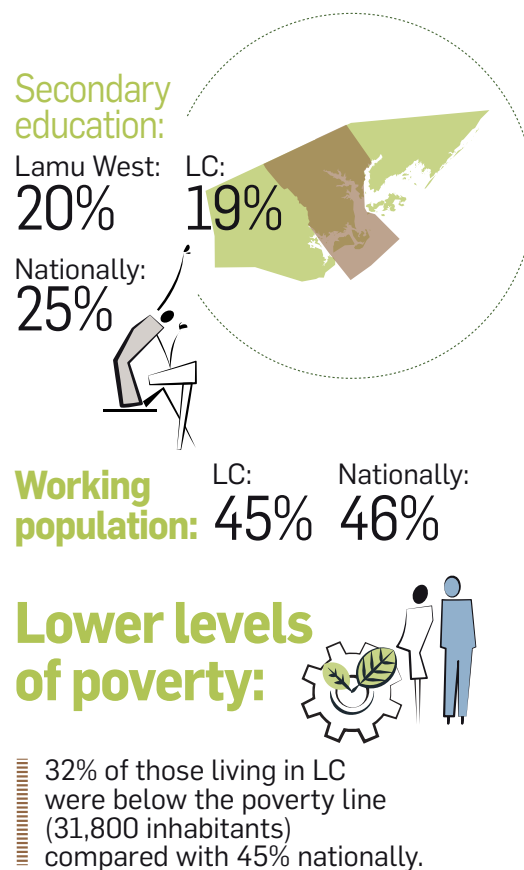


Source: Atkins

Figure 2.5 LM's social and demographic profile



Source: Atkins



2.3.3 Socio-Economic and Demographic Profile

Demographic Profile

The population of Lamu County is estimated to be 143,920, which is relatively small when compared with other coastal region counties. Within the County's population, 27% are classed as urban which equates to 38,466 inhabitants. This is similar to its surrounding counties, with the urban population estimated to account for 23% of the total population in Tana River, 25% in Garissa and 27% in Kilifi. Most of the urban population in the County live in four main urban centres: Lamu Town, Mpeketoni, Mokowe and Faza. Lamu Town had an estimated population of 25,385 in 2019, this has grown by 36.4% since 2012⁵.

The population density of the County is 23 inhabitants per km², making it the 36th densest County out of the 47 overall in Kenya. The population of Lamu County increased by 41.7% between 2009 and 2019, which corresponds to an annual growth rate of 4.17%. If this growth rate continues it is projected that by 2029 the population of the County will reach 203,000 inhabitants. However, it is important to note that these projections purely rely on observed growth rates, but do not take account of other factors likely to impact growth – including fertility rates, land availability, infrastructure and job opportunities.

In particular, these projected growth figures do not account for the likely implications of the LAPSET corridor projects for migration into Lamu County, attracted by the employment opportunities and facilities it is expected to deliver. According to the Lamu Investment Framework for the LAPSET corridor programme⁶, the development of the Lamu node is anticipated to generate a population of approximately 1.1 million when complete, whilst accommodating 425,000 jobs. This will require a detailed approach to planning and social management in order to mitigate against potential threats to the County.

⁵ Lamu County, CSP (2017).

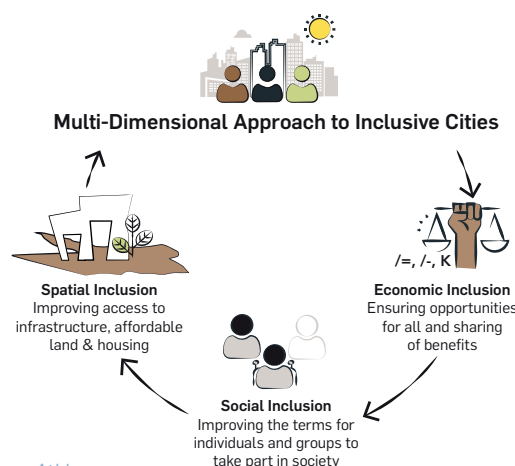
⁶ Atkins Acuity, Lamu Port City Agreed Investment Framework (2017).

Social Inclusion

The vision for Lamu County in its Integrated Development Plan (CIDP) 2018-2022 aims at “a nationally competitive county offering good quality of life for all its citizens through prudent use of resources, equitable provision of services and implementation of sustainable development”. In order to achieve that, their mission is to provide services and ensure the socioeconomic development of the County's inhabitants. Social inclusion of all community members is among their core values, particularly targeting women, PWD, youth, low-income communities and other marginalised groups.

Despite the County's plans and successful implementation of social inclusion measures and programmes, however, key informant interviews (KIIs), focus group discussions (FGDs) and observation conducted at the Municipality level established that PWD, youth, women, and elderly people still feel excluded from socio-economic activities in the region. The approach to the social inclusion study was guided by the client's need for age, gender, Persons with Disability (PWD) and refugee's inclusion in the programme, and the World Bank's multi-dimensional approach to inclusion that considers social, economic, and spatial dimensions as illustrated in Figure 2.6.

Figure 2.6 The three dimensions of inclusion



Source: Atkins

Special Interest Groups (SIG) have indicated that social exclusion in LM manifests in the following forms:

Table 2.1 SIGs and Exclusion Manifestation Table

SIG	Key findings from the Lamu Municipality Diagnostic Report
Women	<p>Impacts of COVID-19: Women often participate in small-scale business such as selling fish, roasted potatoes, and baked products/local foods. However, many businesses were severely affected by the COVID-19 pandemic;</p> <p>Limited access to assets and finance: Since women do not own land or other assets, the lack of collateral makes it difficult to access finance and capital. Opportunities such as the Women Enterprise Fund that require paying back with interests, are not available for Muslim communities. FGDs' participants expressed that they would rather receive grants or Sharia-compliant funds;</p> <p>Lack of access to information and decision-making processes: Women are often excluded from decision-making processes regarding the household and its economic activities. These decisions are often in the hands of men or elderly people. Programmes targeted at women do not consider their perspectives and needs;</p> <p>Social norms that act as a barrier to women's participation in socio-economic activities: For example, there are cultural beliefs and taboos against women's participation in fishing activities. However, they have key roles in other links of the value chain such as processing and sales. Some women have also reported gender-based violence (GBV) when engaging in the Blue Economy; and</p> <p>Key stakeholders in climate action: In Lamu, women actively contribute to the conservation and reforestation of mangroves, crucial for sustainable fisheries. There are several local initiatives, such as the Mtangawanda Mangrove Restoration Women Group, which combine conservation activities with women's economic empowerment initiatives.</p>
Youth	<p>Lack of involvement in decision-making processes: Culturally, it is expected that decisions about youth and their lives are taken by adults and elderly people. For this reason, they are not included in the design and planning of projects and government programmes targeted to them;</p> <p>Restricted employment opportunities: FGDs have indicated that youth face limited employment opportunities due to the lack of industries in the area. Youth reported that the main employment prospects come from LAPSET, or the national and the County Government. Other employment alternatives have been mentioned above (i.e.: transport services, fishing);</p> <p>Lack of access to education and training: There are no higher education institutions in Lamu, and there are five operational TVET and one Innovation Lab in Hindi. For youth who live in the island, travel costs and long distances act as a barrier to access education and training. Moreover, most youth lack financial support to cover high school and technical course' fees; and</p> <p>Difficulties accessing licences: FGDs specified that youths who would like to engage in boat transport require a license. However, the only way to obtain the license is through completing training offered by the Bandari College in Mombasa. Distances and costs also limit access to this training.</p>

Source: Atkins

Table 2.1 SIGs and Exclusion Manifestation Table

SIG	Key findings from the Lamu Municipality Diagnostic Report
Elderly people	Lack of involvement in decision making: Both the County and national governments do not involve elderly people in decision-making processes on issues regarding them. For example, the national Government increased the age to access pesa ya wazee (an elderly support programme) to 70 years, which FGDs participants argued is too high;
	Lack of access to healthcare services: Most elderly people suffer from diseases such as hypertension, diabetes, mobility restrictions, etc.,. However, there is only one public health facility on Lamu Island. Most elderly people cannot afford healthcare and face difficulties to access transportation (e.g.: high costs, lack of accessible infrastructure);
	Lack of employment opportunities: Elderly people lack employment opportunities due to their age and there is an assumption that they are unable to work. For example, they are excluded from fishing activities and they depend on younger people and their children. Some have indicated that they undertake weaving businesses, and sell fish, and others depend economically on their children; and
	Lack of safe walking and recreation spaces: The introduction of boda boda transport on the island has made elderly people feel unsafe walking on the sea front and the narrow paths due to the fast ridden boda bodas.
PWD	Lack of PWD-friendly infrastructure: FGDs specified that government buildings in the mainland have incorporated PWD-friendly infrastructure. However, most buildings and infrastructure (e.g. offices, markets), particularly on Lamu Island, are still not accessible to PWD. Similarly, PWD face challenges accessing transport services (e.g. jetties do not have ramps);
	Lack of PWD involvement in decision-making processes: Although there are government programmes to support PWD, this group does not participate in the design and planning of these programmes. FGD have indicated that PWD are only consulted in certain stages of programmes' implementation, such as passing budgets before they are approved by the County Assembly;
	Lack of access to information: Projects and programmes to support PWD do not develop communication plans with PWD in mind (i.e. material in Braille or sign language). Available support opportunities for PWD are often posted online, yet not all PWD are techno-savvy or have digital access/skills;
	Partial or lack of implementation of disability laws: For example, despite employed PWD being exempted from paying taxes, according to Kenya's Persons with Disability Act (2003), FDGs have specified that most still do. This happens since the exemption process is lengthy, costly, and requires travelling to government offices in Nairobi;
	Costly processes to obtain a business license: FDGs have indicated that the cost for obtaining business' licenses is costly and prohibitive for most PWD. For this reason, some PWD have argued that their only option is to operate their small businesses by the roadside; and
	Stigmatisation: FDGs indicated that PWD are discriminated by other community members and excluded from employment opportunities. Moreover, this group is not invited to participate at the Lamu Cultural Festival.

Source: Atkins

Opportunities for inclusion in the SUED programme include involvement of all in decision-making and in the development of safe, inclusive and climate-resilient infrastructure. This will enable better access to capacity building initiatives, seed capital and employment opportunities – especially through participation in the VC projects.

As raised in section 1.5, there are interlinkages between climate change and poverty, as climate change will have an impact on income security and quality of life. It is important to understand where the burden of climate change impacts may fall and how societal groups can be included in proposed mitigation measures.

Social inclusion is cognisant of this relationship. The UEP has adopted climate adaptation approaches, as well as inclusivity in all forms, to avoid exclusion of certain groups and to reduce inequality. Similarly, it has sought to address how infrastructure and VCs can be made more resilient to climate shocks, with the understanding that climate impacts hit vulnerable groups the hardest.

Economic Profile

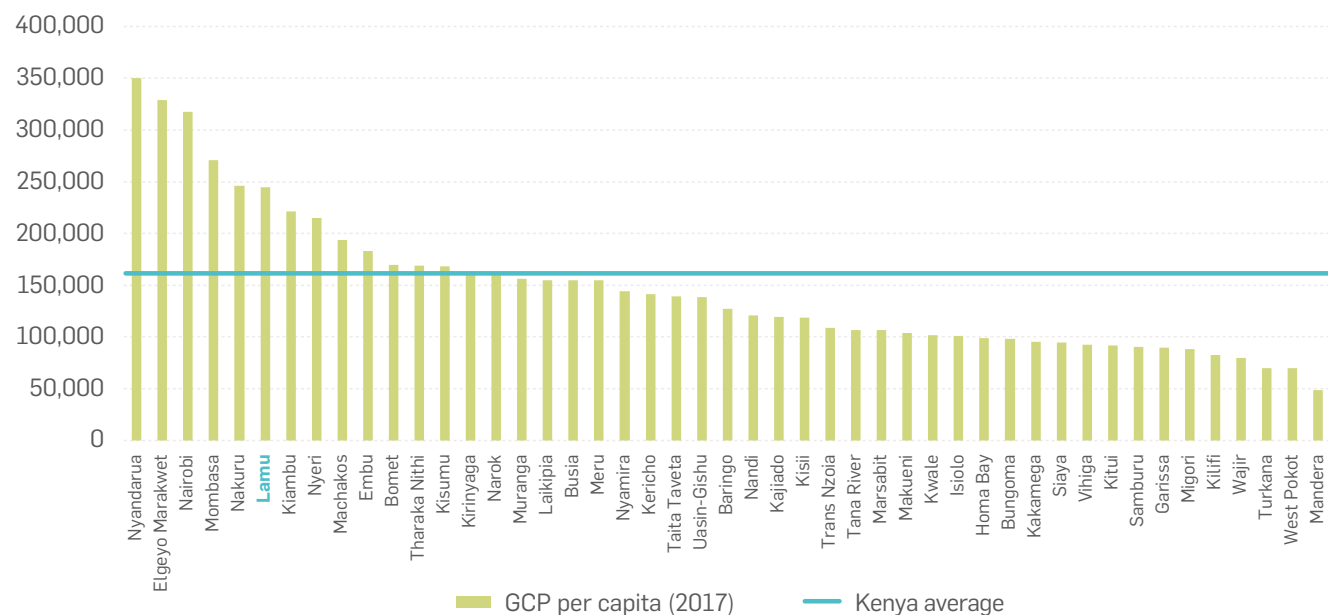
The JKP region contributes towards just 8.6% of the national output, with a combined GCP of approximately KES 654,460 million. Over half of JKP's economic activity is driven by the County of Mombasa, which represents the fourth largest economy in Kenya. By contrast, LC is one of the smallest economies, both nationally and within the bloc. In 2017, it accounted for just 5% of the Bloc's GCP at KES 32,386 million, the smallest contribution of all six economies⁷.

Lamu County's GCP per capita was significantly higher than the national average in 2019, at KES 244,379, compared to KES 161,499 nationally⁸. Figure 2 7 shows that the only counties in JKP with a higher GCP per capita than the national average were Lamu and Mombasa. While Lamu County remains a small economy in absolute terms, its GCP relative to its size, per capita, is higher than the Kenyan average.

7 KNBS, Gross County Product Report (2019).

8 KNBS, Gross County Product Report (2019).

Figure 2.7 Gross County product per capita, 2017 (in KES)

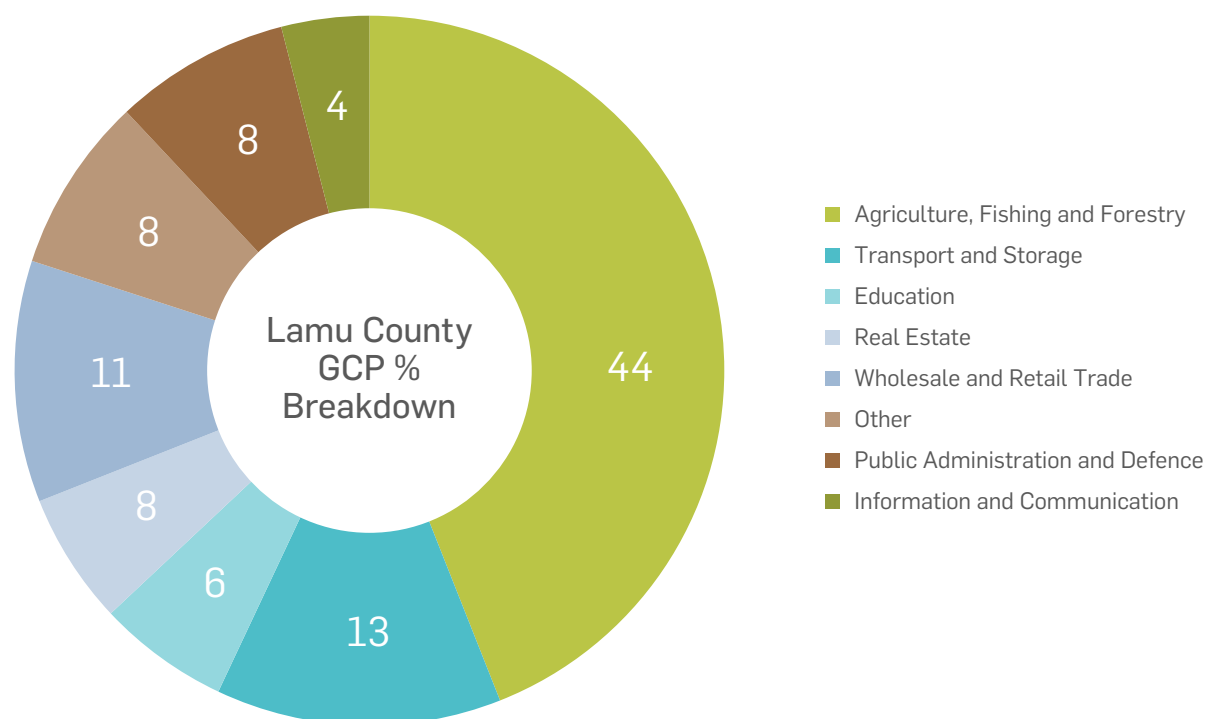


Source: Data from KNBS, Gross County Product Report (2019)

Focusing on Lamu County's internal economy, GCP analysis reveals some slight differences with JKP average, as can be seen in Figure 2.8. Agriculture, forestry and fishing dominates the economic output of LC, accounting for 44% of County GCP. The sector is the backbone of the County's economy. In 2009, about a third of the Kenyan workforce (32%) worked in family agricultural holdings, while this was slightly higher in LC (39.4%). However, Lamu County contributes just 13% of the regional output for this sector. In addition to the small relative size of Lamu County, this could suggest that the agriculture sector is less productive in Lamu, and therefore would account for a smaller share of the County's output compared with some other counties.

The wholesale and retail trade sector accounts for 11% of the County's GCP, which is higher than the JKP average (9%). However, this sector remains small in absolute terms when compared with larger economic powerhouses, such as Mombasa. The public administration and defence sector accounted for 8% of the County's GCP whereas the transport and storage activity sector represented 13% of the County's GCP. Importantly, the vast majority of employment in LC and LM is likely to be in the informal sector. In 2019, almost 83% of employment in Kenya was in the informal sector. While no statistics are directly available at smaller geographies, employment composition and GCP specialisation in agriculture suggests a similar pattern in LM.

Figure 2.8 Lamu County GCP breakdown, 2017



Source: KNBS, Gross County Product Report (2019)

The State of Business in Lamu Municipality

60 businesses, reflecting Lamu's main sectoral activities, were consulted through in-depth interviews. Many of these were small businesses or independent workers but large employers were also consulted, including health and education facilities, and hotels. The analysis below has been utilised to inform the understanding of the business environment, socio-economic inclusion, key challenges and enablers.

Lamu businesses are a variety of different sizes and have links with other businesses upstream and downstream, making the production chain relatively extensive. Most businesses are operating locally, selling their goods or services within Lamu Old Town or the surrounding Municipality, as well as some operating in the wider County. Some businesses state that they sell to other areas in Kenya, e.g. fisherfolks' organisations which sell onto other major cities like Mombasa, Malindi and Nairobi.

The majority of the businesses said that they tend to not deliver their goods, with customers instead tending to visit their shop if they wish to buy their goods or services. This was especially the case for the agriculture, fishing and retail and trade sectors. A significant majority identified transport as a major cost, especially businesses in the retail and trade sector. Most businesses identified word of mouth as the main method of marketing, these businesses rely on walk-ins and referrals to keep business, rather than spending money on marketing.

A significant proportion of businesses that were interviewed indicated that they expect to expand and have a positive outlook for the future. One reason given for this was the opening-up of the LAPSSET port facility which will hopefully have a positive impact on investment. There were some cases of businesses expecting to continue as they are, citing the current uncertainty around COVID-19 and the return of tourism as an explanation as to why they are unsure about the future of their business.

Table 2.2 Business identified challenges to growth

Top challenge mentioned	Detail
Transport infrastructure	The interviewees often mentioned the poor condition of some of the roads in Lamu County, and around the Old Town. Some businesses believed that transport costs were higher because of the poor condition of the roads, with travel damaging their products. Poor access to the villages by roads also inhibits access to health-care and social services like schools, markets and other income-generating activities. Businesses also listed the cost of operating or hiring boats as one of the major cost items for their business.
Access to utilities	For businesses located on Lamu Island, there was an over-arching theme of a lack of access to utilities e.g. electricity and water. They stated that the island does not have good supplies of either, with one medical facility saying they have challenges with power cuts as there is not a consistent source of electricity. This was particularly a problem for the hospitality sector, where electricity and water are major costs for businesses.
Lack of finance	<p>The lack of finance was very frequently mentioned as a key challenge to growth. Several small business owners reported their difficulty in obtaining a loan or a grant, in particular when they have little to no collateral – such as land, capital or property deeds (typically in the retail and trade or agricultural sector).</p> <p>Smaller businesses noted that there are no credit facilities for their type of business e.g. fishmongers. If a loan was available, there tended to be a reluctance to take them up as they were viewed as being too risky. Furthermore, one business owner explained that his religion was against taking out a loan that accrues interest, stopping him from getting one.</p>
Market infrastructure	Some businesses in the retail and trade sector highlighted that they have been relocated to a temporary space whilst the market in Lamu Old Town is being constructed. This space they now operate in is of a lower quality infrastructure, being muddy during the wet season, lacks adequate shade and is small and congested. Business owners in the industry and manufacturing sector also mentioned that they require more modern machinery and storage space.
Insecurity	Insecurity in Lamu has been raised as being a key challenge, with travel bans to the area having been imposed in the past.
Competition	Several interviewees, especially in the tourism and hospitality sector, mentioned competition from existing businesses as well as from upcoming establishments as being a significant challenge to their business. In LM, especially on Lamu Island, there are now lots of hotels competing in the same market for tourists to visit. This has caused a price war where each hotel will have to lower its prices to attract customers, and in doing so, decreases its profit margin.

Source: Atkins analysis

2.4 Infrastructure Overview

The Municipality's infrastructure has been assessed and evaluated in its current provision and state to identify strengths and critical gaps. The assessments also reviewed proposed or planned projects, for how they respond to LM's infrastructure challenges.

Overall, to address the existing infrastructure challenges and barriers to growth, LM will need to upgrade existing infrastructure and commit to new projects to support economic growth and development. Key infrastructure gaps identified are:

Figure 2.9 LM's infrastructure overview

Water

Nationally **58%** of the population have access to at least a basic water supply.



Current water supply in Lamu Town is approx. **2,000m³**

Non-revenue water is estimated at 45%. Losses are high due to leakage from the aging pipe network, illegal connections and a lack of consumer meters.

Drainage

Drainage infrastructure does not form a drainage network.

Main natural hazard is flooding during heavy rains, as well as sea level rise.

Increasing surface runoff pollution into the Indian Ocean, mainly due the mixing of surface and grey/black water in open drain which often overflow due to a lack of capacity.

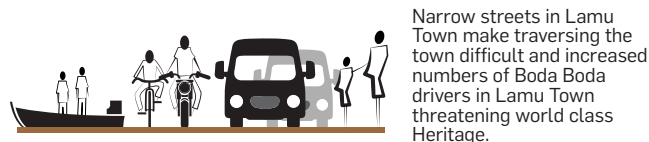


Transportation

Poor road surface conditions within LC. Most access/feeder roads are earth surfaced and do not provide for all-weather access, including lack of storm water drainage.



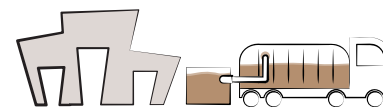
Lack of NMT facilities in urban areas and poor quality Jettys and high cost of sea transport that pose make transport between the mainland and Lamu island difficult, especially for PWDs.



Narrow streets in Lamu Town make traversing the town difficult and increased numbers of Boda Boda drivers in Lamu Town threatening world class Heritage.

Wastewater and Sanitation

There is no centralised sewerage system in Lamu town or the Municipality. Septic tanks and pit latrines are used widely by households and institutions.



Mixing of storm and grey/black water can often lead to outbreaks of cholera and other water borne diseases.

The narrow streets of Lamu Town make sludge collection from septic tanks and pit latrines difficult. When extracted, sludge is normally dumped into the Ocean.

Solid Waste

Only a very small percentage of all total waste is collected and transferred to designated dumpsites.

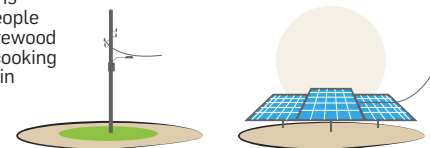


Dumpsites typically do not have NEMA licences and waste is often burned or dumped into the Ocean.

It is acknowledged that current practices cause air and water pollution and pose risk to public health and the environment.

Energy

Cost of electricity is very high. Most people continue to use firewood and charcoal for cooking as LPG and paraffin are too expensive.



Streetlights are present in Lamu Town, mainly along sea front road. The County invested in solar lighting, removed these due to high maintenance costs caused by corrosion from the sea air and spray.

Significant lack of cold storage and available machinery to boost the economy and add value. Current level of energy infrastructure in more rural areas is fairly sparse. Areas needed to support agri-processing are mainly remote and likely to be unserved by the grid.

Source: Atkins analysis

Water Supply, Wastewater and Drainage

- > The Municipality is experiencing a rising water demand due to rapid population growth and urbanisation. In addition, most parts of the Municipality lack water reticulation, however areas with existing water supply pipelines such as Lamu Island have dilapidated water networks. For instance, there are lots of water pipelines not properly buried, and therefore posing the danger of contamination. Furthermore, there are incidents of vandalism that have led to high non-revenue water (NRW) to be 45%. Another major challenge is the lack of fresh water in most parts of the Municipality, with significantly affected areas being as Mokowe, Hindi, Mtangawanda and Siyu. Most of the residents depend on saline water from communal boreholes;
- > The Municipality lacks the capacity to provide fresh water supply in all parts of the municipality. In this respect, most of the municipal water supply focuses on Lamu Town, Shella, Manda (Ras Kitau) and parts of Mokowe. The rest of the Municipality gets its water from private boreholes and private suppliers; and
- > Another challenge is the lack of a municipal sewerage system; therefore, most residents use pit latrines which has significantly resulted in the pollution of groundwater sources and the ocean, as well as causing a public health hazard. For instance, open drainage along Lamu Town's streets flows directly to the Indian Ocean, such open drains are also present in Mokowe, Hindi and Lamu Archipelagos.

Solid Waste Management

- > Lamu Municipality experiences general poor waste management with inadequate waste management infrastructure and equipment. For example, the entire Municipality has only two waste collection tractors, one in Lamu Island and the other on the mainland. Consequently, most of the solid waste remains uncollected leading to high levels of ground and ocean pollution. In addition, this poses a threat to the location's UNESCO World Heritage Site status. The two dumpsites at Shella and Mkomani do not currently have a NEMA license, with the dumpsite at Shella having reached its capacity; and
- > Lamu has some organised waste collection groups such as the Takataka Foundation and Lamu Youth Alliance, that have been proactive in waste management on their own. However, there has never been a formal working relationship with the municipal waste management unit, hence solid waste is not being effectively managed. Furthermore, there are very limited waste recycling points within the Municipality, the only one available being the waste recycling point in Kashmiri. Other challenges include unmanaged donkey dung, and a low sense of responsibility amongst the municipal residents leading to solid waste dumping on the streets, in the ocean and at informal collection points, and poor awareness of environmental impacts and enforcement of environmental laws.

Energy

- > The main source of electricity in Lamu Municipality is KPLC, however some parts of the Municipality, such as Manda Ras Kitau, depend on solar energy and generators to operate. Streetlighting is present in many areas of the Municipality including Lamu Town, primarily along the waterfront, Mokowe, Hindi and towards Lamu Port area. Firewood is the main source of fuel for cooking and lighting in rural areas and a few urban areas. Another challenge is affordability among residents. There is no energy masterplan that provides a framework for existing and future energy demand.

Transport

- > The main mode of transport in Lamu Municipality is water transport that connects Lamu archipelago with the mainland. This is followed by road transport, which is not well-developed due to poor road conditions, poor network distribution, poor public transport, and a lack of non-motorised transport (NMT) in its urban areas, such as Mokowe, Hindi, Mpeketoni and Witu. There is also a lack of alternative routes for motorised transport (motorcycles) on Lamu Island that has led to modal conflict;
- > The Municipality lacks safe public water transport vessels. In addition, the existing jetties are small and inadequate, and cannot cope with the transport demand in the Municipality;
- > Lamu is connected by air at Manda airport which has been in poor condition although there are ongoing efforts to rehabilitate it. Another challenge to transport is the insecurity of road networks occasioned by the insurgency of terror groups in areas such as Boni, Mpeketoni, and Witu, among others; and
- > Lamu Municipality's population is forecast to increase significantly which will put additional pressure on the Municipality's infrastructure. There is an expectation that with the completion of the LAPSET project, there could be a population of approximately 1.1 million. This will increase demand for water, drainage, sanitation, solid waste management, energy and transport infrastructure services in the area, therefore stretching the already limited infrastructure and services provision.



2.5 Environment and Climate Change Risk Profile

The flat topography makes the County prone to flooding during the rainy seasons and periods of high tides. There are four main rivers and two major bodies of fresh water, these being Lake Kenyatta and Lake Amu. These rivers are highly dependent on rainfall for their input and quickly drain to the creeks and oceans. During the wet season, these rivers provide the locals with the needed fresh water for domestic use.

The County has four distinct agro-ecological zones which are highly influenced by the rainfall variability pattern experienced across the County. LC has both gazetted and rich biodiversity spaces, which cover 11.5% of the County's surface area. The largest forests are Boni and Dadori National Reserves and other forest areas include the Witu Forest Reserve, Lungi Forest Reserve and Pandanguo forests. There are also a number of wetlands and swamps due to the County's low-lying nature and proximity to the Indian Ocean.

Furthermore, the County has a rich biodiversity and marine environment. Over 60% of all mangrove forests in Kenya are found in Lamu County, these are known as some of the most extensive and species-rich mangrove forests along the entire coast of East Africa. The County is also home to coral reefs and extensive seagrass beds, which support numerous fish, aquatic mammals, turtle, shark and ray species. Mangroves, coral reefs, and seagrass are vital fisheries' breeding grounds and support fish populations that provide income and livelihoods for local fisherfolk. One marine protected area is located in Lamu, this being the Kiunga National Marine Reserve, found in the northeast of the County, which extends over 250 km² and effectively covers 0.18% of the country's marine and coastal area.

The CSP and CIDP recognise the immense value the unique and endemic habitats and biodiversity found within the County bring to the local economy. They seek to protect these whilst unlocking their full potential to support the Blue Economy. Furthermore, climate variability and climate change are recognised as emerging threats to the sustainable development of the County. The impact of drought and floods

is reported to have increased, and farmers have seen less reliable rainfall, with more variability between years and within seasons. This has often led to conflicts between pastoralists and farmers as they move livestock across the county in search of water.

Climate projections show that average, minimum and maximum temperatures will increase in the County. There are clear indications that both rainy seasons will become shorter, with less reliable rainfall in May at the end of the long rains, and a delayed start to the short rains. Thus, although overall rainfall is expected to stay at similar levels for the long rains and increase in the short rains (around 20% increase in total), the rainy seasons will be more intense, and there is a clear need to manage variability in rainfall. Climate risks to the agricultural sector will remain high, as increases in drought stress are likely, and rainfall intensity is expected to increase, meaning that flood risk is likely to increase.

Key climate risks are increased temperatures and prolonged periods of heat stress, droughts and rainfall variability, flooding due to increased intensity of rainstorms, and sea level rise.

There is an opportunity in Lamu to work with the significant natural assets of the County in order to both increase resilience to these climate risks, as well as enhancing biodiversity, and improve leisure, recreational activities and the tourism offering. Poor and marginalised groups tend to be disproportionately vulnerable to climate risks, as outlined in section 1.5, due to a reliance on natural resources for livelihoods, housing which is more likely to be in areas at risk of flooding, and other climate hazards, and a lack of access to social and financial resources.

Without explicitly considering the climate risk faced by these groups, economic growth and poverty reduction initiatives that target these groups may be undermined. Equally, if climate adaptation and resilience programmes do not explicitly include and consider marginalised communities, they risk reinforcing existing inequalities.

2.6 Diagnostics Conclusion: Drivers and Barriers for Growth

To promote diverse economic development within an attractive investment and business environment, LM will need to focus on its key economic sectors and the competitive advantages that can support growth within the Municipality, and throughout the County. The economic profile supported by business consultations includes the following:

Agriculture, livestock and processing: the local population largely rely on this sector as the main economic subsistence activity;

Fishing and marine: building upon the existing fishing sector by supporting the provision of processing facilities;

Tourism and heritage: capitalising on the unique cultural heritage of the Lamu Old Town and the endemic marine and land-based biodiversity of the County; and

Emerging maritime trade and transport and future industries: reflecting the existing commercial activity in LM and its strategic location, as well as the future growth opportunities presented by LAPSSET.

2.6.1. Barriers for growth

The diagnostics analysis demonstrated that there are many common challenges to growth, which are shared by all sectors in Lamu, as presented below. These also reflect the strong influence of national and international trends on local economies within Kenya:

Instability from conflict: most recently in the form of terrorism by Al-Shabab and encroachment into agricultural land. There are enduring conflicts between pastoralists and farmers, as pastoralists move in search of water and pasture, placing additional pressure on the already limited land for development;

Rapid urbanisation: which will be exacerbated by LAPSSET employment speculation. This process of urbanisation, coupled with uncontrolled development and poor enforcement, is likely to add increased pressure on the use of land - including accelerated loss of farmland and pastures, inciting further conflict;

Pollution and depletion of rich natural resources in environmentally-sensitive areas: including significant depletion of wildlife and degradation of wetlands through physical alteration and pollution. Any new investment will need to be considered with regard to its potential consequences on the environment;

Inadequate infrastructure: limited or poor provision of road infrastructure, water supply, sanitation, drainage and solid waste facilities. The Municipality will need to upgrade infrastructure and commit to the implementation of low carbon, resilient, and inclusive infrastructure to support sustainable development;

Climate change and extreme weather events: including floods, drought, rainfall variability, rising temperatures and sea level rise. This will affect the productivity of key economic sectors, including agriculture and fishing, which in turn will have an impact on food security and the livelihoods of local communities; and

Lack of strategic vision for LAPSSET Lamu node: with the need for a detailed Municipality-level plan which outlines how projects will be integrated locally and influence population growth, as well as employment opportunities. This should contain plans to include local communities and SIGs in projects.



2.6.2. Drivers to growth

In addition to the outlined barriers for growth, the SWOT analysis process undertaken for the Diagnostics Report highlighted a number of recurring opportunities for economic growth in Lamu, predominantly due to its rich natural resource base and strategic location. These shared drivers for growth are summarised below:

Strategic location along the Kenyan coast: once being the most important trading centre in East Africa. While its role as a key commercial centre has diminished, its location has ensured that Lamu remains a strategic priority for the central Government, representing a key node within the LAPSET programme;

Rich natural resources: which greatly benefit the primary economic sectors, particularly the key sectors of agriculture, livestock, tourism and fishing. The potential to generate employment and wealth from these resources is yet to be fully exploited, for instance, through value-addition or infrastructure investment;

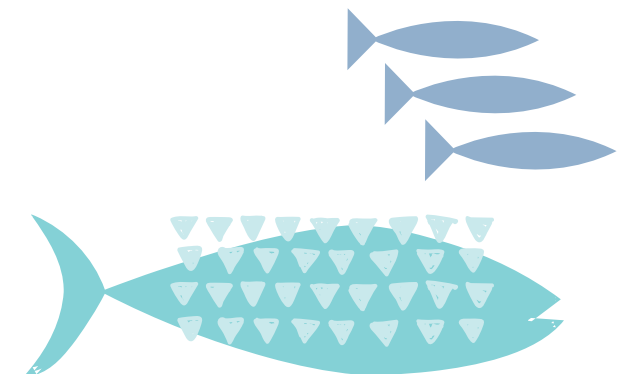
Endemic marine biodiversity: Including coral reefs, seagrass beds, lagoons and creeks, with potential for significant wealth creation in the fishing and marine sector. There is also a huge opportunity to diversify into the emerging Blue Economy sectors, such as eco-tourism, renewable energy and aquaculture;

LAPSET programme opportunities: Particularly for the diversification of Lamu's economy. The proposed infrastructure projects are expected to be key catalysts for development in the County, including investment in a new port, an SEZ and an international airport to transform Lamu into a gateway for Kenya;

A range of ecological zones that permit growth of a variety of crops: including high demand produce such as maize, bananas and cotton. The central Government has identified Lamu as a national growth area for agri-processing, with an aim to increase the contribution of agri-processing to GDP by 50%;

Tourism potential: predominantly due to the UNESCO World Heritage Site at Lamu Old Town and the diverse range of marine and terrestrial wildlife. This sector is expected to grow through future investments incorporated in the LAPSET programme, including the proposed development of a Resort City in Lamu; and

Blue Economy development: established on the Kenyan Government's pledge to leverage emerging opportunities in its 'Big Four' agenda sectors. The economy of Lamu will require diversification in the long term, and the emerging Blue Economy sectors represent a significant opportunity to do this. Kenya hosted the UN Sustainable Blue Economy Conference in 2018 which led to the production of the Sector Plan for Blue Economy as a programme to develop the Blue Economy in Kenya.





3. Development Framework

3.1 Introduction

The UEP development framework provides a spatial element and broad future direction for development which promotes sustainable and inclusive green growth whilst addressing current and potential future infrastructure gaps and constraints. This coherent and robust development framework reflects the aspirations of the Municipality and its stakeholders, and serves to integrate inclusive climate resilient infrastructure proposals and VC projects and thereby structure, prioritise, and phase economic and urban development across the Municipality. The VCs and infrastructure proposals will be sequenced based on optimising their individual and collective impacts whilst aiming to minimise costs and resource utilisation. Whilst each proposal may be implemented as a standalone project it is only through their effective linking and sequencing that they will create the largest impacts for future private and public investment potential.



Lamu has historically benefited from its strategic location along the Kenyan coast, once being the most important trading centre in East Africa. Despite its role as a key trading centre having diminished, its location has ensured that Lamu remains a strategic priority for the Kenyan government due to it sitting at the heart of the LAPSSET corridor programme where priority projects such as the Port and the SEZ are located. Additionally, Lamu Old Town is a UNESCO World Heritage Site, thanks to being the oldest and the best-preserved Swahili village in East Africa, which has ensured its role as a tourist attraction for visitors from across the world.

The development framework is also grounded on the main forward planning documents steering development across Lamu, which are the CIDP, CSP, Draft LIIUDP and the Draft IDeP. While some of these documents are yet to be legally adopted, it is important to note the UEP is aligned with the key priorities highlighted in these planning frameworks including fisheries, agriculture and tourism.

The urban economic development of Lamu is built upon the following main priorities:

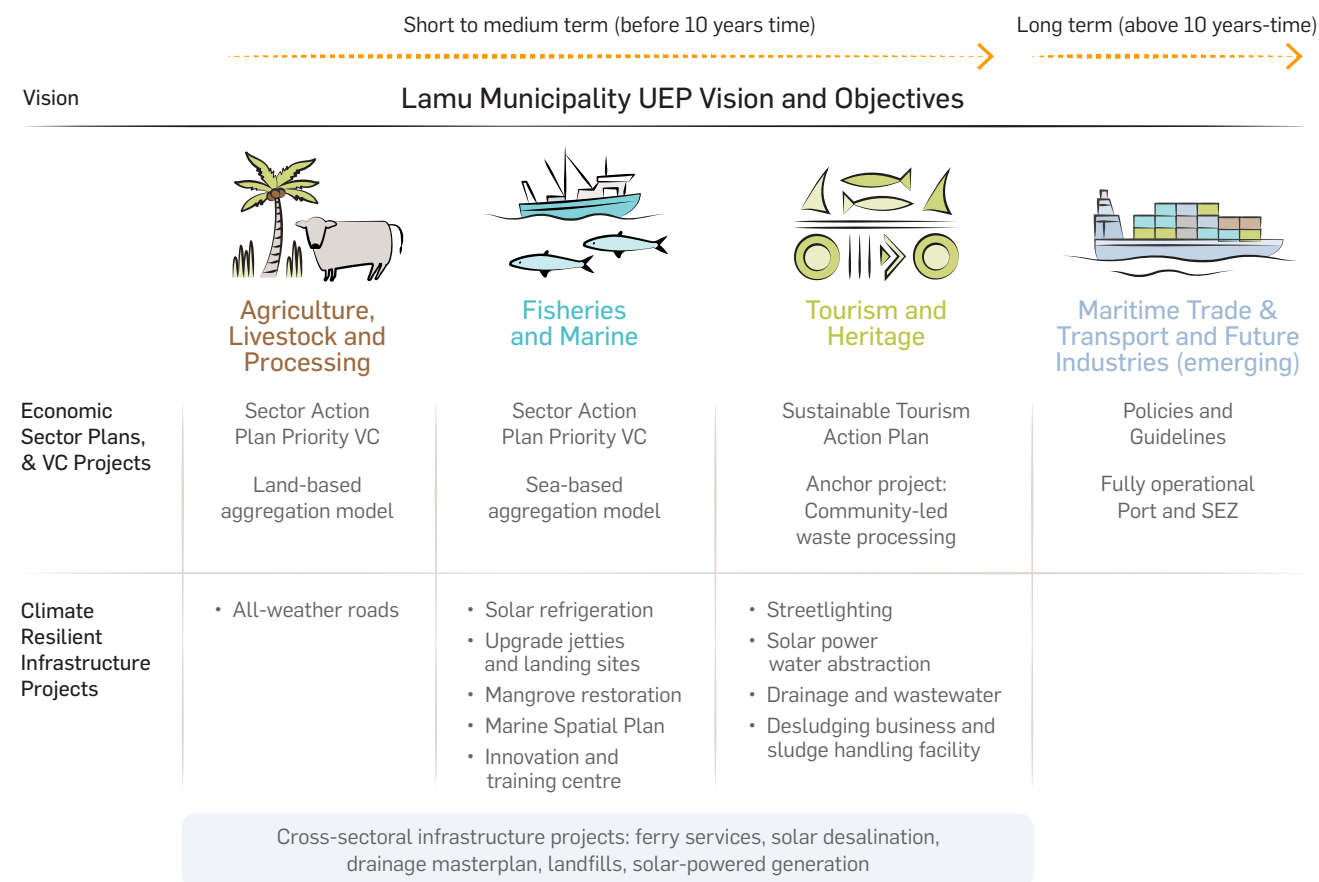
> **Blue Economy potential** - Lamu County is well-endowed with natural resources including sensitive terrestrial and marine ecosystems. The marine environment along the Lamu coast is rich in mangroves, seagrass beds, sandy beaches, coral reefs, fish and marine wildlife. These resources support important artisanal and commercial fisheries, as well as local livelihoods and the local tourism industry. The Blue Economy is essential to promote economic growth by positioning the economy beyond land-based economic activities, such as agriculture, while enhancing the protection and sustainability of the sensitive marine and terrestrial ecosystems around Lamu.

- > **LAPSSET potential** - the LAPSSET development is a nationally-significant economic programme under Vision 2030, including seven major infrastructure projects around Lamu node. The port has already started construction, with three berths completed (currently one operational) and therefore acting as a catalyst for further associated development at Lamu. The SEZ is intended to attract agri-processing and export-oriented manufacturing to leverage off the port activities. Other long-term projects include the oil pipeline, railway, highways, Lamu airport, a resort city, power generation and water supply. If well-managed, these flagship projects represent a significant opportunity to leverage support, contribute to the Blue Economy potential and generate a range of employment opportunities for the local population.
- > **Lamu Municipality Spatial Strategy** - the LM's spatial strategy to manage and guide urban and economic growth and development should be layered as follows:
 - i. First focus on ensuring that Lamu Island, including Lamu Town, is sustainable, self-sufficient, well managed and grounded on circular economy principles.
 - ii. The Municipality's future centre for urban growth should therefore be steered towards Mokowe premised by the potential employment generation opportunities from LAPSSET and the future relocation of the County Head Quarters. Development in Mokowe should be guided by the principles of compact eco cities where people have improved access to sustainable jobs, services, resilient infrastructure, housing and community facilities.
 - iii. Finally, improving connectivity within the rest of the County, particularly Pate and Manda islands, Mpeketoni and Witu are key to strengthening urban – rural linkages to foster economic growth.

Figure 3.1 outlines the development framework that integrates the Vision and objectives (section 3.2) with the key economic sector plans that are core to the Blue Economy development for Lamu (sections 4.2, 4.3, 4.4, 4.5 and 4.6)

which include the soft initiatives, the priority VCs and the infrastructure development interventions. This will enable climate resilient and socially inclusive economic growth across Lamu Municipality.

Figure 3.1 Overview of LM development framework



Source: Atkins

3.1 UEP Vision

The UEP sets out a Vision to guide the economic and urban development of the Municipality. A visioning exercise was undertaken at the TBP workshop. PSG members, MB members and wider stakeholders were asked to consider the key elements of the UEP vision, whereby proposed vision statements were submitted by 50 stakeholders. The team have analysed the responses to identify common objectives. The following key elements were mentioned and articulated for LM:

- > A clean, organised, community driven Municipality,
- > Sustain the coral reef and health of the environment,
- > A tourist hub,
- > A hub of industry and jobs, LAPSET to create jobs for the local community and improve livelihoods,
- > Community and private sector involvement,
- > A role model in offering high quality of life to its citizens,
- > Protect the culture,
- > Economically vibrant Municipality with a balance growth (development) and cultural heritage (conservation),
- > Well-connected towns with hinterland,
- > Improvement of infrastructure, and
- > Safe and peaceful Municipality.

The Vision statement that best represents the MB, PSG and wider stakeholder's aspirations is therefore stated below and adopted by the UEP:

“Lamu shall be a model Municipality fostering sustainable, inclusive and community driven economic transformation governed by Blue Economy principles, safeguarding its unique natural, cultural and heritage assets while improving local livelihoods.”



Lamu Economic Vision

3.2 Blue Economy potential

What is the Blue Economy?

"The Blue Economy concept seeks to promote economic growth, social inclusion, and the preservation or improvement of livelihoods while at the same time ensuring environmental sustainability of the oceans and coastal areas." (World Bank).

According to the Government of Kenya, Blue Economy refers to "the sustainable use and economic development of both aquatic and marine spaces including oceans, seas, coasts, lakes, rivers, wetlands, and underground water. It encompasses a range of productive sectors, including fishing, aquaculture, tourism, transport, shipbuilding, energy, bio-prospecting and underwater mining and related activities. Kenya is endowed with rich coastal and maritime resources, which have huge potential for development of the Blue Economy that has not been developed to full capacity"

The rationale to develop the Blue Economy in Lamu is twofold. Firstly, Kenya and Lamu in particular is rich in marine and coastal resources with the potential for utilization that can support economic growth, jobs, livelihoods, food and energy security. The national government has developed a Blue Economy Sector Plan (2018–2022) as part of the Vision 2030 and the 'Big Four Agenda' supporting the development of programmes and projects including the construction of fish ports and fish markets in Lamu, the Aquaculture Business Development Programme and the Kenya Marine Fisheries and Socio-Economic Development (KEMFSED) Programme. The CIDP and the CSP also recognise the Blue Economy potential. Secondly, if the utilization of these natural resources is done sustainably, their value can be maximised and sustained, not only for future generations but also the development of further activities in the future.

Lamu is one of the key locations in Kenya that could support the development of the Blue Economy because:

- > LC hosts the most extensive and species-rich area of mangroves in Kenya, which besides their importance for biodiversity, also provide climate protection through carbon sequestration from the atmosphere (also called 'blue carbon' when taken and stored in marine environments), and support nature-based tourism and coastal protection. Mangrove ecosystem services also include habitat functions such as breeding, spawning and nursery grounds for commercial fisheries; regulation of floods, storms and erosion; water purification and prevention of saltwater intrusion. However, mangrove coverage in Lamu is declining, mainly due to coastal deforestation and pollution from urbanisation and industrialisation. While clearance of mangroves for salt extraction and mariculture (particularly for prawn cultivation) is common in Ngomeni, in LC the main threat to mangroves is from dredging and construction.
- > The coastal areas in LC benefit from enhanced oceanic nutrient circulations that increase primary and secondary productivity supporting rich marine life which includes fish, crustaceans, sea turtles, molluscs, marine mammals, seabirds, as well as several key supporting marine and coastal habitats. This in turn supports the fisheries, aquaculture, mariculture and tourism sectors.
- > Coral reefs support both the artisanal and commercial fisheries and form the backbone of the coastal communities' economies. However, they also support the tourism industry, which employs numerous people throughout the supply chain, including boat operators, tour companies, tour guides and hoteliers in the hospitality sector. They also play an important role in the provision of coastal protection and can be a source of potential marine biotechnological resources to support cutting edge medical research.

- Seagrass, beaches, and an indented coastline with various islands within LC are also key resources to support the development of the Blue Economy.

Carbon capture/blue carbon: marine ecosystems around Lamu, such as mangroves and seagrass beds, contribute to climate stability by removing carbon from the atmosphere and storing it as organic carbon (blue carbon). Mangroves have a high CO₂ sequestration rate of approximately 603 tCO₂e/km²/year, and a substantial carbon stock, estimated at 104,710 tCO₂e/km²^{9,10}. Seagrass carbon sequestration rates are between 42 and 136 tCO₂e/km²/year. The carbon storage capacity of seagrass beds depends on the species, sediment type and water quality, but it is estimated that average stocks range from 36,264 to 51,889 tCO₂e/km²^{11,12}.

This carbon sequestration and storage potential can be used to attract private investment to fund mangrove or seagrass conservation initiatives through voluntary carbon markets where businesses fund the conservation projects that lead to carbon sequestration and in that way offset their own emissions. This is similar to the ecosystem service payment that national governments currently employ with other nations in order to protect areas of the rainforest in other parts of the world and offset their own GHG emissions. The IPCC has published guidelines for inclusion of seagrass and mangroves in national GHG inventories.

Unfortunately, the marine ecosystems and coastal resources in LC are under threat from unregulated development, pollution, soil erosion, overfishing, poor agricultural practices and ocean acidification. While the growth of tourism is encouraged to contribute to economic growth, rapid coastal development driven by a rebounding tourism market, particularly in the Manda and Lamu Islands, could result in the loss of these vital areas and increase levels of pollution, including wastewater

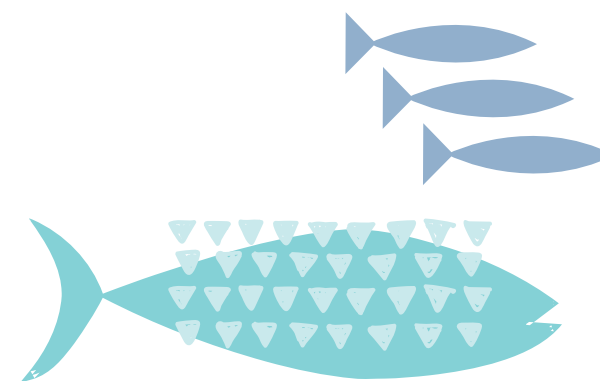
and litter. About 80% of marine litter is from land-based sources¹³, and there is a need to emphasize the need and importance of targeting land-based waste sources. The impact from discharging untreated wastewater into the sea, and the use of pesticides and fertilizers in agriculture can also be damaging to coastal habitats, that are critical for tourism and fisheries. An unregulated increase in boats and visitors to the coral reefs and mangroves could also result in long lasting damage to these valuable ecosystems.

Developing the fisheries sector by building a fish processing plant, could generate increased value to the existing catch, as well as much needed revenue and skilled jobs. However, if not planned and managed properly, for example against a sustainable fisheries management plan, the new processing plant could lead to increased pressure on fish stocks and an impact on non-target species from by-catch, as well as damage to the marine habitats from unsustainable practices and polluting discharges. By adopting a Blue Economy approach, good practices including management plans are critical to ensuring long term sustainability.

Illegal, unreported and unregulated (IUU) fishing is a cause for concern for the fisheries sector, mainly through larger vessels operating offshore, Kenya loses circa US\$ 100 million a year on IUU¹⁴. A market study for the fish processing plant is essential to determine what species, what product, what price, what volume, etc., is needed for it to be profitable, maximise value and to be sustainable. Similarly, the parallel development of aquaculture could generate income and material for the processing plant, but this also needs to be appropriately managed and developed against a market study. Fast offtake caused by high prices of aquaculture products could lead to rapid uncontrolled pollution. If aquaculture takes the form of excavated pond farming for example, this can rapidly lead to the destruction of key coastal habitats.

Because of these threats, it is necessary that economic growth in Lamu follows a Blue Economy approach. The Blue Economy seeks to promote economic growth and improve people's livelihoods while safeguarding a healthy marine environment and building resilience, so that it can sustain economic and social activities in the long term. The development of the Blue Economy shall consider employment opportunities for all, regardless of gender, age, ethnicity, religion, or abilities. For instance, women's groups are currently involved in mangrove restoration providing opportunities for social inclusion and economic empowerment, but it also highlights the importance of women as key agents in environment protection and climate change mitigation.

Further details on the Blue Economy development for LM are described in section 3.5.3, focusing on the key economic sector action plans which include soft initiatives and interventions, priority VCs and inclusive resilient infrastructure proposals.



9 Atwood, T et al. (2017). Country-level mangrove soil carbon stocks and losses. PANGAEA - Data Publisher for Earth & Environmental Science

10 Breithaupt, J., Smoak, J., Smith, T., Sanders, C. and Hoare, A. (2012), Organic carbon burial rates in mangrove sediments: Strengthening the global budget. *Global Biogeochemical Cycles*, 26(3).

11 Oreska, M., McGlathery, K., Aoki, L., Berger, A., Berg, P. and Mullins, L. (2020). The greenhouse gas offset potential from seagrass restoration. *Scientific Reports*, 10(1).

12 Greiner, J., McGlathery, K., Gunnell, J. and McKee, B. (2013). Seagrass Restoration Enhances "Blue Carbon" Sequestration in Coastal Waters. *PLoS ONE*, 8(8), p.e72469.

13 UN Habitat, Background Paper Blue Economy and Cities (2018), Available online at: <https://unhabitat.org/sites/default/files/2020/04/un-habitat-background-paper-on-blue-economy-and-cities.pdf> (Accessed: 06/11/2021)

14 Marete (2018) in Benkenstein, A. (2018). Prospects for the Kenyan Blue Economy. South African Institute of International Affairs.

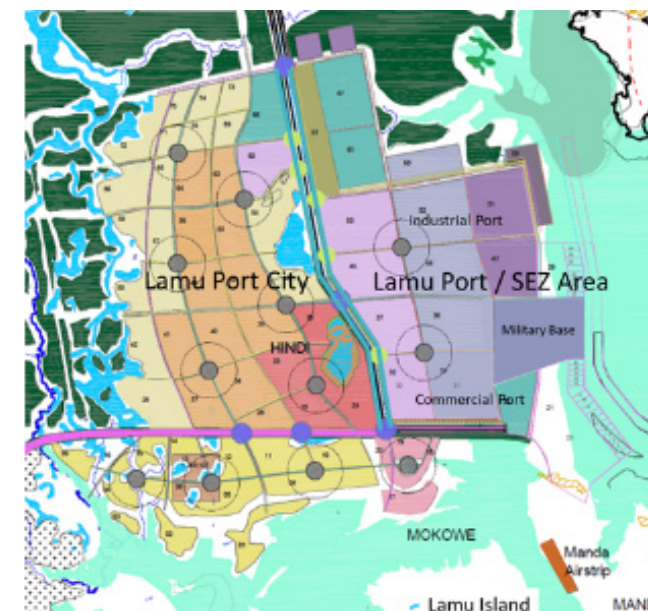


3.3 LAPSSET long-term potential to leverage from Blue Economy

The LAPSSET development corridor is a nationally-significant economic programme under Vision 2030. The LAPSSET programme consists of several mega- projects proposed at Lamu node: Lamu Port, oil refinery and pipeline, Special Economic Zone (SEZ), Resort City, highways, railway and power and water utilities projects. These projects aim to generate significant employment and commercial opportunities and transform the area into a major metropolis housing a substantial population. The LAPSSET programme could provide a transformational opportunity for Lamu and its residents, providing increased connectivity within the County, and stronger links within Kenya, East Africa and beyond.

The LAPSSET infrastructure projects in Lamu aim to boost economic development and leverage from the Blue Economy potential, however most of these are at pre-feasibility and feasibility stages. A phased development approach has been taken by LAPSSET to ensure the long-term transformation is successfully managed and delivered. This means the fully operational LAPSSET projects are expected in about 20 to 30 years' time. In the meantime, some projects have progressed or will kick off during the UEP timeline which are detailed right.

Figure 3.2 Current proposed land use master plan and transport network for the Lamu Port/SEZ and City complex



Source: LAPSSET Corridor Development Authority, Integrated Transport Infrastructure Master Plan for Lamu Port City (2018).

Lamu Commercial Port in Manda Bay has started operation with three berths completed out of the planned 24. The port is expected to handle 13.5 million tonnes by 2030 and about 24 million tonnes of cargo by 2050¹⁵. The first three berths were constructed in collaboration with Chinese partners while other berths (up to 21 more) are intended to be constructed and operated by the private sector. The development of Lamu Port will allow for relief of the congested Port of Mombasa by providing deeper berthing channels and longer berths, and provide the opportunity to develop adjacent export-oriented manufacturing and agri-processing industries, amongst others, or those that make use of global value chains, within the Industrial Port zone.

Figure 3.3 - Ongoing construction of Lamu Port



Source: Atkins site visit

The combined areas of the Commercial Port and the Industrial Port will incorporate the Special Economic Zone (SEZ) as part of the overall Lamu Port area. The Lamu Port area/SEZ is projected to expand and create a mixed-use industrial area ranging from logistics and light industries to medium and heavy industries which will provide land and infrastructure required to support agri-processing and manufacturing operations as well as logistics and service-related activities. The SEZ will provide an environment that attracts investment and adds value to the agricultural, livestock and fishing products supplied by the local communities.

This will capitalise on and help drive the Blue Economy potential of the area. Over 80% of traded international goods are transported by sea and this is expected to double by 2030 and quadruple by 2050 due to much of the food produce and items being traded through ports and rivers¹⁶. This presents an invaluable opportunity for Lamu to be a place where products are farmed, processed and manufactured to supply a major hub for export and import, and in doing so it will re-position itself once again at the heart of the East African trading centres and routes.

To support this economic transformation, the right infrastructure and investments are needed to enable the key economic sectors to thrive as well as to meet the needs generated by increased local demand from new industries, businesses and residents. The development of the Lamu node at LAPSET is also anticipated to generate a population of up to one million inhabitants and create up to 425,000 jobs when the area reaches the completion of the full development phase¹⁷ which is clearly a significant level of development from its current semi-rural state to that of a metropolis. The water, sanitation and power utilities as well as improving transport connectivity will be a priority to enable industrial, commercial and city development to successfully take place, whilst supporting the growing local community.

Moreover, the development of such a large port and industrial area could result in environmental degradation from pollution, change in land utilisation patterns, increased demand for natural resources, and effects to the unique and sensitive ecosystems of Lamu. The potential social and environmental impacts from future industries, businesses and urbanisation need to be appropriately managed to ensure long-term social, environmental and financial sustainability through stronger EIA regulations, detailed land use master plans, resettlement action plans and compensation schemes, and a strong corporate social responsibility policy.

Adopting a Blue Economy approach to LAPSET development around the Lamu node that is beyond 'business as usual' will not only create significant job opportunities but will also safeguard key natural assets, including marine ecosystems, coastal resources and other ecologically sensitive areas.

¹⁵ Lamu County, Planning report for the Part Development Plan of the proposed LAPSET Project Component Sites (2015).

¹⁶ UN Habitat, Background Report Blue Economy and Cities (2018).

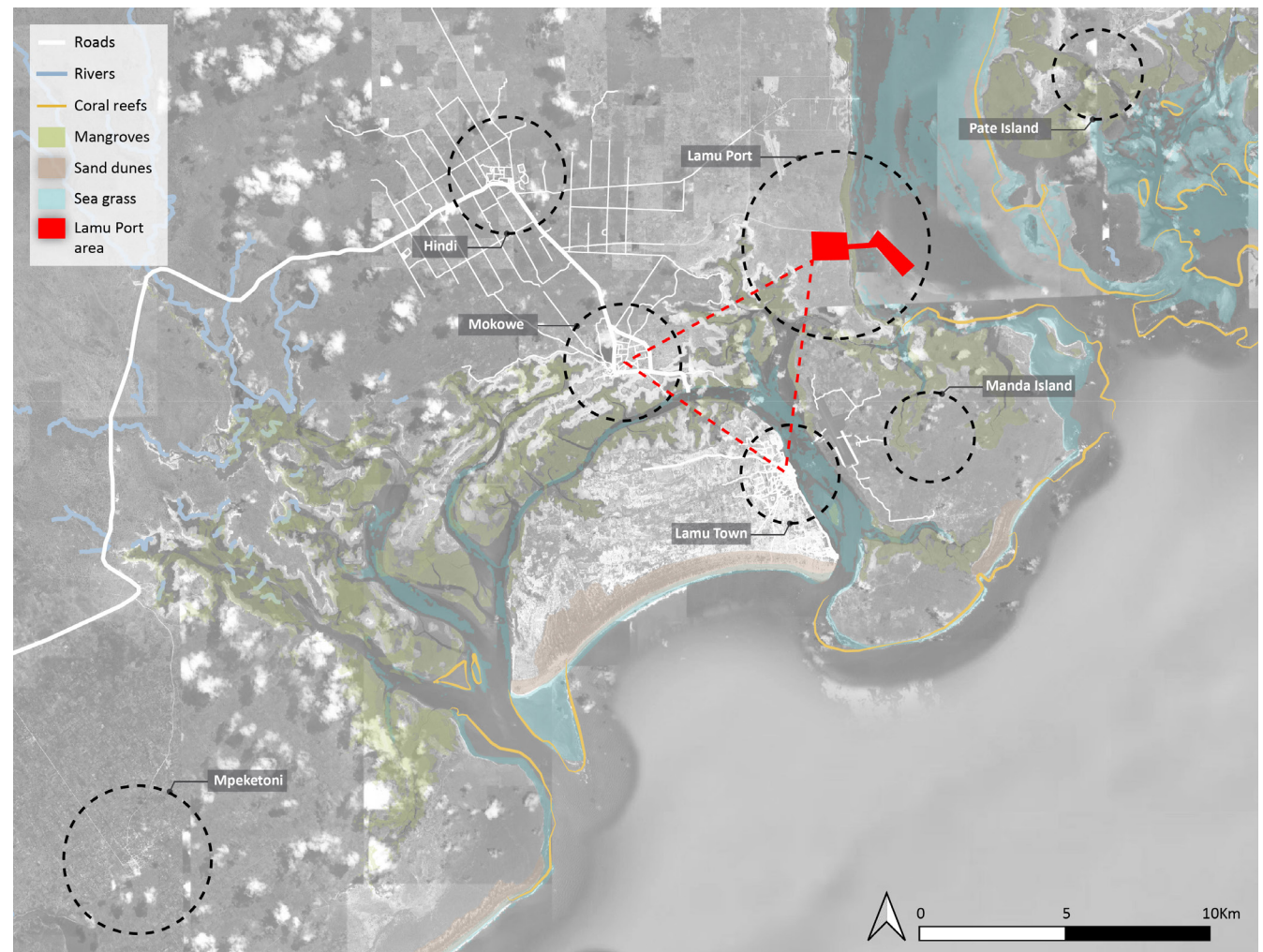
¹⁷ Atkins Acuity, Lamu Port City Agreed Investment Framework (2017).

3.4 Spatial strategy to economic development

Adequate planning for coastal urban centres which are cognisant of, and reflect, the Blue Economy principles is critical to ensuring the preservation of Lamu's unique ecosystems, its important cultural and heritage assets, and the development of socio-economic blue and green opportunities. Spatial planning is key to responding to climate change risks and must guide the investment in resilient and inclusive infrastructure across the Municipality whilst directing urbanisation around Mokowe, thereby protecting the Lamu Old Town UNESCO World Heritage site and islands complex, and capitalising on the growth around the LAPSET node.

Taking into consideration the planning framework suggested and described in more detail in the Diagnostic Report (Appendix A), the core spatial area to be considered by the UEP will be the 'triangle' between Lamu Town, Lamu Port Area and Mokowe while ensuring other key urban centres such as Hindi and Mpeketoni, along with Pate and Manda Islands are well connected to support sustainable urban development across the entire Municipality. This strategy is shown in Figure 3.4.

Figure 3.4 Spatial strategy to economic development



Source: Atkins analysis

This strategy allows for the continued and effective planning, development and growth of the Municipality in preparation of the future development of the LAPSET node and metropolis. The "key" to this strategy is that meaningful, resilient and responsive urban and economic development can and should continue with, or without, the full implementation of the LAPSET node and metropolis.

Lamu Island will be the tourism and heritage hub where key infrastructure interventions will support the retention of the UNESCO World Heritage Site award, improve the citizens quality of life and attract and create more tourism opportunities. The current challenges and issues facing Lamu Island, which have been well documented within this report and the Diagnostics Report, need to be addressed and mitigated before any further development is permitted. The proposals within this UEP, both hard infrastructure interventions and softer initiatives to make the Island more attractive and operate at a more enlightened level, are aimed to achieve this goal.

Thus, future urban growth should be steered towards Mokowe as the future County Head Quarters, as well as the preferred location for the VCs (described in section 3.5.3), in order to leverage from the potential future growth of LAPSET and the need to manage growth on Lamu Island. Mokowe currently plays a key role as a trading hub with goods from the rest of the country passing through the town for distribution across the islands. However, this will need to be supported by the additional and adequate provision of climate resilient utilities, services and social infrastructure to attract and benefit the future growing population.

Mpeketoni is a market town within the high potential agricultural zone, which has attracted many people to settle in the town over the last decade due to its strategic location. It therefore has a significant role to play within the agricultural produce and supply chain elements of the key economic sector of agriculture, livestock and processing. Pate and Siyu Islands are tourism centres with rich historical and cultural environments, where their communities have retained their

traditions, attracting domestic and international tourists. They have the potential to sensitively expand on this offering and become more engaged in the mainstream tourism circuit within Lamu. Outside of the Municipality boundary is the town of Witu, which is also an important agricultural centre located near the Tana River basin and close to the Mombasa-Lamu highway. Witu is projected to grow significantly over the next ten to 15 years (CIDP) and as such will be an important agricultural hub and logistics centre that will also enjoy the potential benefits from the developments not only in the LAPSET node but also across the Municipality.

The UEP will therefore aim to enhance urban-rural linkages between the core triangle and these urban and island centres, and will join forces to ensure a more integrated, greener and inclusive development across the Municipality and County, with better connectivity as well as helping to balance development between the key urban centres rather than competing for investment and resources. Agriculture and fisheries collection networks with logistics and aggregation hubs located across the urban centres are proposed in order to support the development and growth of these localities across the County and strengthen the urban-rural linkages to enable sustainable and resilient economic growth and job opportunities.

Therefore, the three main elements of this spatial strategy to foster sustainable urban economic development in Lamu Municipality are listed below and described in more detail in the following sections:

- > Sustainable urban and infrastructure interventions, along with managed growth on Lamu Island to become a model of self-sufficiency, circular economy and sustainable tourism;
- > Steer future growth towards Mokowe as the current trading hub with the rest of the country, the future County HQ, the strategic location in proximity to Hindi and LAPSET node and the preferred location to host the proposed VCs; and
- > Sea-based and land-based aggregation models to support economic growth, through improved connectivity, and strengthened urban-rural linkages.



Managed growth of Lamu Island

Lamu Town and Lamu Island currently serve as the administrative centre, commercial centre, and tourism and cultural hub. There are other important settlements within the island including Matondoni, Wiyoni and Kipungani, these are mainly small villages; Shela, to the south-west of the island, is a renowned hospitality hotspot. See Figure 3 5. Manda, Pate and Siyu Islands also are tourism centres with rich historical and cultural environments, where their communities have retained their traditions, attracting domestic and international tourists as well as locals. Crafts and vernacular costumes are still produced here and are one of the main attractions for visitors. The urban development strategy for Lamu Island will be grounded in 'managed growth' and the principles of self-sufficiency and sustainability, adopting a circular economy approach enabled by the Blue Economy sectors highlighted in section 3.5.3. The urban development interventions should address key challenges in Lamu Town, the largest town in the County, as well as to improve the quality of life of residents, allowing for natural growth in a controlled manner and ensure the town is resilient to future climate change. These priorities include:

- > Retaining and protecting the UNESCO World Heritage Site award;
- > Tackling the sanitation issues caused by poor solid waste management practices, lack of sewerage treatment and, open stormwater drainage and its disposal in to the ocean without any previous treatment;
- > Ensuring the resilience of Lamu Old Town to flood shocks;
- > Decongesting and rationalising the town's movement systems, including for example the segregation of sea front jetties for passengers and cargo;
- > Create a diversified and low impact and less intense tourism offering; and,
- > Addressing the connectivity and affordability issues to associated with transport is critical. Lamu Island will need to be well-connected, via seaway transport / ferry services, with the rest of the islands and the mainland.

Case Study 3.1 - Stone Town of Zanzibar, Tanzania UNESCO World Heritage Site^{18,19}

The Zanzibar World Heritage Site was at risk of being added to the Word Heritage Sites 'in danger' list due to lack of maintenance, non-functioning management systems, a lack of effective control of development proposals, and poor management of stakeholders involved in the management and conservation of the property. In 2013, the issues were addressed through a multi-level development and heritage base plan, which aimed to create a balance between urban development and heritage conservation.

The project created a community engagement dialogue between citizens' concerns with the benefits of a culture-led strategy. Key outcomes achieved include:

- > The Zanzibar City Centre Local Area Plan, which promotes a people-centred public transport system by prioritising pedestrian streets and improving commercial and public areas.
- > The Historic Urban Landscape Atlas of Ng'ambo, a publication which compiles the rich history and heritage of the Ng'ambo area by promoting its image and enhancing its heritage values.

In terms of waste management, the 2019 mission report by the World Heritage Committee acknowledged that the Zanzibar Urban Municipal Council (ZUMC) started to address the problem of solid waste management and is investigating in improving the sewerage system of the Stone Town, including addressing the current problem of sewerage discharge directly into the ocean.

It was also noted that the State Party had procured funding and that the ZUMC had appointed a consultant to design a new separated storm water and sewerage system. These were perceived as positive steps towards improving the living environments and public health in the property, but it was noted that the design would require careful consideration before implementation and subsequent monitoring.



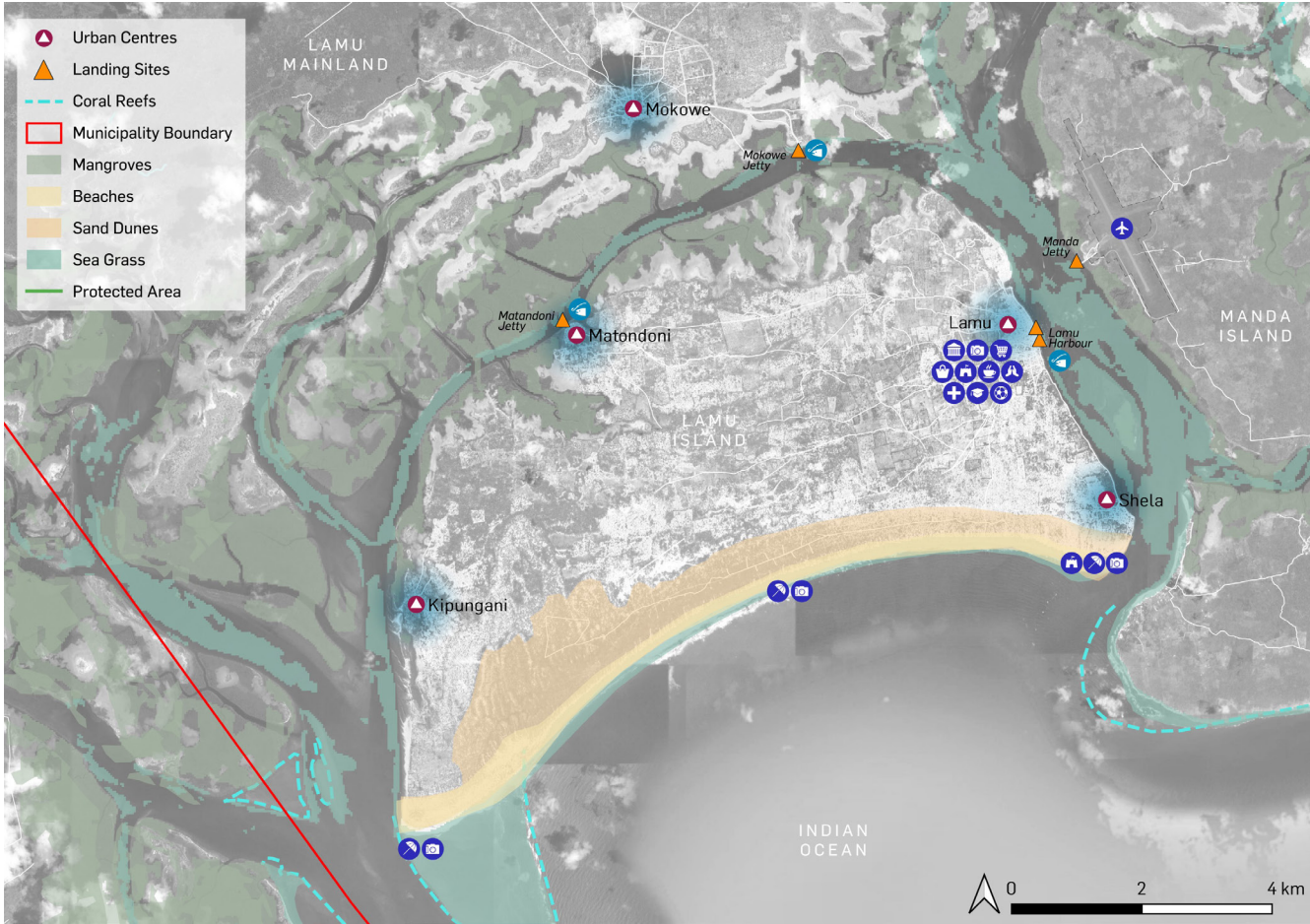
¹⁸ UNESCO World Heritage Centre, Stone Town of Zanzibar (2021). Available at: <https://whc.unesco.org/en/list/173>. (Accessed: 16/12/2021).

¹⁹ UNESCO World Heritage Centre, Bridging a spatial and social divide through inclusive planning in Zanzibar Town (2021). Available at: <https://whc.unesco.org/en/canopy/zanzibar/>. (Accessed: 16/12/2021).

It is important that any interventions and projects implemented are carefully designed and managed in order to avoid any negative impacts on the environment and the local community such as the unrestrained movement of tourists. Good design parameters developed in collaboration with local residents should ensure an authentic experience for visitors

while protecting culture, heritage and local livelihoods. Each of these projects are funded on safeguarding the existing community and local resources and, aim to enable the creation of economic opportunities in line with the wider tourism development trends. These projects are further developed in section 4.4.

Figure 3.5 Lamu Island - key places



Source: Atkins

Future growth towards Mokowe

The spatial strategy focuses future urban growth stimulated by the LAPSET programme (primarily industrial, logistic and trade) around Mokowe whilst less intense growth and more sensitive transformations are considered for the islands. The latter is clearly aimed at restoring and safeguarding the delicate balance between economic development, nature and heritage.

Future growth should therefore be focused around Mokowe by enabling and attracting economic growth and infrastructure investment and leverage off the town's proximity in providing the key link to Lamu Town and the Islands and having close connectivity with the future fully-operational LAPSET node.

It is also essential to strengthen road and sea links with surrounding agricultural areas and centres such as Mpeketoni, and Witu further south, as well as fishing activities and landing sites elsewhere on the islands and along the coast. The two proposed aggregation models will support the development and use of these linkages (further described in sections 3.5.3, 4.2.3, 4.3.3).

According to the Lamu Investment Framework for the LAPSET corridor programme²⁰, the development of the Lamu node is anticipated to generate a population of approximately 1.1 million when complete in 2040, whilst creating up to 425,000 jobs. It is also anticipated that a large proportion of the future population will be migrants, attracted by the employment opportunities and facilities that LAPSET is expected to deliver.

LAPSET development will have significant impacts on the existing and future local population. This future urban growth will need to be properly managed and accommodated on the mainland, as only a very limited amount of growth will be possible on Lamu Island and the other islands.

²⁰ Atkins Acuity, Lamu Port City Agreed Investment Framework (2017).



Hindi has been identified as the future epicentre of the Lamu Port City metropolis, however in the interim period prior to the development of the LAPSSET node, it is critical that economic and development opportunities are created for the local population. It is for this reason that Mokowe is considered the preferred location for initial investment and enabling infrastructure interventions, such as the location for the initial cluster of VC projects to be developed out of the UEP and

SUED Programme. The development of Mokowe should be founded on the compact eco-cities principles where people live closer to work and services, and on-site infrastructure, utilities, building and social facilities are resilient, inclusive and green. Below is a series of eco-city development principles and key considerations which should be applied to the development of Mokowe:

Figure 3.6 Eco-cities principles



Source: Atkins analysis

Climate resilience and passive design principles

- > Responding to the capacity of natural systems;
- > Promote the design of passive buildings to reduce electrical cooling, heating, ventilation and lighting while guaranteeing comfortable conditions for all users;
- > Integrate greening and landscape as a key element to help improving the air condition and pollution.

Low carbon or carbon neutral principles

- > To use locally sourced and sustainable construction materials;
- > To reduce carbon footprint.

Shared utilities and logistics site

- > The clustering of business and industries within a designated site promotes the shared use of facilities such as warehouses and logistics, training and meeting facilities, and parking areas. This allows the industrial site to benefit from economies of scale and achieve efficient infrastructure services and economic gains by reducing overhead costs; and
- > To foster the implementation of smart technologies to achieve a good and efficient management of the shared facilities, such as providing sustainable public transport for employees.

Circular economy and zero-waste

- > Rethink the waste management system to turn plastic waste into resources, taking inspiration from the ground breaking local initiative, the Flipflop Project;
- > To minimize the generation of waste by reorganizing industries in a way that one could use the waste from another, as an input into a process or as a source of energy;
- > Accommodate remanufacture, restore, or repair shops to prevent or reduce waste and support a circular economy; and
- > Ensuring resources are used efficiently.

Water management

- > To promote sustainable urban water cycles by implementing rainwater collection, storm water retention and harvesting techniques and wastewater recycling;
- > To promote the efficient use of water resources and ensure good water quality while protecting environmental assets.

Sustainable transport

- > To design an urban layout which optimises the network infrastructure, reducing vehicle movements while promoting walking and cycling and the use of electric vehicles within Mokowe;
- > To encourage sharing facilities resulting in a reduction of private car usage (also supporting the circular economy); and
- > To promote the use of smart technologies to digitise transport infrastructure allowing the exchange of information in between vehicles, drivers, passengers and transfer hubs. An example of these are streetlights capable of monitoring parking spaces as well as traffic patterns.

Local and inclusive community employment to enhance the social performance by:

- > Creating local jobs, and providing better working and labour conditions;
- > Following social performance standards in relation to social inclusion, gender equality, and community dialogue;
- > Providing social infrastructure to workers and community; and
- > Improving occupational health and safety.

Urban form

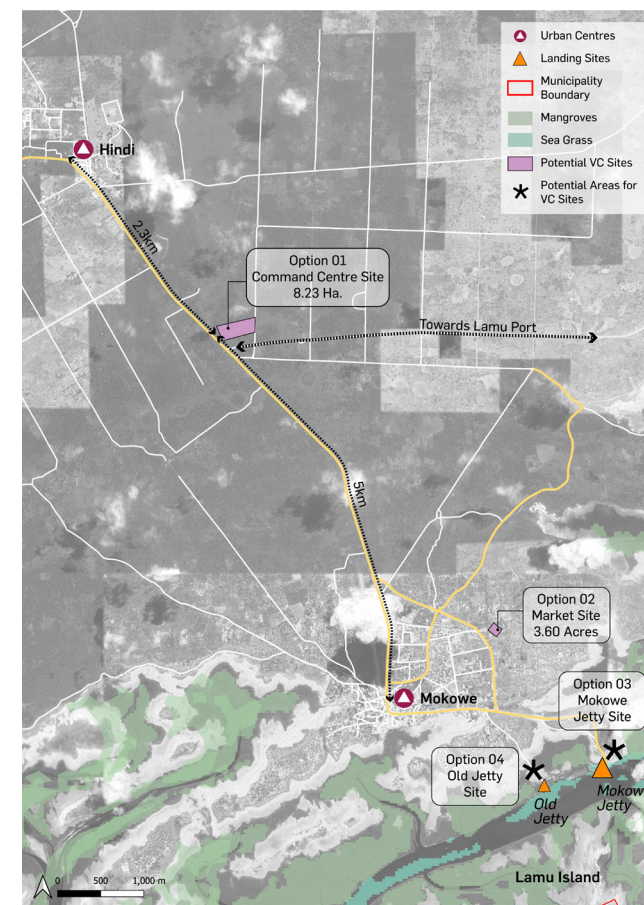
- > Developing accessible neighbourhoods with a choice of public transport;
- > The urban design needs to focus on improving the public space network with a streetscape which promotes healthy and active lifestyles where residents and workers are encouraged to walk rather than travel by car;
- > Developing a community that incorporates a mix of jobs and facilities; and
- > Incorporating green infrastructure.

Mokowe to host the VCs

In line with the eco-city principles and given Mokowe's strategic location, as described above, it is considered the most appropriate venue to locate the proposed agricultural and fish processing VCs and related activities.

Four potential sites have been selected for the processing activities as shown in Figure 3 7. Two options for the fish processing located near to the existing and old Mokowe jetty; and the coconut processing plant located within the preferred County Command Centre Site or the proposed Market Site in Mokowe itself. All these sites are under consideration and being assessed for utilities and developability including land ownership.

Figure 3.7 Potential sites to locate VCs



Source: Atkins analysis

Fish processing site

For the fishing plant VC, the suggested location (Option 03) is near the existing operational Mokowe jetty, see Figure 3.8 for potential examples of the site's development. Reasons for this location are;

- > Easy to unload boat and transfer fish catch to processing plant;
- > Dedicated services jetty for the processing plant so as not to mix uses and activities;
- > Land available for expansion; and
- > Easily accessible by a short link road to allow for fish products to be transported by road.

This Option 03 site is privately owned and will require purchase by either the processing plant operator or developer, or alternatively by the County or Municipality for leasing to the operator or developer.

Should the purchase of the Option 03 site not be possible then a second potential site for the fish processing plant, Option 04, has been identified adjacent to the old Mokowe jetty. Land ownership is currently being investigated by the Municipality to ascertain its suitability for development, however the same locational advantages can be attributed to this area as it has direct water access, a road access to the C112, and room for potential expansion.

It is noted that should the development of the two above options not be possible due to land ownership issues then the preferred alternative site for the fish processing plant is Option 01 at the County Command Centre Site.

Figure 3.8 Examples of potential fishing plant adjacent to jetty



Source: Atkins

Coconut processing site

For the coconut processing VC and other agri-processing VCs, two locations have been identified on public land. Key considerations for the location of this and other VCs, which can be co-located, are;

- > Minimal disturbance and impacts on the town / main urban centre;
- > Easily accessible and connected with main roads, particularly to the hinterland and LAPSET Port; and
- > Priority Coconut VC requires about 4,000 m².

Option 01 – the County Command Centre Site is 22 acres in extent and adjacent to C112, 3.4km from Mokowe and 2 km from Hindi and it is close to a new access road to Lamu Port. The site is big enough to allow for future expansion if needed to co-locate other VCs, including the fish processing plant, which will allow for economy of scale. The Municipality has confirmed that both power and water are available to the site.

Option 02 – the town's Market Site of 3.5 acres, is less suitable as it is small considering the current land requirements for the coconut processing plant and water treatment plant, with no room for other VCs. Additionally, the land around the site is privately-owned and unlikely to become available if future expansion is required.

The finalisation of the potential sites will be undertaken in conjunction with the Municipality during the next month or so, and as part of the pre-feasibility stages of the VC assessments.

Aggregation models to enable economic growth and strengthen resilience

Aggregation can provide a holistic approach to overcoming supply chain challenges and also serve as a key pillar of integrated economic development, but it requires smarter ways of producing food and distributing it across the entire VC ecosystem. Aggregation can improve and stabilise farmer incomes and strengthen the resilience of food production, and provide farmers with essential access to information and

resources, including knowledge tools to build capacity, plus, storage solutions and better market access and prices.

Aggregation of smallholder farmers into groups will bring together isolated, fragmented small-scale farmers to create viable economies of scale capable of servicing large-scale buyers that provide guaranteed markets and predictable payment. This includes interlinked activities involved with the production, handling, processing, distribution, consumption, and disposal of food products, as well as tackling existing gaps to ensure they continue to work together effectively and in an integrated manner. Storage solutions, such as solar-powered cold storage hubs can extend the shelf life of perishable food and reduce post-harvest losses, allowing small-scale farmers to increase their quality of produce, sale volumes and income.

Guaranteed markets also serve as an incentive for smallholders to invest in improving their methods of productivity and in meeting the standards and requirements of modern markets, and ultimately enhance their competitiveness. This, in turn, generates better farmer incomes and the ability to save and invest more and lift farmers out of the cycle of poverty. From a buyer's perspective, aggregation enables the cost-effective provision of logistical capacity to collate the output of many farmers scattered in remote rural areas and build the capacity of those farmers to meet required volumes and quality. These elements work to create a sustainable, resilient, and productive supply chain.

The two aggregation models proposed are a land-based model to support agricultural, livestock and processing sector and a sea-based model to support fisheries and marine. These models are detailed in sections 4.2.3 and 4.3.3.

The phasing of developing infrastructure to enable the aggregation model is elaborated under the climate resilient infrastructure projects including solar refrigeration cold storage (project 3), upgrading of landing sites and jetties (project 4), and the upgrading of access roads to all-weather standards (project 1).

4. Economic Development Plan

This section sets out the Economic Development Plan for Lamu Municipality by setting out specific development interventions for Lamu's key economic sectors of Agriculture, livestock and processing; Fisheries and marine; Tourism and heritage and an emerging sector of Maritime trade, transport and future industries. The section is structured around the key economic sectors action plans formulated for each core sector that include soft initiatives, interventions and infrastructure proposals as well as the priority VC projects to catalyse development.

4.1 Overview

Crucially, the Economic Sector Action Plans are designed to align with, and support, the development of the Blue Economy. The Blue Economy is essential to promoting sustainable economic growth within LM, by advancing the economy beyond land-based economic activities such as agriculture, while enhancing the protection of the sensitive marine and terrestrial ecosystems and protecting the unique cultural and heritage assets to improve tourism. The Action Plans are established on the SWOT analysis undertaken at the Diagnostics Report stage (Appendix A), summaries of the SWOTs are presented below for each sector. These Action Plans have also been informed through the SUED business consultation exercise (section 1.3), workshops with local stakeholders and data analyses.

- > **Agriculture, livestock and processing;**
- > **Fisheries and marine; and**
- > **Tourism and heritage**

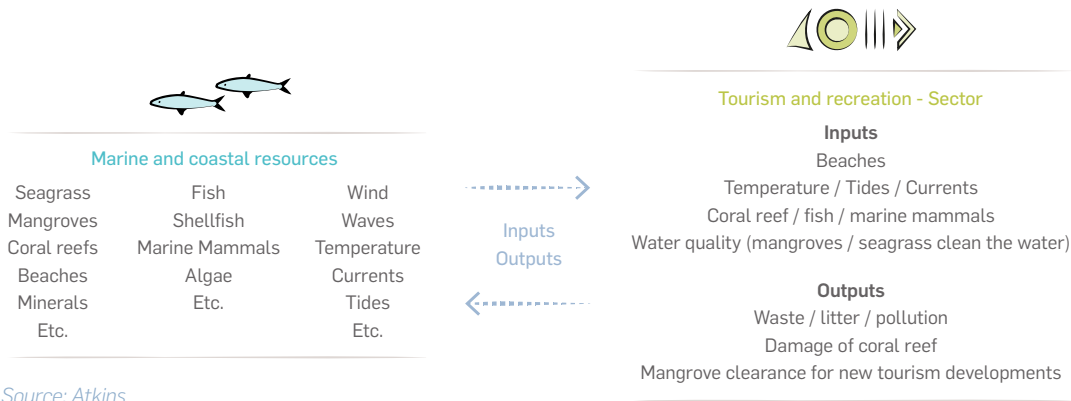


In addition, several key policies and guidelines have been identified for the sustainable development of the emerging sector of maritime trade, transport and future industries on the back of LAPSET future potential as described in section 3.4.

The sectoral plans for LM must be integrated and reflect co-dependent interventions. As for every growing economy, these sectors are strongly interrelated, and development cannot be thought of in silos. Instead, the Action Plans are designed to be developed in synergy, meaning that some interventions are likely to be cross-sectoral. For example, agriculture by-products (e.g., coconut fibres / husks / meat) can be used in fisheries for building fish aggregation devices, or in aquaculture as feed or as construction material. In turn, dry seaweed and other products resulting from aquaculture could be used as potential natural fertilizer or animal feeds in agriculture.

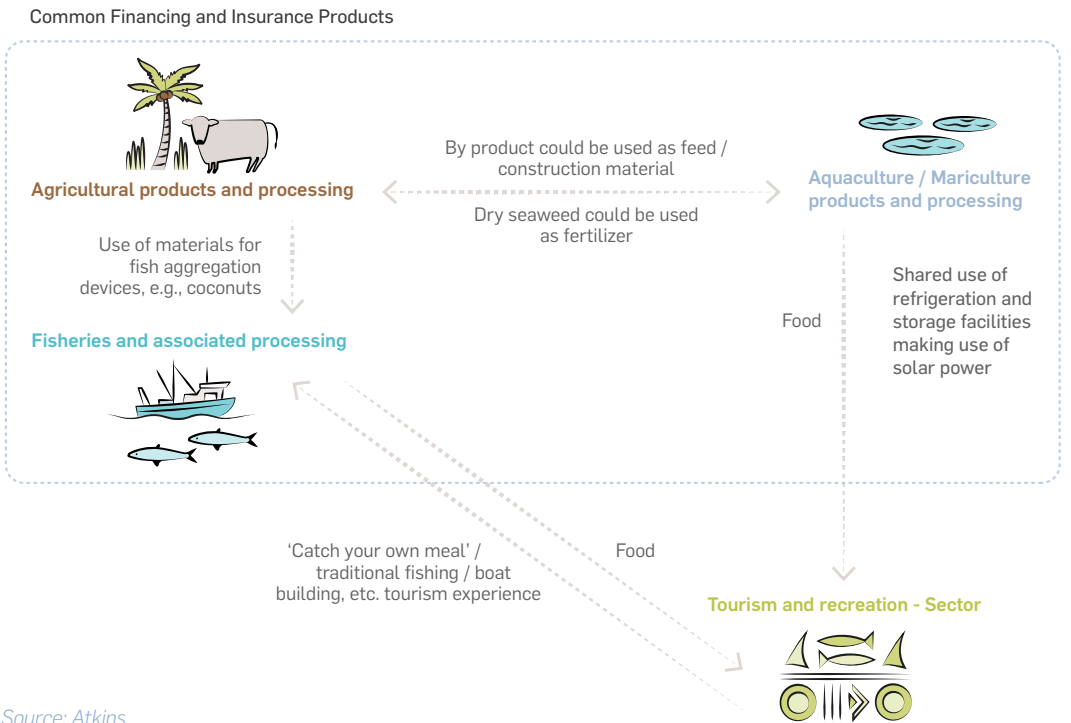
The fisheries and agriculture sector, besides producing food for the tourism industry, could develop additional links with the sector, such as offering 'traditional fishing excursions', 'traditional agriculture lifestyle experience' or 'catch your own meal' experiences. Aquaculture and mariculture could benefit from shared storage and solar-powered refrigeration facilities with fisheries, aquaculture, mariculture and agriculture, as well as common financing and insurance products. Finally, waste products from fish processing can also be used in a number of potential ways, including in the generation of power through biomass plants. Figure 4.1 outlines examples of the interactions between marine and coastal capital with the tourism sector, while Figure 4.2 presents examples of the links and synergies between economic sectors.

Figure 4.1 Example of interactions between marine / coastal capital and the tourism sector



Source: Atkins

Figure 4.2 Example of links and synergies between economic sectors



Source: Atkins

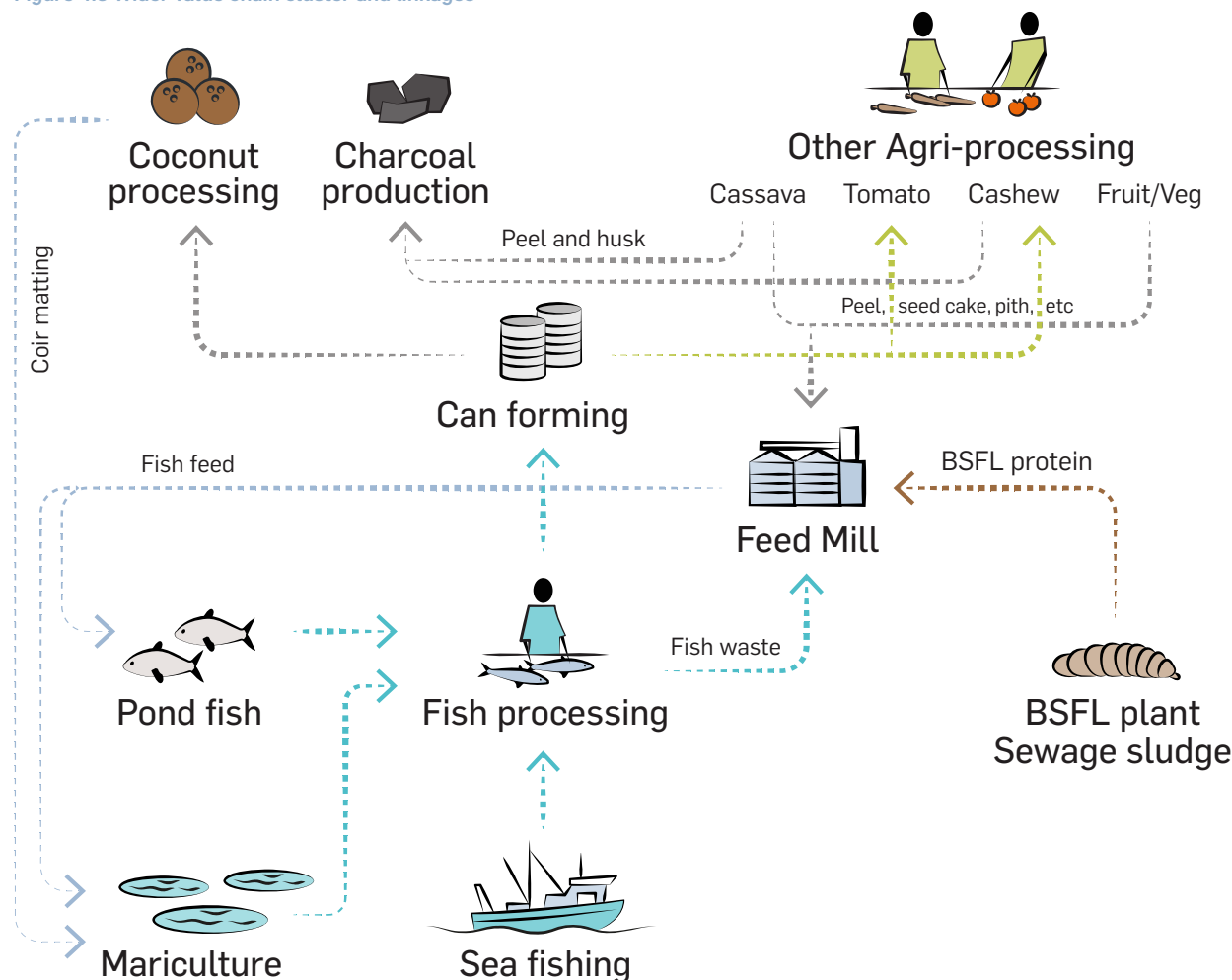
The Technical Briefing Paper (Appendix B) includes an assessment of shortlisted VC opportunities and linkages between these VCs. Across the shortlisted VCs there is substantial potential for developing linkages to support the ecosystems for the VCs that could share resources as described below. Maximising these potential linkages will not only improve the overall economics of the VCs and the Blue Economy in Lamu, but also promote circular economy principles to support resource efficiency and sustainability:

- > Use of by-products suitable for animal feed production or charcoal;
- > Shared processing such as including metal can production and wastewater processing; and
- > Joint collection of produce from farming areas and dispatch of products.

The Sector Action Plans consist of a mix of soft interventions such as education and training, changes to systems such as skills development, technology availability and smaller infrastructure recommendations, such as local or household water capturing. The larger, strategic urban development and infrastructure proposals identified for the Lamu Municipal area are contained in section 4.6. The Sector Action Plans should be regarded as a strategic sequence of events, with the soft interventions intended to maximise the potential of the sector to benefit from those strategic urban development and infrastructure proposals, and the VC opportunities of coconut processing (section 4.2.4) and fish processing (section 4.3.4) presented as pilot schemes to drive development of the sectors within the County.

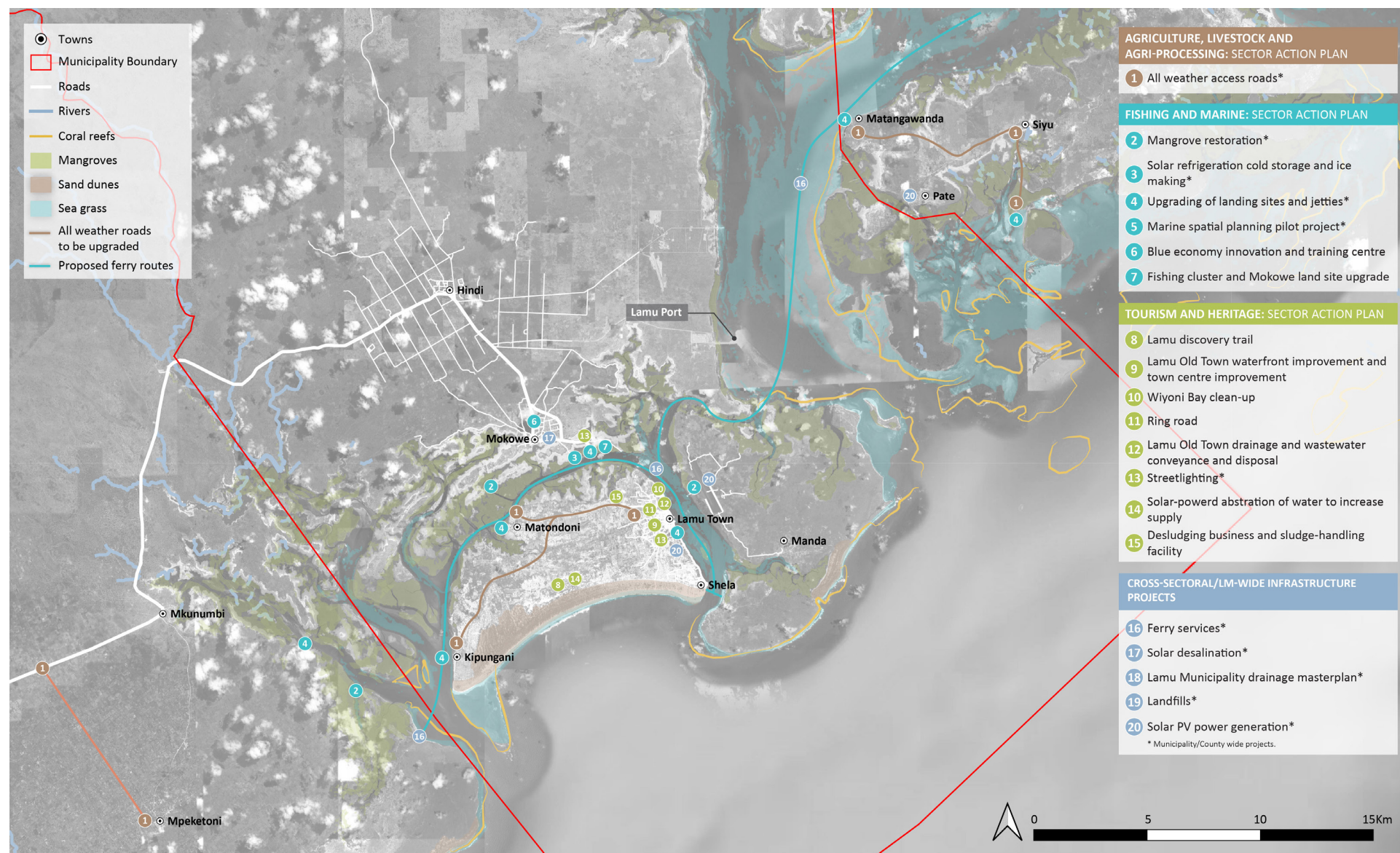
Ultimately the aim of these plans is to provide clear actions for the development of the sectors in their own right, whilst also as supporting ecosystems for the selected VCs, and to identify appropriate climate-resilient and inclusive infrastructure proposals to support growth. The Economic Sector Action Plans, including the shortlisted VCs, will also consider aspects related to sustainability, climate resilience, social inclusion and the circular economy. These Economic Sector Action Plans are detailed in the following sections.

Figure 4.3 Wider value chain cluster and linkages



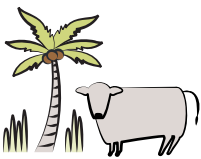
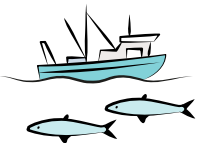
Source: Atkins

Figure 4.4 Climate resilient infrastructure projects map



Source: Atkins analysis

Table 4.1 Blue Economy Sector Action Plans overview

Economic sector	Economic ambitions	Actions	
 <p>Agriculture, Livestock and Agri-Processing</p>	<p>Improved sector resilience towards climate change</p> <p>Inclusion of SIGs, particularly youth, women and PWD</p> <p>Enhanced value addition and commercialisation of agricultural and livestock produce</p>	<p>4.2.1 Soft initiatives, training and capacity-building</p> <p>A1: Organise farmers into cooperatives to share resources and improve access to finance</p> <p>A2: Create practical and business training programmes for farmers, pastoralists and agro-pastoralists</p> <p>A3: Introduce technology and management practices to improve resilience and productivity</p> <p>A4: Establish reliable water sources for farmers and pastoralists</p> <p>A5: Reduce produce waste and post-harvest losses</p> <p>A6: Encourage mutually beneficial contract farming to maintain supply to the agri-processing sector</p>	<p>4.2.2 Climate resilient infrastructure projects</p> <p>Project 1: All weather access roads</p> <p>4.2.3 Aggregation model</p> <p>Land-based aggregation model for agricultural produce</p> <p>4.2.4 Value Chain opportunity</p> <p>Coconut processing VC to catalyse development</p>
 <p>Fishing and Marine</p>	<p>Protect and maximise benefits from Lamu's marine resources</p> <p>Enhanced sector resilience towards climate change</p> <p>Inclusion of SIGs, particularly youth, women and PWD</p>	<p>4.3.1 Soft initiatives, training and capacity building</p> <p>A7: Preparation of an Integrated Water Quality Protection Plan</p> <p>A8: Undertake training and establish ongoing fish stock assessment to form development of a Sustainable Fisheries Management Plan</p> <p>A9: Enhance regulation, enforcement and monitoring of the fishing sector</p> <p>A10: Grow the number and capacity of fishing cooperatives</p> <p>A11: Improve access to modern fishing equipment/infrastructure</p> <p>A12: Undertake a market study and increase the marketing of fish and other products accordingly</p> <p>A13: Feasibility study for establishment of integrated aquaculture / mariculture systems to take pressure off nearshore fisheries and to increase food security</p>	<p>A14: Investigate opportunities for synergies with other Blue Economy Sectors</p> <p>A15: Undertake natural capital valuation to determine value of ecosystems and associated services in order to support future development and management decisions</p> <p>4.3.2 Climate resilient infrastructure projects</p> <p>Project 2: Mangrove restoration</p> <p>Project 3: Solar refrigeration cold storage and ice making</p> <p>Project 4: Upgrading of landing sites and jetties</p> <p>Project 5: Marine Spatial Planning Pilot Project</p> <p>Project 6: Establish Blue Economy Innovation Centre</p> <p>4.3.3 Aggregation model</p> <p>Sea-based aggregation model for fishing-related produce</p> <p>4.3.4 Value Chain opportunity</p> <p>Fish processing VC to catalyse development</p> <p>Project 7: Fishing cluster and Mokowe landing site upgrade</p>

Economic sector

Economic ambitions

Actions



Tourism and Heritage

Developing Lamu's tourism offer and enhancing community involvement in the sector

Beautification and decongestion of the Municipality

Climate-resilient infrastructure to support sector development

4.4.1 Developing Lamu's tourism offer

Project 8: Lamu Discovery Trail

A17: Develop and promote the hospitality sector in Lamu

A18: Introduce and enhance community-led initiatives

A19: Establish an inclusive Lamu Tourism Board

4.4.2 Beautification and decongestion

A20: Develop Swahili heritage guidance

Project 9: Lamu waterfront and town centre improvement

Project 10: Wiyoni Bay Clean-up

Project 11: Lamu ring road

4.4.3 Climate-resilient infrastructure

Project 12: Lamu Old Town drainage and wastewater

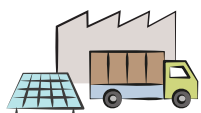
Project 13: Streetlighting

Project 14: Solar-powered water abstraction

Project 15: Desludging business and sludge-handling facility

4.4.4 Value Chain opportunity

Waste collection and processing



Cross-Sector

Climate resilient infrastructure projects

Project 16: Ferry service

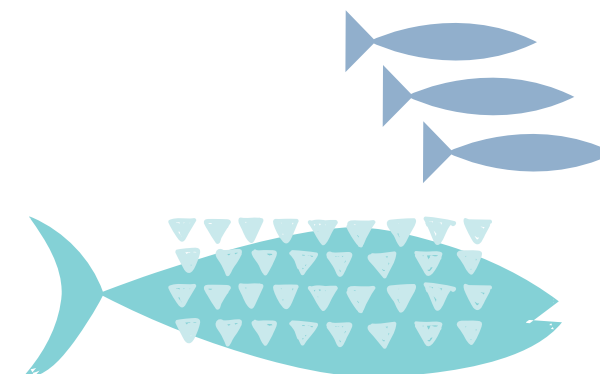
Project 17: Solar desalination

Project 18: LM drainage masterplan

Project 19: Landfills

Project 20: Solar PV power generation

Source: Atkins analysis



4.2 Agriculture, Livestock and Agri-Processing Sector Action Plan

The agriculture and livestock sector is one of Kenya's 'Big Four' sectoral priorities, with a crucial role in the Vision 2030 development programme, accounting for approximately 51% of national GCP and 56% of employment²¹. Similarly, agriculture and livestock represent a vital foundation of Lamu's economy, contributing the highest proportion of employment in the wider County. Lamu has a strong level of agricultural productivity, with an agricultural GCP per capita of KES 129,926, considerably above the national average of KES 68,070²².

Lamu County has a significant amount of land available for agriculture and livestock production. The main crops grown within the County include maize, bananas, cassava and cotton; whilst livestock rearing focuses on cattle, sheep, goats, donkeys and poultry. A key weakness of the sector is the lack of commercialisation and value addition to Lamu's various agricultural and livestock products, with most products being sold in their raw form within the County.

Lamu County benefits from a diverse selection of agro-ecological zones, ranging from the coastal lowland to the ranching zones. This generally benefits areas for livestock in the north/north east and also allows for a variety of crops to be grown in the south/south west. However, the sector has witnessed the effects of climate variability and climate change, with a combination of heavy rains and drought resulting in low-yielding crops and a scarcity of animal fodder, and these impacts are likely to increasingly threaten productivity in future. As such, the UEP provides an opportunity to develop climate-resilient value chains and support farmers in adapting to changing conditions, while enhancing Lamu's already strong agricultural position.

From the Diagnostic Report analysis, the following key strengths, weaknesses, opportunities and threats were established. These were used to determine the actions proposed in the following section.

Table 4.2 Agriculture, Livestock and Agri-Processing SWOT

Strengths	Weaknesses
Diverse range of agro-ecological zones for agriculture and livestock production	Limited value-addition and commercialisation of products, with the majority sold in raw form
Wide array of high-potential crops, including cotton, cereals/grains, fruits and vegetables	Lack of appropriate modern technologies and machinery, including crop/livestock varieties
Significant increases in the majority of crop production volumes over the last ten years	Inadequate skills and knowledge (e.g. soil management, post-harvesting technique)
Some increasing involvement of SIGs within the sector, such as youths	Considerable post-harvest losses, due to a lack of cold storage and processing facilities
Opportunities	Threats
The Agricultural Sector Transformation and Growth Strategy (ASTGS) identifies Lamu as a national growth area, building on its strategic location for exports and crop variety	Climate change: increasing floods, droughts, unpredictable rainfall, temperature fluctuations, new and intensifying pests and diseases
Promotion of drought resistant crops and animal breeds that consume less fodder	Rapid urbanisation, exacerbated by population increases due to LAPSET, will place increasing pressure on land available for agriculture and exacerbate existing conflicts
LAPSET development will connect Lamu to national and international export markets	Increasing conflicts over land, with farmers from other counties seeking land in Lamu, particularly during drought seasons
Coconut processing facility could absorb demand from nearby counties, i.e. farmers in Kwale sell to processors in Tanzania	
Links with tourism - move tourists away from sensitive coastal areas whilst providing additional sources of revenue to farmers, for example provision of 'eco-experiences' more traditional living experiences	

Source: Atkins analysis

²¹ World Bank, Kenya Economic Update, Edition n.19, (2019).

²² KNBS, GCP Report, (2019).

The Sector Action Plan, outlined in Table 4.3, should be viewed as a practical sequence of actions to support the development of the agriculture, livestock and agri-processing sector, taking account of the Municipality's existing strengths and weaknesses. The Plan commences with the soft initiatives, training and capacity-building interventions (section 4.2.1) recommended to best position Lamu's agricultural and pastoralist communities to benefit from the inclusive and climate resilient infrastructure proposals (section 4.2.2) and the land-based aggregation model (section 4.2.3), which are proposed to enable agricultural development and sector growth across LC. The VC opportunity of coconut processing is presented as a potential pilot scheme for the sector to catalyse development (section 4.2.4). The individual actions are presented in detail at each stage, including several best practice case studies to exemplify how these schemes can be implemented effectively within Lamu.

In addition to the infrastructure projects presented in this Action Plan, a series of cross-sectoral interventions are outlined in section 4.6, with the potential for specific benefits for the agriculture, livestock and agri-processing sector.

Table 4.3 Agriculture, Livestock and Agri-Processing Action Plan

Economic ambitions	Actions
Improved sector resilience towards climate change	<p>4.2.1. Soft initiatives, training and capacity-building</p> <p>A1: Organise farmers into cooperatives to share resources and improve access to finance</p> <p>A2: Create practical and business training programmes for farmers, pastoralists and agro-pastoralists</p> <p>A3: Introduce technology and management practices to improve resilience and productivity</p> <p>A4: Establish reliable water sources for farmers and pastoralists</p> <p>A5: Reduce produce waste and post-harvest losses</p> <p>A6: Encourage mutually beneficial contract farming to maintain supply to the agri-processing sector</p>
Inclusion of SIGs, particularly youth, women and PWD	<p>4.2.2. Climate resilient infrastructure projects</p> <p>Project 1: All weather access roads</p>
Enhanced value addition and commercialisation of agricultural and livestock produce	<p>4.2.3. Aggregation model</p> <p>Land-based aggregation model for agricultural produce</p>
	<p>4.2.4. Value Chain opportunity</p> <p>Coconut processing VC to catalyse development</p>

Source: Atkins analysis

4.2.1 Soft Initiatives, Training and Capacity Building

This section outlines the soft initiatives, training and capacity building interventions proposed to enhance the productivity and resilience of the sector, improve inclusion of excluded groups and increase the value-addition and commercialisation of produce. Ultimately, the aim of these initiatives is to position the sector so that it can maximise the potential benefits of the recommended climate resilient infrastructure projects (section 4.2.2), the aggregation model (section 4.2.3), and the identified VC opportunity of coconut processing (section 4.2.4). While not a definitive roadmap, the initiatives are presented in a logical sequence for implementation, starting with actions that can be introduced immediately and following through to longer-term interventions.

A1: Organise farmers into cooperatives to share resources and improve access to finance

Several farmers in Lamu emphasised a lack of access to modern technology, information and other agricultural inputs that are integral to improving their farming practices, resulting in yields below their true potential. This was particularly relevant for small-scale farmers and livestock keepers, who typically rely on traditional manual techniques or borrowing equipment from neighbours. The initial step to address this issue should be to encourage small-scale farmers to join existing cooperatives or form new groups. Primarily, this will enable farmers to share resources and services, which will reduce the upfront capital costs for members, while also encouraging collaboration and knowledge sharing²³. This sharing of resources represents a crucial element of the circular economy, ensuring maximum utilisation of a single resource. Various infrastructure, resources and services could be shared:

²³ FAO, Mobilizing Capital in Agricultural Service Cooperatives (1997).

- > **Equipment and infrastructure** – including cold storage, farming tools and delivery vehicles. Several emerging digital technology platforms could be utilised to support this process. For instance, the Hello Tractor platform, which has a growing foothold in Kenya, connects small-scale farmers to tractor owners to temporarily hire otherwise idle vehicles. The result is convenient and affordable tractor services for farmers and an extra source of income for tractor owners²⁴.
- > **Resources and services** – including the supply of agricultural inputs and delivery services, as well as the sharing of best practices and marketing strategies, such as price determination and branding. Farmers can also benefit from economies of scale, with respect to the transportation of produce to markets and agri-processing facilities.

Crucially, organising farmers into cooperatives provides a platform for enhanced access to finance, including through table banking and Village Savings and Lending Associations (VSLAs). This is particularly important for marginalised groups such as women, youth and PWDs, who can benefit from improved access to market information and finance. A VSLA, often referred to as 'chamas', is a group of individuals (between 20 and 30) who come together with the aim of making savings and taking small loans from those savings. After a certain period, the accumulated savings and the loan profits are distributed back to members. This provides opportunities for farmers who would otherwise have no access to conventional banking services that require collateral for credit accessibility.

Several NGOs across Kenya have recognised the value of VSLAs in providing poor communities with a secure place to save, as well as the opportunity to borrow on flexible terms and access affordable basic insurance. As such, several organisations are now supporting VSLAs by equipping members with the skills required to operate their groups effectively (see case study), with the potential for existing local cooperatives like the Lamu Women's SACCO to collaborate with such groups in future.

To improve social inclusion within the sector, it will be critical for cooperatives to promote collaboration among SIGs and provide information on available funds, such as the Uwezo Fund, the Women Enterprise Fund and the Youth Enterprise Development Fund²⁵. Based on the GeSI findings, it is also recommended to incorporate funding options that require alternative forms of collateral or are Sharia-compliant. Cooperatives can also be organised to engage excluded groups in agricultural development activities and decision-making processes²⁶. This has been exemplified by existing community-based organisations in Lamu aimed at adequate representation in decision-making, such as Lamu Youth Alliance and Lamu Women's SACCO, who could play a key role in supporting further community development.

Case Study 4.1 - Joyful Women Organisation (JOYWO), Kenya

Founded in 2009, JOYWO is a registered NGO with the mandate to promote the economic empowerment of women in Kenya and beyond through financial inclusion, collective agency, voice and influence. At present, the organisation includes a membership of over 100,000 women across all 47 counties, each situated within a local cooperative or savings group.

The NGO's flagship project has been the provision of financial resources to women to engage in livelihood projects by facilitating and promoting table banking. Through this model, a group meets once a month and members save money, take loans from the contributions made and make repayments for loans taken. In order to be a member, the group must have between 10 and 20 participants, with at least 70% being women who are engaged in income generating activities.

JOYWO aims to strengthen and develop the skills of its member groups to adapt and thrive in the changing world, this includes periodical training on table banking, business and entrepreneurial skills, modern agricultural methods and access to government procurement opportunities, as well as developing linkages with financial institutions.

24 The Borgen Project, Bringing African Farmers into the Digital Revolution (2019) Available at: <https://borgenproject.org/tag/hello-tractor/> (Accessed: 28/10/2021).

25 Chamasoft, Table Banking: The Concept of Table Banking (2015) Available at: <https://blog.chamasoft.com/table-banking-the-concept-of-table-banking/> (Accessed: 28/10/2021).

26 Sifa, C.B., Role of Cooperatives in Agricultural Development and Food Security in Africa (2014) Available at: Role of cooperatives in agriculture in Africa (un.org) (Accessed: 28/10/2021).

A2: Create practical and business training programmes for farmers, pastoralists and agro-pastoralists

Poor farming and harvesting practices, as well as traditional livestock management practices, were noted as a significant issue for the agriculture and livestock sector in Lamu.

There are currently limited training centres across the County, with the majority of training taking place at Lake Kenyatta Agricultural Training Centre (ATC) in Mpeketoni. As a result, there is scope to develop training centres in other areas of LC, for instance in Witu or Mokowe, which could be operated by the cooperatives outlined in Action A1.

Creation of integrated and well-planned training programmes for farmers and pastoralists should consider the following topics as a minimum:

- > Information on maximising productivity and resource efficiency. This could include encouraging farmers to carry out soil testing to identify optimal fertilisers, as well as training on effective implementation of livestock management. It is also important for farmers to understand the benefits and costs associated with agricultural inputs and how to optimise them;
- > Climate-smart techniques that will allow farmers and pastoralists to be prepared for more variable weather events. For instance, working with the Kenya Climate Smart Programme on approaches such as water harvesting to improve water availability and increase resilience. Training on how to access and interpret weather and climate information will help in adapting to climate change;
- > Increasing understanding around which crop and livestock varieties have the optimal output and are the most resilient, in preparation for the introduction of such crops in Action A3;
- > Methods for protecting crops and livestock against pests and disease, including benefits and negatives of using pesticides and best practice; and

- > Provide support for, and accessible information about, acquiring business certificates and other necessary documentation for trading of produce, as well as business management activities like marketing, accounting and supply chain management. This should include advice on how farmers can best position themselves for long-term contract farming, in line with Action A6.

Given that remote farming communities and SIGs can have difficulties attending training centres due to transport costs, mobility restrictions, or time availability, training centres should consider visiting local communities. This should involve specific training programmes for Lamu's agro-pastoralists, tailored to be culturally appropriate and relevant for their practices. Consider female or young trainers to improve the outcomes of these trainings with SIGs. Farms could also be utilised as test beds for agricultural students, with improved yields demonstrated in participating farms when students collaborate with farmers.

Due to social norms, discrimination or reduced participation in cooperatives, SIGs often lack access to information about training or extension services. To promote social inclusion, it is recommended that a cohort of young people are trained as peer educators, as individuals will be more likely to engage in training if developed by peers. Training a youth cohort could also represent an opportunity for additional income. This system could also be implemented with other SIGs. In addition, the location, timing and length of trainings should be compatible with women's care and community responsibilities to encourage their participation. A clear, well-designed communication strategy in a format and language accessible to all should be implemented to inform communities about training opportunities and the associated benefits in terms of increased production and revenues.

Case study 4.2 - Agro-Pastoral Field School (APFS), Mandera²⁷

In the County of Mandera, hands-on learning methods for producing, managing and utilising fodder are taught through an APFS – a “school without walls”, where groups of 20 to 30 agro-pastoralists engage in experiential and participatory learning sessions. A total of 10 APFS groups have been formed across five project sites. The activities are part of a partnership programme on drought resilience between FAO and the Intergovernmental Authority on Development (IGAD), implemented since 2016 together with the Agency for Technical Cooperation and Development (ACTED) in Kenya, the Mandera County Government, and funded by the Swiss Agency for Development and Cooperation (SDC).

Men, women and youth all take part equally during APFS learning sessions. Shanqaray Hassan Mohamed, Vice Chair of one of the Garissa APFS groups in Mandera, said this has helped overcome traditional barriers: “Women and youth have benefited from experimenting as well as from the learning process as a whole, since initially they were not part of decision-making in the community. With the APFS, women are able to produce, store and sell hay bales and are therefore no longer dependent on men for most of their upkeep. We have successfully replicated fodder production at our farms, improving our output and enhancing our living standards.”

²⁷ FAO, Combatting Drought in Kenya through Agro-Pastoralist Field Schools (2018), Available at: <https://www.fao.org/emergencies/fao-in-action/stories/stories-detail/en/c/1170759/> (Accessed: 26/10/2021).

A3: Introduce technology and management practices to improve resilience and productivity

LC has a significant amount of agricultural land available for production. However, productivity has been restricted by low adoption of the appropriate technologies, such as high-yielding crop varieties, while a lack of modern machinery means farmers are unable to cultivate large areas. Furthermore, the costs of inputs and productive resources, such as irrigation, are too high for farmers. Similarly, livestock production has been described as traditional in Lamu, facing inadequate livestock infrastructure and modern technologies to improve productivity. Consequently, there is a need for improved access to technologies and infrastructure that could improve the resilience and productivity of the sector.

In addition, current agricultural and livestock management practices continue to threaten Lamu's already fragile marine and terrestrial ecosystems. For instance, one major issue highlighted in the diagnostics phase was the unsustainable use of pesticides, with discharge from pesticides polluting the marine ecosystem through run-off. If not addressed, these land-based pollutants could contribute to ocean 'dead zones' – areas which can no longer sustain life because they have low or zero oxygen²⁸. In order to combat such challenges, there needs to be a push for the introduction of modern, sustainable management practices across the agriculture, livestock and agri-processing sector. These actions must be integrated in line with the proposed Integrated Water Quality Protection Plan (Action A7) to ensure the negative impacts on Lamu's valuable marine resources are minimised.

Once Lamu's farmers and pastoralists have been organised into well-functioning cooperatives (Action A1) and provided with training to maximise productivity and resilience (Action A2), the next step should be to look towards the introduction and promotion of modern technology and management practices for the sector, these include:

- > Crop varieties that are more resilient to climatic shocks and insufficient soil moisture. For instance, promotion of drought resistant crops such as simsim, coconuts (as in the prioritised VC) and cashew nuts will decrease the vulnerability of the sector. These crops are already fairly widespread within LC, with the potential for increased uptake. This should include intercropping to produce a greater yield on a given piece of land;
- > Better practices for livestock management, including fodder production and conservation for drought periods, and the selection of more resilient breeds. This includes the Fleckvieh breed of cattle that was recently introduced in Kenya, plus enhanced feeding;
- > Rangeland reseeding accompanied by reduction, or temporary exclusion of livestock numbers as appropriate to rehabilitate overgrazed rangelands;
- > Development of cold and dry storage facilities (see section 4.2.3), which is particularly important as more extreme weather events are likely to increase post-harvest losses;
- > Introduction of green houses, allowing farmers to diversify production and increase resilience to climatic shocks. Green houses provide better performance in terms of water and nutrient management, and protection against pests and disease;
- > Support and development of micro AD technology at farms, which can generate gas and fertiliser from animal and human waste. This could include the introduction of simple and affordable systems like rubber-balloon biogas plants²⁹. The produced gas can be recovered and used directly for cooking and lighting, while the nutrient-rich sludge can be used as a fertiliser. Further information on appropriate AD technology can be found in section 4.4.4;
- > Drip irrigation that can offer significant increases in water use efficiency compared with surface water; and
- > Renewable energy options, such as solar energy at farm level to support small-scale activities, as described in section 4.6.1.4.

A viable solution for improving access to modern equipment and infrastructure is the availability of communal resources, for instance through the cooperatives outlined in Action A1, which farmers can book to use. These groups should be encouraged to jointly invest in such equipment, thus reducing the upfront capital cost for the individuals and encouraging collaboration. This would increase sector efficiency, maximise productivity and boost incomes for farmers. This will particularly benefit SIGs, smallholder farmers and pastoralists, and vulnerable groups who are disproportionately affected by the impacts of climate change. Nevertheless, it will be crucial to prioritise culturally appropriate and affordable options, or to provide financial and technical support to these groups. The incorporation of climate-smart technologies can also represent new employment opportunities for SIGs.

A4: Establish reliable water sources for farmers and pastoralists

Changing weather patterns, particularly due to climate change, increasingly threaten the productivity of the agriculture and livestock sector in Lamu and the wider region. A combination of heavy rains and drought have resulted in a scarcity of animal fodder and low-yielding crops in recent years, with farmers reporting the drying up of wells which used to provide water all year round and well water becoming more saline and unusable. The Climate Change Vulnerability Assessment study (Appendix D) demonstrates that this situation is likely to worsen over time.

In line with the Blue Economy principles, Lamu needs to develop a holistic water management strategy, which considers climate change risks, the impact of sector activities on water quantity and quality, and the sector's requirements, and aligns these with the Municipality's water needs. This would look to integrate the water and wastewater projects (section 4.4.3) and further inclusive, household-level interventions such as:

28 The Commonwealth, Marine Pollution (2021) Available at: <https://thecommonwealth.org/marine-pollution> (Accessed: 27/11/2021)

29 Tilley, E., Ulrich, L., Luethi, C., Raymond, P. and Zurbrugg, C. (2014) Compendium of Sanitation Systems and Technologies. Dübendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology

- > Sustainably-planned community boreholes. These can be implemented quickly, considering groundwater availability. Boreholes will enhance the ability to irrigate crops and provide drinking water to livestock in rural areas currently not served by the domestic water supply system;
- > Repair and expansion of existing small-scale water pans;
- > Expand use of soil conservation techniques. The Livelihoods Fund focuses on land restoration to increase food security and preserve water resources³⁰. Soil moisture can also be preserved by promoting the use of organic manure that improves water retention capacity;
- > Insurance for farmers who take up solar-power irrigation systems (SPIS). For instance, the Counties of Turkana and Isiolo encourage the uptake of financial and insurance facilities for purchase of SPIS³¹; and
- > Through Action A2, appropriate training and guidance should also be offered to farmers and agro-pastoralists on utilising irrigation and crop management techniques to improve yields.

Such interventions should be promoted through the farmer groups and cooperatives outlined in Action 1 to encourage social inclusion. This should be accompanied by initiatives such as changing farmer groups and associations' membership requirements, and developing awareness sessions to promote SIGs' participation in decision-making processes and enhancing their access to information.

Organisations such as USAID, Islamic Relief, Kenya Integrated Water Sanitation and Hygiene Programme and the AfDB's Kenya Towns Sustainable Water Supply and Sanitation Programme have previously implemented these measures across Kenya. While there are currently limited local NGO initiatives aimed at establishing reliable water sources, this presents an opportunity for involvement of local

farming groups and cooperatives to design and implement interventions that will benefit Lamu's farming and pastoralist community directly.

A5: Reduce produce waste and post-harvest losses

Through the introduction of modern technologies (Action A2) and training on best management practices (Action A2), the productivity of Lamu's agriculture and livestock sector will be enhanced. However, high production is likely to be affected by the current lack of a value chain approach to the sector in Lamu – linking its inputs, production, processing and marketing. If these issues are addressed, there is potential to open up opportunities for employment and wealth creation. Crucially, inadequacy in storage and processing facilities has continued to constrain the marketability of perishable produce.

Section 4.2.3 outlines the development of a land-based aggregation model for Lamu, with different levels of collection centres to support produce collection, storage and accessibility to local and regional markets. In addition to this, farmers and traders should be incentivised to found cooperatives to establish common storage facilities, in line with Action A1. The National Cereals and Produce Board (NCPB) could offer a model for developing post-harvesting facilities, whereby farmers pay a small membership fee to access shared warehouses³².

The SIGs identified in the GeSI study are often excluded from storage opportunities, due to limited access to information and resources, as well as lack of affordability. As a result, it would be important to promote and include SIGs groups in development of storage and collection centres, for instance incorporating accessible infrastructure, whilst also considering affordability. In order to target SIGs, a digital communication strategy should be considered to inform farmers about storage availability. This strategy should be in an accessible format to

communicate market information and other key information such as weather issues. There are various existing examples of digital platforms that could be promoted or utilised as best practice case studies, including: Agri-Fin Accelerate, a programme that seeks to enhance digital access to financial and informational services for farmers, and Wefarm, an SMS-based knowledge sharing platform³³.

In addition to collection centres and cold storage (section 4.2.3), another option for reducing produce waste is to transform raw produce into less perishable items through agri-processing. The UEP highlights the VC opportunity of coconut processing, with a focus on oil extraction and production of by-products like charcoal and coconut flour (see section 4.2.4). This will require the development of several processing facilities, which could be operated by cooperatives or community-based organisations. The wide variety of crops grown in Lamu County presents several opportunities for development of other VCs, which could result in reduced post-harvest losses and therefore support key livelihoods and increase resilience to climate change.

The agriculture and livestock sector presents a number of opportunities to adopt circular economy practices. For instance, where by-products are generated in the agricultural value chains, for instance during processing, this could be utilised to produce animal feed for sale to livestock farms. One opportunity could be for development of a feed mill which takes by-products from agri-processing to make a blended animal feed (one of the proposed VC opportunities in Appendix B). This will generate a cheaper alternative input for livestock farmers, while generating an additional income stream for agricultural farmers and/or agri-processors³⁴. Any by-products not appropriate for livestock feed could be considered for compost or anaerobic digestion.

30 Farming First, Smallholder Resilience Starts with Soils (2018), Available at: <https://farmingfirst.org/2018/05/why-increasing-smallholder-resilience-starts-with-soils/> (Accessed: 26/10/2021).

31 Panaficare, Building Irrigation Infrastructure in Turkana, Kenya (2021), Available at: <https://panaficarekenya.org/1144/building-irrigation-infrastructure-in-turkana-kenya/> (Accessed: 26/10/2021).

32 National Cereals and Produce Board, Our Mandate (2021), Available at: <https://www.ncpb.co.ke/our-mandate/> (Accessed: 27/10/2021).

33 AgriFin Accelerate, Four Years of Learnings from Tanzania (2019), Available at: <https://www.mercycorpsagrifin.org/2020/02/19/four-years-of-learnings-from-tanzania/> (Accessed: 27/10/2021).

34 Environment Agency, Towards Sustainable Agricultural Waste Management (2001).

A6: Encourage mutually beneficial contract farming to maintain supply to the agri-processing sector

In order to motivate farmers to diversify production to include more resilient crops or livestock varieties, as outlined in Action A3, farmers in Lamu will need to see guaranteed demand and a consistent market for these products. This could include the development of contract farming arrangements, whereby a buyer enters a fixed long-term agreement with a farmer to buy a specific quantity of product at a set price, in order to establish a steady level of supply-demand³⁵. Contract farming typically also involves the provision of support from the buyer for growing the product, for instance by supplying inputs or supporting transportation. Consequently, farmers are guaranteed access to a long-term market for their produce and are able to sell at a stable price, thus reducing produce waste (in line with Action A5). In addition, there is an opportunity for producers to increase their knowledge of efficient agricultural practices through training provided by the buyer, usually an agri-industrial company.

Contract farming will ensure a stable and timely supply of inputs to the agri-processing sector through the aggregation model (section 4.2.3), including the coconut processing facility (section 4.2.4), with the required crops grown in the right quantity and quality. However, compliance often presents a key challenge for contract farming, as a result of the limited existing legal framework³⁶. Therefore, to ensure trust from both parties and encourage contract farming, it is advised that a County-level compliance framework is established. Development of such a framework would demonstrate legal and institutional support for farmers, thus encouraging them to engage in contract farming in future.

Furthermore, as cashless transactions increase in importance with COVID-19 restrictions and the rise of e-commerce, there is a growing need to support farmers in selling produce online. One potential opportunity is for the development of a digital marketplace platform, as demonstrated by Farmsquare in Nigeria³⁷. This could be managed by a cooperative and could act as an intermediary in collecting products, receiving orders, delivering goods and carrying out financial transactions between farmers and buyers. This would provide businesses with a reliable supply of produce, control over products/price and provide a guaranteed customer for produce and therefore a guaranteed income.

Case Study 4.3 - Farmsquare, Nigeria³⁸

Farmsquare is an online agricultural store and marketplace based in Nigeria for farm produce, agricultural products and equipment. It offers an online platform for farmers to digitally market their produce and customers to conveniently and securely shop for agricultural commodities, with orders being delivered to the customer's location.

Farmsquare partner directly with local farmers to offload their harvests to buyers, which helps to reduce postharvest farm produce wastage by 70% and remove the costs associated with buying from middlemen. The platform supplies and delivers organic produce/ products, conventional fresh farm produce, processed agro-products, livestock, fruits, vegetables, chemicals, fertilizers, seeds, livestock feeds, machineries and equipment to customers.

Farmsquare also promote certified organic products and offer farmers information, education and training on modern farming techniques and resource efficiency/ optimisation through their Agro News and Blog page.

³⁵ FAO, Contract Farming: Partnerships for Growth (FAO Agricultural Services Bulletin 145) (2001).

³⁶ Federal Ministry for Economic Cooperation and Development, Contract Farming Handbook: A Practical Guide for Linking Small-Scale Producers and Buyers (2013), Available at: (PDF) Contract farming handbook A practical guide for linking small-scale producers and buyers through business model innovation Volume II – Selected tools and case examples | Margret Will - Academia.edu (Accessed: 27/11/2021).

³⁷ Farmsquare, Company Overview (2020), Available at: <https://farmsquare.ng/about-us/> (Accessed: 27/11/2021).

³⁸ Farmsquare, Company Overview (2020),

Available at: <https://farmsquare.ng/about-us/> (Accessed: 27/11/2021).

4.2.2 Climate Resilient Infrastructure Projects

4.2.2.1 Project 1: All-weather access roads

Project Overview

The transportation and movement of produce from farm to roadside and finally to market or industry can be very expensive, especially where the terrain is difficult and there are no adequate roads. Poor roads constrain access to markets causing high transport costs, post-harvest losses, community isolation and deprivation. Improving critical rural urban linkages can support farmers with better access to markets, reduce transport costs and post-harvest loss. Lamu Island, Pate Island and Mpeketoni are rich agricultural production areas. While all the agricultural feeder roads within these areas need development in some form to ease access to markets and farming inputs for farmers, this proposal focuses on improving roads that will have the most impact on agricultural productivity and market access. A selection of priority links in these areas are elaborated below:

- > Lamu Island has a high potential agricultural area north of the heritage town (as seen in Figure 4.32) which is served by two sandy pathways connecting Old Lamu town to Matondoni and Kipungani. In the past, there have been attempts by National Constituency Development Fund (NCDF) and KeRRA to improve the Matondoni section to motorable standards, but it remains largely underdeveloped and lacks storm water drains;
- > Similarly, in Pate Island, its centre Siyu, is a highly productive area but its connection to sea access points at Mtangawanda and Shanga Rubu are characterised by narrow, damaged, and non-functional cross-drainage structures. Transport worsens during rainy season when seawater floods and cut off internal access between these critical areas;
- > In Mpeketoni, the connection to the strategic road network (A7) has poor geometry in a few places; passes through low-lying areas and seasonal swamps; and does not provide all-weather connectivity. Because of the earth surface and

high frequency of traffic, there is severe dust in the vicinity and the air quality is very poor; and

- > In Kiunga, produce used to be trucked by road up to Mokowe. However this ceased due to insecurity and subsequent maintenance neglect has led to the road's complete deterioration. Restoration of the link can revive

transport along the corridor and expand access to markets for town centre products, which at the moment are either sold locally or are moved via costly sea transport. However, this is a much longer-term proposal considering efforts are needed to first improve the security in the area and to guarantee that movement along the route is safe.

Figure 4.5 Proposed network upgrade



Source: Atkins analysis

In summary, poor road conditions affect movement of goods and people from the islands agriculturally productive areas and inhibits access to markets, farms, schools, employment, and social networks. Road upgrade improvements are needed to enhance accessibility. This would entail improvement of the existing roads to provide all-weather access, safeguarding works against deterioration and conducting regular annual maintenance. Using waste plastics in road construction can increase the value of plastic waste and make it more likely that people collect it. However its use in construction is relatively new with few successful studies determining that incorporating small quantities in pavement, can result in its improved stability, strength, and durability. Its use should be considered in the road upgrade initiatives. Additionally, landscaping and tree planting are needed along the roads to provide favourable walking environment for residents and animal transport. The sequencing of the networks should be matched with the land based aggregation outlined in section 4.2.3.

Location

Lamu Island, Mpeketoni, Pate Island and Kiunga

Linkages

Agriculture, Livestock and Agri-Processing

SUED principles for implementation

Climate resilience recommendations

Improved roads will reduce disruption from flooding where they cross seasonal swamps and improve air quality by reducing the volume of dust in the air from earth surface roads. The choice of road material should include consideration of the effect of increases in maximum temperatures on the road surface. Storm drainage provision and management can reduce disruption and damage from flooding; however, this will need to be designed taking into account increases in rainfall intensity. More climate-resilient roads will improve access to market, and thus support the livelihoods of many smallholders and small businesses.

Table 4.4 Project 1 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
The improvements will cover a total of 41km comprised of	Total cost = KES 1.770 billion	Improved access to VCs and markets	Delivery of road upgrade through a partnership between Kenya Rural Roads Authority (KeRRA) and LC	Funding through development partners
> Mkunumbi – Mpeketoni (13km)	41 km road	Reduced post-harvest losses	Delivery of tree planting through County Government – Environmental Department	Maintenance through Kenya Road Board – Road Maintenance Fuel Levy Fund (RMLF)
> Matondoni-Lamu (6 km)	KES 1.2 billion	Reduce transport cost	Funding through Development partners like World Bank, USAID	Agricultural producers and cooperatives
> Kipungani – Lamu (12 km)	NMT improvements along the new links with street furniture and landscaping - KES 410 million	Improved land value	Maintenance through Kenya Road Board – Road Maintenance Fuel Levy Fund (RMLF)	Delivery of tree planting and landscaping through County Government – Environmental Department
> Mtangawanda – Shanga (10 km)	Tree planting on two roads to provide favourable environment for walking			
Feasibility of security and physical road improvement of Kiunga -Majengo road	Annual cost of the maintaining 41 km road and junctions - KES 120 million			
	Kiunga road feasibility study - KES 20-40 million			

Source: Atkins analysis

Table 4.5 Project 1 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Rural road inventory and condition data is limited	Incomplete information on rural road network coverage, condition, and traffic data	Medium-term to long term, in line with development of initial aggregation network
	Cost benefit analysis needed	Rural road investment program required to inform phasing of investment

Source: Atkins

Social inclusion recommendations

Good quality roads are fundamental for economic development and poverty reduction. Roads provide access to social infrastructure such as health and education, livelihoods, and employment opportunities. They are key for facilitating access to markets for farmers, traders, residents, and vehicles. Better roads also reduce health and safety risks, contributing to the general wellbeing of local communities.

- > This project is not expected to cause the physical or economic displacement of local communities. However, in case resettlement is unavoidable, a Resettlement Action Plan (RAP) should be prepared to mitigate adverse socio-economic impacts and the disruption of social safety nets. Affected populations should be consulted about the relocation site/alternatives, the implementation schedule and compensation and assistance measures. Specific measures should be developed for PWD, elderly people, and other marginalised groups.
- > Timely communication of a works schedule is recommended to minimise the disruption of socio-economic activities in the area. Whenever possible, prioritise the employment of local youth and other SIGs.
- > Prioritise the employment of local communities for the construction and maintenance of roads. Work with existent local NGOs and cooperatives such as Lamu Youth Alliance.
- > Considering climate resilience recommendations for the design of roads above is fundamental to avoiding disruption of livelihoods or economic activities in case of climate hazards.

Case study 4.4 - China low-cost rural roads³⁹

Investing in low-cost rural roads has been found to generate larger marginal returns, raise more people out of poverty per dollar invested, and reduce regional development disparity more sharply than investing in urban roads. For instance, in China, investment in rural roads has been found to have benefit-cost ratios for national GDP that are about four times greater than the benefit-cost ratios for high-quality urban roads, and yield 1.57 Yuan worth of agricultural GDP for every Yuan invested. This implies investments in rural roads fosters more broadly distributed economic growth.

³⁹ IFPRI, Road Development, Economic Growth, and Poverty Reduction in China (2005).



4.2.3 Land-based aggregation model for agricultural produce

The agriculture sector in LC is dominated by small-scale farmers who are dispersed across the entire County. These farmers are rarely organised around inputs or outputs or any agricultural services. Roads to the farms are in poor condition and impassable during bad weather, whilst most remote areas are not connected to the major trading corridors. This means farmers cannot transport their farm produce to the market to sell, and because there are no proper storage facilities, a high proportion of perishable goods end up being spoiled and wasted. Where products are successfully brought to the shoreline, they must be transported by boat to markets on other islands, which is expensive and unaffordable.

In order to address the lack of a single high-volume source of farm produce and transport connectivity issues, a farm gate or market aggregation model, where produce would be collected from farms or local market area to a central storage for onward distribution to the agri-processing plant, is essential. A network of collection centres can support aggregation and storage of produce from small-scale farmers so that they can bulk their produce and benefit from economies of scale. The collection centres would serve to aggregate several agricultural products and provide some pre-processing before delivery to markets or industry for further processing. Pre-processing could take the form of grading, sorting, drying, fermenting, or bagging in standardized bags. For instance, the coconut VC will provide farmers with a predictable and stable market which, in turn, will be an incentive to encourage farmers to invest in improving productivity. By locating collection centres in areas with high coconut productivity, the aggregation network helps minimise transport costs associated with the sourcing of raw material from multiple small-scale farmers.

Having multiple collection centres will enable the end-market or off-takers to reduce their dependence on a single source of produce. Ten agricultural produce collection centres have been identified based on their proximity to high agriculture

productive areas, to market centres and to road or water transport corridors. Some form of aggregation already occurs in these areas to service local markets, and the introduction of a formal aggregation system would build from the existing network. These areas are Mpeketoni, Mkunumbi, Hindi, Mokowe, Manda, Kipungani, Matondoni, Lamu, Mtangawanda and Kiunga, as shown in Figure 4.6.

The collection centres would need to be linked with sea transport infrastructure such as jetties, where large vessels can anchor and ferry services that provide affordable public transport service. On land, transport networks such as all-weather access roads that connect the centres to the farmlands are necessary (details in Project 1). A good public transport connection will also be needed for farmers delivering the products directly to the collection centre.

Smallholder farmers selling to the collection network could be supported, for example, through the provision of produce-handling material such as appropriate bags and crates, farming advice, market information and timely payments of supplied goods. At the collection centre, post-harvest storage solutions are needed, such as warehouses with cold storage facilities, solar-powered cold storage units, on-site water harvesting, and on-site waste management will also be required. The provision of receiving, sorting, grading, storing and dispatching facilities will support the undertaking of some form of pre-processing. Since many agricultural products are perishable, transport to the processing plant and final markets will need to be adapted to provide refrigeration for products prone to damage (section 4.3.2.1).

A phased intervention strategy should be considered when developing the collection network. It will be important to first develop the aggregation network in areas where a busy market exists that could benefit from improved coordination. Areas such as Mpeketoni, Mokowe, Hindi and Lamu, are already established market centres and interventions here, such as the provision of cold storage and improved accessibility, could have an immediate benefit to current traders by growing their market access and improving their incomes.

Once the aggregation model has created a consistent high demand and larger size of organised seller and buyer/off-taker network, expansion should be considered. The aggregation network could progressively be extended to secondary growing markets such as Kiunga, Mtangawanda and Mkunumbi and finally to emerging markets in Matondoni, Kipungani and Manda. As the introduction of aggregation will have an effect on the market dynamics, the sequencing should be reviewed based on the evolution of demand brought about by the initial aggregation system.



Figure 4.6 Proposed produce collection centres



Source: Atkins

4.2.4 Coconut processing VC to catalyse development

This VC project is for coconut processing and was selected as a priority by local stakeholders. A wide range of products can be extracted from coconuts. This VC would focus on oil extraction and production of associated by-products including charcoal, coconut flour, vinegar and fibres.

The key outcomes of this VC include:

- > Providing a secure off-take and stable prices for coconut farmers, which in turn can support investment in increased planting and use of improved varieties;
- > Making full use of all components of a widely grown crop (husk, shell, meat and water);
- > Improving prices to farmers through local processing;
- > Providing charcoal (from processing by-product) to replace the use of local wood / charcoal, thereby reducing pressure on forests and mangroves;
- > Raising the potential for downstream products such as soap, flakes, nata de coco (jelly); and
- > Creating direct employment for around 84 full-time employees, with high potential for employing special interest groups (SIGs).

4.2.4.1 Base Assessment

Lamu County, together with the rest of the coastal region, provides an ideal climate for growing coconut. While substantial volumes are grown, processing capacity is limited to a few small-scale operations in the County which, in turn, has impeded the development of coconut farming.

Coconuts are often underutilised, being grown predominantly for either the meat extracted from mature nuts (which is dried into copra⁴⁰) or the water in immature fruit (a popular drink). Many parts of the nut are wasted or underutilised such as the husk, shells and water in mature nuts, and there is little production of value-added products such as oil, cream and flour.

⁴⁰ Copra is the dried kernel or flesh of the coconut.

All parts of a coconut from the outer shell to the inner flesh and water can be made into valuable commodities, with the primary products from a mature coconut including:

- > **Husk:** 35% by weight of mature coconut. Provides some fibre for coir products, and material for charcoal;
- > **Shell:** 12% by weight. Suitable material for charcoal;
- > **Water:** 15% by weight. Clear liquid inside the kernel. Suitable as a drink;
- > **Testa:** outer skin of the kernel which is sometimes removed (around 18% of the kernel by weight). Provides oil, cream, milk, and flour;
- > **Kernel:** Coconut meat that makes up around 28% of total weight. Dried to prevent decay, forming copra; and
- > **Copra:** Grated to form desiccated coconut. This can be mixed into a slurry and pressed to extract:
 - > **Oil:** Up to 5% of whole nut weight, depending on extraction method.
 - > **Cream:** Heavy liquids separated from oil and milk;
 - > **Milk:** Lightest liquid from pressing;
 - > **Fibre:** Dry remains after pressing, suitable for animal feed or;
 - > **Flour:** Dry, ground fibre, forming a gluten-free flour.

Once a coconut processing facility has been established, there is potential to develop additional products such as “nata de coco” (a jelly from fermented coconut water), hydroponic growing media (from fibres), netting to reduce erosion on sand dunes, activated carbon (from powdered husk), and chips (cooked flakes of copra) as well as a range of healthcare products (soaps, shampoos, skin lotions and creams). Coconuts reach maturity in around ten to 14 months, depending on conditions. When mature, the volume of flesh and oil in the coconut (and nutritional value) are highest. When targeting coconut water production, the nuts are harvested at around six months, and provide a thin layer of soft flesh suitable for cooking.

Unprocessed mature coconuts are relatively bulky in relation to their value. Processing is then best undertaken at a local/ regional level. Existing processing capacity in LC is limited and generally small in scale and product range (e.g. just focusing on oil extraction), which constrains the economics. Coconut processing is best undertaken relatively close to the growing areas, and to be competitive the processing should monetarise all parts of the fruit.

Coconut farmers in the County then have limited offtake for their produce. There are some processors in Kilifi, but the main processing facility in Kenya is south of Mombasa. Trucking costs prohibit sales of unprocessed fruit far beyond the County, and during good harvests some fruit can remain unpicked for want of a market.

This VC would establish fully integrated coconut processing in Lamu, taking whole mature fruit and producing oil, charcoal, fibre, flour and coconut water/vinegar, during the first phase. Once this is established, the production range could be expanded to include coconut creams and milks, flakes and desiccated products, yarns, lumber and healthcare products.

This VC is in line with local and national policies:

- > The County Government is distributing improved seedlings to raise yield of coconut orchards as well as overall production (in line with Action A1).
- > The CIDP identifies the need for coconut processing and local value added;
- > Jomo Kenyatta University of Agriculture and Technology's five-year programme to improve efficiency in the coconut processing value chain, started in 2017 and is funded by the International Development Research Centre of Canada⁴¹;
- > The VC supports the food security aspect of the 'Big Four' agenda as well as KEPSA's (Kenya Private Sector Alliance) objective of increasing value added in agriculture⁴².

4.2.4.2 Production Potential and Supply Chain

Production process

The first step in processing coconuts is to remove the outer husk, which can be completed in a mechanical stripper. The useful fibres can then be separated from the rest of the husk which is suitable for producing charcoal.

The coconut water is then removed from the shell (for bottling or further processing), and the shell is split exposing the kernel (the white 'meat' plus outer skin) which then needs to be dried before it starts to spoil.

The kernels can be sun-dried, but this requires substantial space and can result in spoilage if the weather is poor. Drying is then usually undertaken in kilns with the unusable fibres and shell being used for fuel. To maximise efficiency, the fibres and shell can be used to produce charcoal, with the waste heat being used to dry the meat. This method results in good quality copra and avoids the smoke and ash problems from direct burning.

The dried 'meat', or copra, is shelf-stable, and can be stored and processed as required. For processing the copra, and extracting the oil and cream or milk, there are a number of options:

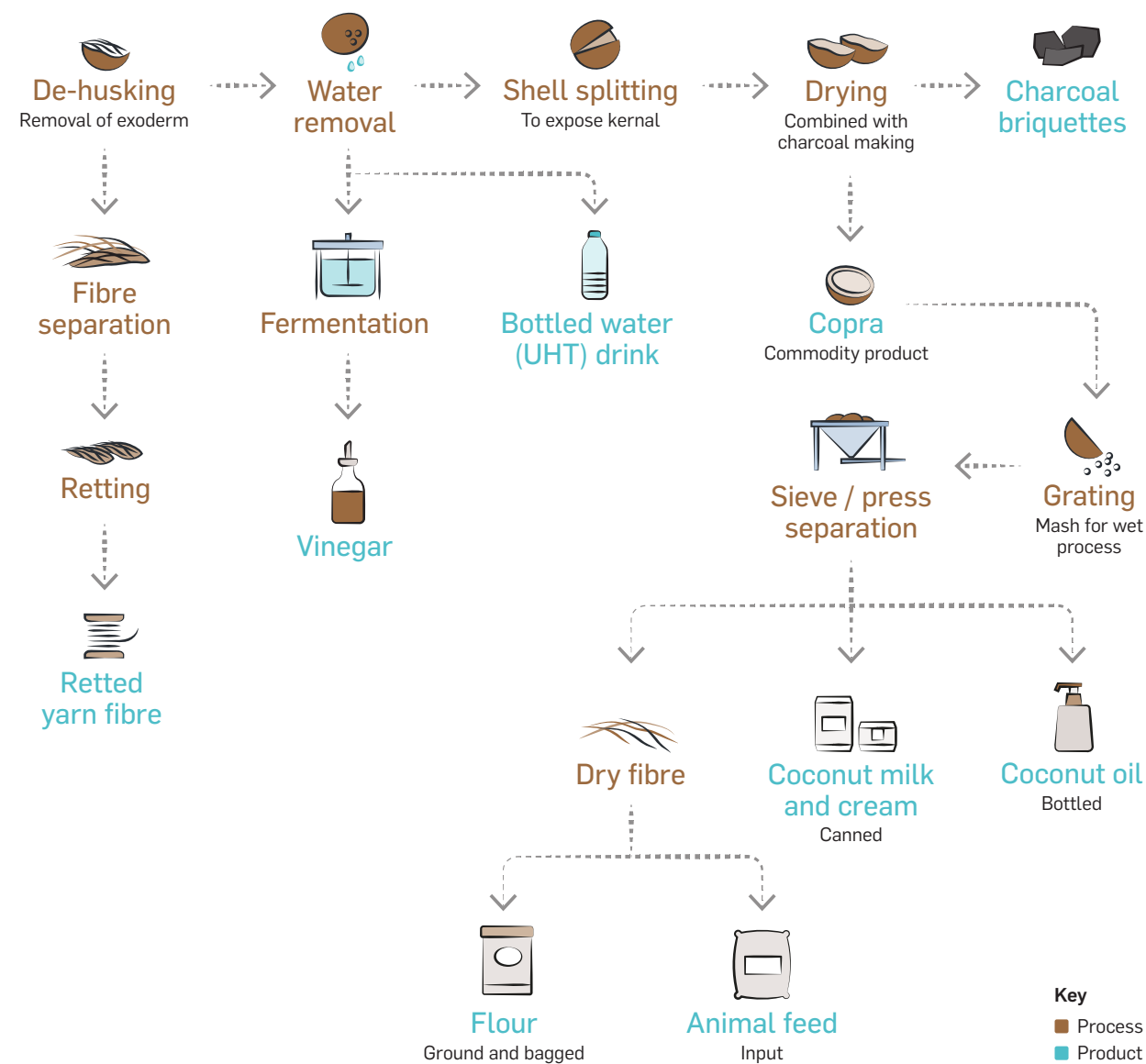
- > Direct expeller pressing of copra, which is low cost, but also low yield;
- > Cold extraction from mashed copra, which is very low cost and low yield;
- > Hot extraction from mashed copra, which is higher cost and higher yield, but copra is heated to over 40°C which reduces the antioxidant properties of the oil (and therefore the value); and
- > Fermentation extraction with mashed copra, which has good yield and low cost but a long processing time and is technical.

41 JKUAT, Researchers coconut resources are under utilized in Kenya (2020) Available at: <http://jkuat.ac.ke/projects/research-chair/2020/02/19/researchers-coconut-resources-are-under-utilized-in-kenya/> (Accessed: 30/11/2021)

42 KEPSA is a business representation organisation with over 50,000 direct and indirect members: <https://kepsa.or.ke/our-focus/>

The selection of the processing technology depends on the relative costs of the equipment, electricity and finished products. As a first step, it is assumed that the direct expeller, dry processing, method is used to extract virgin coconut oil, with the remaining fibre being ground and sieved to produce a gluten-free flour. Wet, mash-based extraction could be developed later. With this method the extracted liquid can then be spun to separate out the oil and cream (essentially an emulsion of coconut oil and water with suspended fibre particles), which can be further split into a light coconut milk and full fat cream. See Figure 4.7 for process flow for coconut processing.

Figure 4.7 Process flow for coconut processing - all primary products



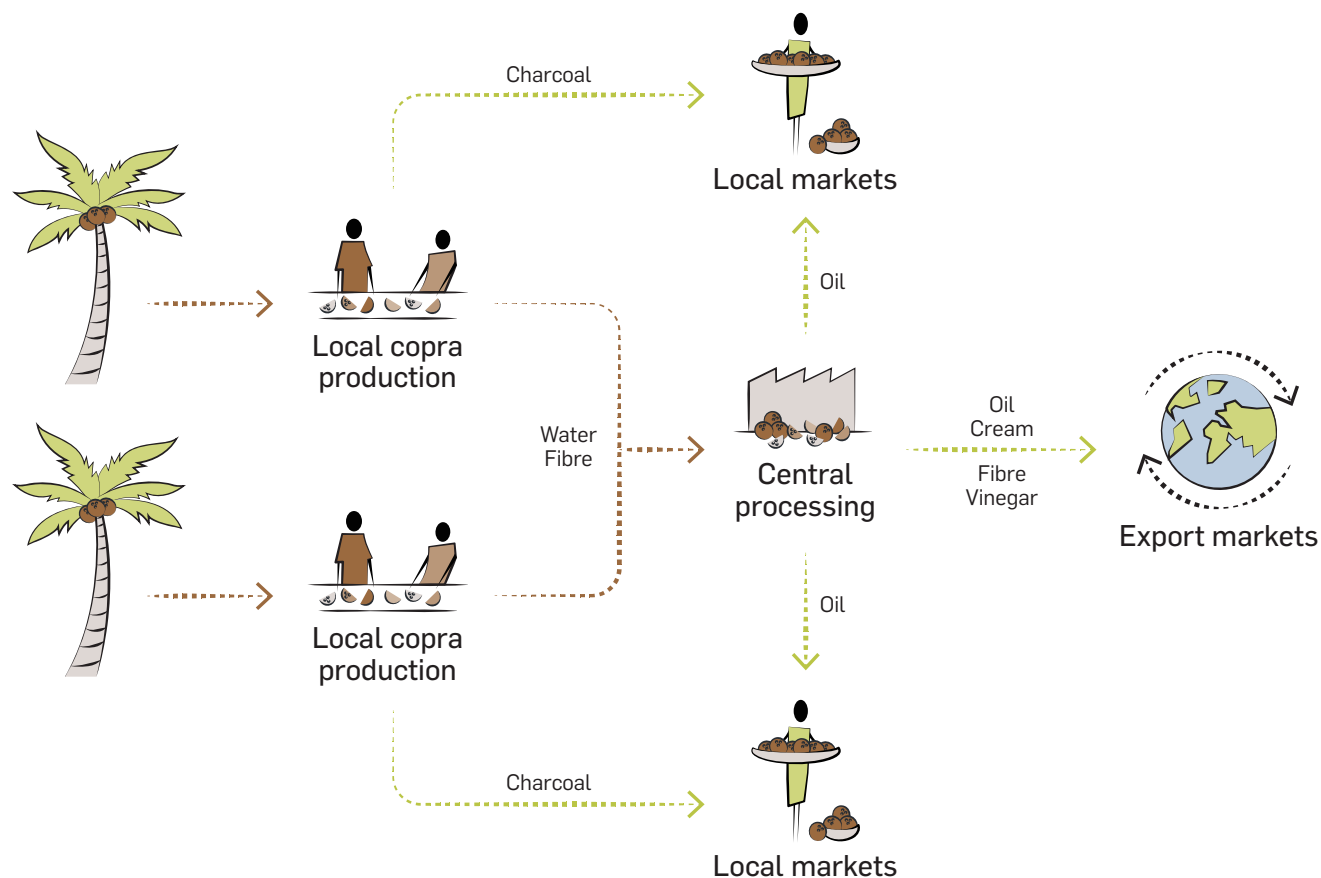
Source: Atkins analysis

This initial stage of processing from raw nut to copra can be operated commercially on a relatively small scale, and there are significant savings in transport costs from locating this processing near to the growing areas, while developing a central facility for processing the more valuable copra. Specifically, the husk and shells account for 48% of the weight of a mature coconut, while the final weight of the dried copra is equivalent to only 10% of the whole weight.

A two-stage processing structure is then proposed, with primary processing facilities located at key collection centres (e.g. Mpektoni, Pate, etc.), supplying a central processing facility with copra (see Figure 4.8).

As the sector develops, and more palms are planted, additional local copra production sites could be established.

Figure 4.8 Lamu coconut processing



Source: Atkins analysis

Capacity

The target production capacity for this VC is one tonne of whole mature coconut per hour, around 2,500 tonnes per year. This represents less than 20% of the average harvested volumes between 2014 to 2017.

With this production volume, a semi-manual processing approach is suitable. This will ensure a large number of job opportunities while also being modular. It will then be easy to expand processing capacity in line with available volumes of nuts, with just some additional investment in machinery.

Much of the production process is modular, and can be expanded on to cater for increased volumes. It can be expected that with a secure offtake and stable prices, coconut harvests in LC could increase substantially. With improved varieties and farming techniques, yields from coconut palms have been rising from around 28 fruits per palm to 34 fruits in 2019. However, there is potential to go much further, with achievable yields estimated at 75 fruits per palm per year, with a maximum of 150 fruits⁴³.

To support the improvements in yields, the County Government has been handing out seedlings of improved varieties for replacement planting and new orchards. There is also substantial scope to increase the area under coconut, with around half of the County suitable for coconut orchards.

Prices and margins

Kenya has a competitive cost base for coconut processing. Farm gate prices for mature coconuts in Kenya had been around KES 15 until 2019, when prices dropped to KES 10 per fruit as a result of increased production and no additional processing capacity. A price of KES 15 per nut equates to a de-husked price of US\$ 230 per tonne, which is in line with current Indonesian prices, and below Sri Lankan and Indian prices⁴⁴.

⁴³ Viffa Consultants, State of coconut commodity market in Kenya, SME market opportunity outlook (2018).

⁴⁴ International Coconut Community, Weekly price service (2021), Available at https://coconutcommunity.org/statistics/weekly_price_update, (accessed 29/11/2021).

Table 4.6 Capacity and volumes for coconut processing

Production Target and Volumes Flows				
Inputs	Tonnes / per day	Tonnes / per year	Number / per day	Number / per year
Whole mature nuts	10	2,500	8,333	2,083,333
Intermediate outputs				
Husk	3.3	825		
Shell	1.5	375		
Meat	3.0	750		
Copra	1.0	250		
Final products				
Coconut oil	0.6	150		
Coconut water	2.2	550		
Yarn fibre (retted)	0.1	28		
Flour	0.3	75		
Charcoal	1.4	361		

Source: SUEd Atkins Team

However, some existing processors in Kenya have struggled to achieve profitability, (e.g. Roots Kenya Limited Company on Pate Island⁴⁵), though this appears to be due to a combination of factors: relatively small scale, a narrow product range with higher associated costs and limited marketing.

Demand Outlook

There is good demand for the key coconut products from this VC. Output of coconut oils, flours and creams, which are internationally traded commodities, would target export markets, while the charcoal would be sold into local markets.

- > Coconut oil: despite past concerns over the healthiness of coconut oil (it is high in saturated fats, but it is now understood that these help increase the good HDL cholesterol levels, while turning the bad LDL cholesterol into less harmful forms⁴⁶), demand for oil has been rising and the outlook is for continued growth. Global demand for coconut oil is forecast to increase by 9.5% per year from 2019 to 2024, reaching around US\$ 5 billion⁴⁷.
- > Coconut flour: increasing demand for high fibre, low calorie, dietary products in western markets, together with demand for gluten-free products, has created strong demand growth for coconut flour. Strong growth is expected to continue, with global demand forecast to rise by 7.2% per year from 2019 to 2023⁴⁸.
- > Coconut cream and milk: strong growth in Asian markets and increasing popularity of Asian cuisines in western markets, had driven strong growth in creams and milks. This is expected to continue with global demand forecast to rise by 7.2% per year from 2020 to 2025⁴⁹.

- > Charcoal: is the leading fuel for cooking in the County, as it is across Kenya. Increasing demand has led to extensive deforestation and bans on logging have tightened supplies and raised prices. There is strong and growing demand for a sustainable source of low-cost charcoal.

Supply chain and location

- > This VC would cover several locations, with local copra production close to the main coconut growing areas, and a central processing facility taking in copra and producing oil and flour, and later cream, milk and other products.
- > The local copra production sites would each require around 500 m while the central processing facility would need around 1,200 m² of space.

4.2.4.3 Indicative Costs and Revenues

Investment

The total investment required is estimated at around KES 200 million. Around 60% is for buildings and site preparation, some 25% for machinery and vehicles, and 10% for working capital. The remainder covers marketing, and initial training.

Operating costs

Total operating costs are expected to approach KES 80 to KES 100 million per year (see Figure 4.9), of which KES 20 to 25 million will be for the purchase of coconuts. Annual manpower costs are estimated at KES 75 million, with the other major cost, packaging, expected to be around KES 20 million.

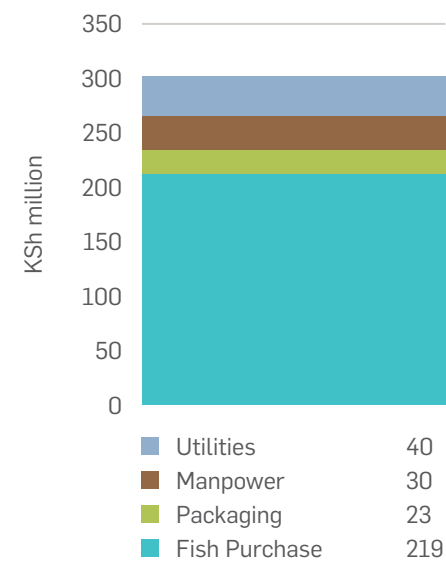
Note that for the financial assessment, the focus has been on the production of coconut oil and associated products (flour, charcoal, fibre and coconut water). The decision over the precise product balance should be addressed during the detailed financial analysis.

Human resources

The coconut processing facility will be relatively labour-intensive, with many manual activities (splitting, cutting, loading dryers, etc).

- > Head count of 84 FTE in total, with 14 FTE at each of the nut to copra processing centres, and 56 FTE at the main processing facility;
- > Monthly salaries of KES 13,000 to KES 25,000 depending on skills; and
- > Additional employment costs estimated at 25% of salary.

Figure 4.9 Operating costs 2026



Source: SUED Atkins Team

45 The Star, Coconut farmers seek help as Lamu firm faces collapse (2019), Available at: <https://www.the-star.co.ke/news/2019-01-30-coconut-farmers-seek-help-as-lamu-firm-faces-collapse/>, (Accessed: 30/11/2021).

46 The Health Line, top 10 evidence-based health benefits of coconut oil (2021), Available at: <https://www.healthline.com/nutrition/top-10-evidence-based-health-benefits-of-coconut-oil> (Accessed: 21/10/2021) Market Research Future, virgin coconut oil market (2021), Available at: <https://www.marketresearchfuture.com/reports/virgin-coconut-oil-market-4130>, (Accessed: 21/10/2021).

47 Market Research Future, virgin coconut oil market (2021), Available at: <https://www.marketresearchfuture.com/reports/virgin-coconut-oil-market-4130>, (Accessed: 21/10/2021).

48 Research and Markets, Global Coconut Flour Market, 2019-23 (2021), Available at: <https://www.researchandmarkets.com/reports/4667557/global-coconut-flour-market-2019-2023>, (Accessed: 21/10/2021).

49 Mordor Intelligence, Coconut cream market – growth, trends, Covid-19 impact and forecasts (2021), Available at: <https://www.mordorintelligence.com/industry-reports/coconut-cream-market>, (Accessed: 21/10/2021).

Table 4.7 Manpower for coconut processing

Manpower	Full-time equivalent	
Local copra production facilities x 2	Per unit	Total
Dehusking / shelling	4	8
Drying to copra/charcoal production	4	8
Packaging (water, yarn, charcoal)	2	4
Sales and dispatch (charcoal, water, yarn)	2	4
Management / admin	2	4
Sub-total	14	28
Central processing facility		
Collection / storage		6
Oil production		20
Other processing		12
Sales and dispatch		6
Management and admin.		6
Other: security, stores, cleaning		6
Sub-total		56
Total manpower		84

Source: SUEA Atkins Team

Raw materials

The project economics are based on producing coconut oil and related products (rather than coconut creams and milks). The key costs are then:

- > Average purchase price of coconuts is KES 10 per whole nut, equivalent to over KES 8,000 per tonne, paid at the collection points for processing copra and charcoal; and

Packaging costs

- > Oil – KES 25 per 0.5 litre jar
- > Flour – KES 10 per 1 kg bag
- > Copra/yarn – KES 2,000 per tonne
- > Vinegar (from coconut water) – KES 75 per 5 litre container
- > Charcoal – KES 20 per 4kg bag

Other Opex

Covers electricity, water and other utilities, maintenance of machinery, marketing and training. The opex also covers transport fuels and vehicle maintenance costs, (based on using two 2-tonne trucks to take materials between the copra production centres, main processing sites and local market outlets and the Port).

Revenues

Annual revenues are estimated at KES 124 million by 2026, with some 60% of revenues from coconut oil sales. This estimate is based on the following average sales prices, which are in line with factory gate prices:

- > Oil – KES 225 per 0.5 litre jar, equivalent to KES 0.49 million per tonne
- > Flour – KES 75 per 1 kg bag
- > Charcoal – KES 120 per 4 kg bag (standard retail size)
- > Yarn – KES 90,000 per tonne (in line with raw yarn international trade price)
- > Coconut water vinegar – KES 280 per 5 litre container (cooking/cleaning grade)



Value added

The value added, calculated as sales revenues less the cost of the coconuts, packaging and other inputs (electricity, water, etc.), is estimated at the equivalent of KES 24,600 per tonne of coconut purchased, representing over half of the sales price.

Table 4.8 Value added

KES per tonne of coconut equivalent	
Coconut purchase price	8,333
Other inputs (packaging)	7,124
Other opex (power, fuel)	5,216
Value added	24,596
Sales price	45,269

Source Atkins analysis

Enabling Business Environment and/or other catalysts

The VC would benefit from close cooperation with coconut farmers to help develop a collection network, promote the planting of new and more productive varieties. In addition, there is potential for working with any existing small-scale processors in the County (such as Roots Kenya on Pate Island).

The VC should also engage with the Kenyan Coconut Development Authority, to ensure alignment with their policies and support.

4.2.4.4 VC location, agri-processing cluster and infrastructure requirements

Two potential sites have been identified to locate the coconut processing plant as described in section 3.5.2 and shown in Figure 4.10 Option 01 - County Command Centre Site is the preferable site as it is close to the road network, and allows for future expansion and co-location of other VCs. The final decision of the site selection will be done in conjunction with the Municipality.

Infrastructure Assessment

The following is a summary of the critical water, wastewater, solid waste, energy and transport needs of the coconut processing VC:

Water

Water is needed for the processing equipment, procedures and staff hygiene. For coconut oil production, it is assumed that water requirements are similar to olive oil extraction. At a lower estimate 1.3 m³/day of water would be required in order to process the daily coconut oil production as stated in Table 4.6⁵⁰. A further 4.2 m³/day would be required for the FTE employees in order to maintain a high standard of hygiene⁵¹. Therefore, the total amount of water required for the plant is around 5.5 m³/day. Water can be sourced from an on-site borehole or from a joint desalination plant which services both the coconut and fish processing VC (section 4.6.1.2).

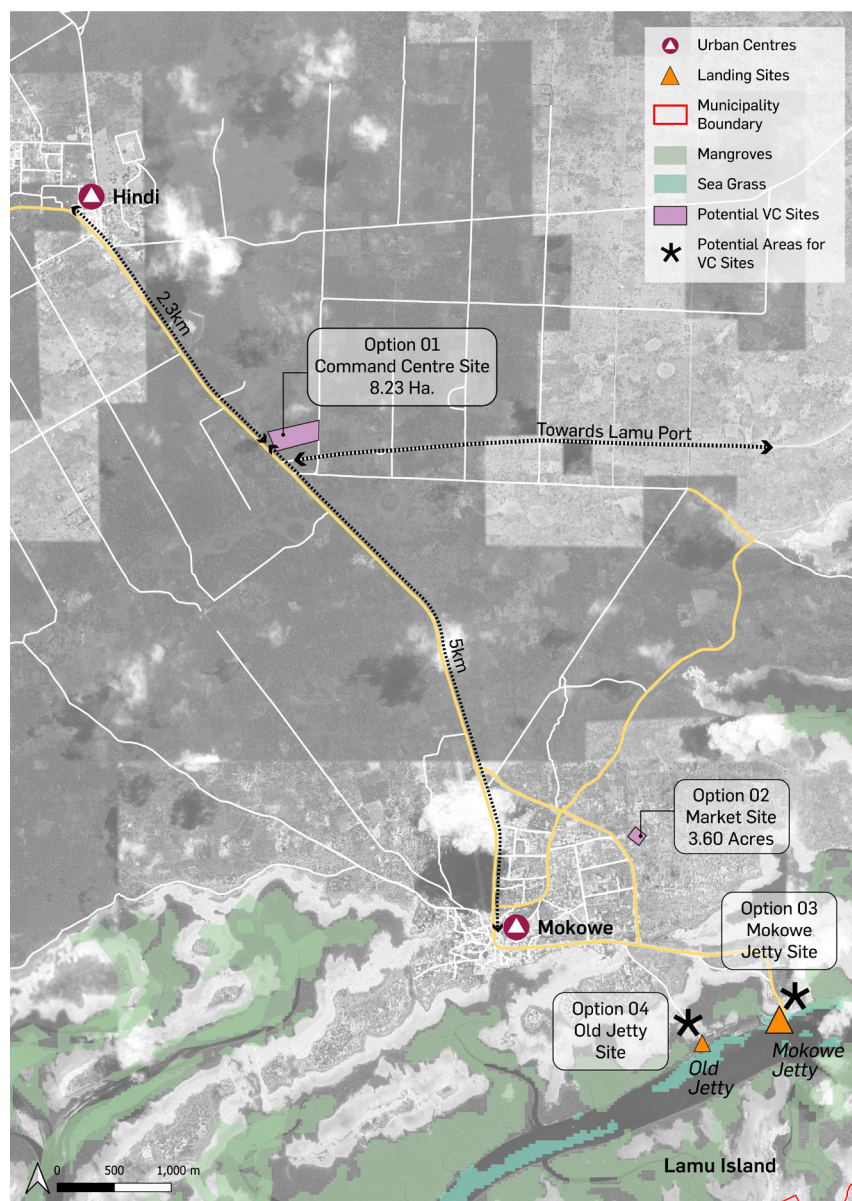
Processing coconut water and oil has shown to produce wastewater with a high biological oxygen demand (BOD)⁵². This wastewater should undergo primary and secondary treatment before it is discharged in order to meet discharge quality standards.

50 Giner Santonja, G., Karlis, P., Stubdrup, K. R., Brinkmann, T., Roudier, S., Best Available Techniques (BAT) Reference Document for Food, Drink and Milk Industries (2019), Available at: BAT reference documents | Eippcb (europa.eu), (Accessed: 25/10/2021).

51 Ministry of Water and Irrigation, Practice Manual for Small Dams, Pans and Other Water Conservation Structures in Kenya (2005), Available at: http://smalldamsguidelines.water.go.ke/technical_reports/, (Accessed: 22/10/2021).

52 Tripetchkul, S., Kusuwanwichid, S., Koonsrisuk, S., and Akeprathumchai, S. (2010), Utilization of wastewater originated from naturally fermented virgin coconut

Figure 4.10 VC location



Source: Atkins analysis

Solid Waste

Almost no solid waste will be produced by the facility as the by-products of the processing can be utilised to fuel the dryers at the facility, to produce yarn fibre (retted), to produce charcoal, or dried and used within a feed mill to support the circular economy principle. There will be some municipal-type waste arising from the daily activities of the workers. Based on each worker generating approximately 0.6 kg of waste per day and assuming that 70 FTE workers will be employed at the facility, the total municipal waste generation will be 0.04 tonnes per day or 10.5 tonnes per year. This waste should be segregated at source into mixed dry recyclables, organics, and residual waste.

Power

Based on the anticipated size of the facility, the general power and lighting demand for the buildings and process load could be in the region of 180-210 kW, and a heat demand of 100-120 kW⁵³, depending on the type and efficiency of equipment installed.

The production chain features drying for the coconut kernels which requires process heat. There is the potential to utilise the coconut husks and shells as a fuel for this process, however these may also be used as higher-value products in the future so consideration needs to be given to the entire sustainability of the VC. If the husks and shells are not available, the electric equipment should be considered to provide process heat (i.e. high voltage electrode steam boilers), as other fuels, such as natural gas, LPG, oil or virgin wood, have significant issues around supply chain logistics, including sourcing, cost and stability, as well as environmental issues around deforestation and greenhouse gas emissions. The final location of the facility will be near Mokowe in Option 01 (see Figure 4.10) where the grid is available to the site although currently not very reliable.

⁵³ The peak energy demand is compiled through a combination of specific equipment required for the process and a unit rate allowance for small power and lighting for building area

The demand is quite high, but there should be enough spare capacity in the main substation and a suitable 11kV grid supply should be available which can be extended to the site to provide the facility with a dedicated connection, however, this needs to be confirmed by KPLC. The processing facility should have an 11/0.4 kV distribution transformer on site (1 x 315 kVA).

Grid unreliability and power costs are major issues with respect to the successful operation of the plant. A well implemented power resilience solution will allow the continued operation of the plant regardless of events on the local power grid. The solution to ensure some level of reliability when the power is lost and to reduce costs would consist of the following:

- > On-site energy generation. Solar PV should be installed on the site to reduce reliance on the grid and reduce electricity bills. An appropriate installed capacity would be around 55 kW⁵⁴. This would require an area of about 360 m². This could be located on building roof(s) and possibly some standalone solar arrays if needed. This output will be reduced during cloud cover and at night, so the grid supply will still be sized to cover the peak demand however PV could reduce the cost of grid electricity by up to KES 20,000 per week.
- > Voltage regulation. Spikes, sags or fluctuations in voltage supply can cause damage to equipment and disrupt operations. Regulation equipment integrated into the distribution transformer at the incoming voltage will protect the manufacturing equipment.
- > Battery storage. This should be included to help with any extended power cuts. Lead-acid batteries are appropriate technology for this environment. An appropriate storage capacity of around 315 kWh would provide a suitable level of business continuity.

- > Uninterruptible power supply (UPS) would be needed to instantaneously bridge between any power cuts and the battery storage.
- > The battery storage, voltage regulation and UPS equipment would require a dedicated building on site of roughly 7 x 5 m (35 m²). Other than the husk and shell waste previously referred to, the process has very limited waste output, so waste-to-energy is not a viable proposition. High efficiency motors and drives and other low energy equipment such as LED lamps should be installed throughout, to ensure the demand is at the lower end of projections. The plant operation should also ensure it has budgeted maintenance programmes to cover items like the regular cleaning of PV panels, the servicing of motors, fans and coils and replacing equipment when its performance begins to degrade.

Transport

The transportation system and level of accessibility will have a major influence on the basic function and form of the proposed VC site. The site should be strategically located along the new bypass C112 providing it with direct access to a national highway that is capable of handling the volumes of traffic attracted and generated by the site. Internally, all roadways proposed within the site should be at least two lanes, with a network arrangement that allows the free flow circulation of vehicles driving in and out of the site. This is particularly important should there be clustering of a number of VCs within the same site. Parking should also be considered, and it can be a hybrid of on-plot, centralized and on-street parking.

Environmental Assessment

The environmental benefits of this project include the use of agricultural products as inputs providing income to farmers and reducing post-harvest losses. An EIA is required to ensure the development does not cause detrimental effects to the environment. The following issues should be considered:

- > By-products such as the outer husk and the kernel would be used as charcoal briquettes and the production of other products contributing positively to the environment
- > The processing plant requires around 5.5 m³/day of water, which could be reduced by treating wastewater on-site and reusing as much as possible within the facility;
- > Wastewater discharges from the processing facility should be treated on-site prior to discharge into the natural environment;
- > Given the level of energy demand (180-210 kW) on-site renewable energy systems shall be installed to provide a proportion of the energy needed and supplement the grid supply; and
- > If the selected site (option 1 or option 2) is in close proximity to noise sensitive receptors (human settlements), mitigation measures need to be put in place. This is due to the levels of noise produced during processing.

Climate Resilience

Lamu County grows substantial volumes of coconut, which would meet the target input volume of 2,500 tonnes per year (equating to 20% of 2014 volumes produced). This VC is fully agricultural and as such is sensitive to climate change, particularly increased temperatures and drought during fruit set⁵⁵. Coconut trees are predominately rain-fed and are frequently exposed to soil water stress conditions as a result of low rainfall, water infiltration, water retention and rapid drainage. They grow well in coastal areas and can withstand temporary waterlogging conditions as a result of floods and tides, storm events, and can protect against erosion in high rainfall areas. Monoculture farming of coconuts is not recommended as it can lead to low crop yields and has a low land utilisation, however the inter-space between the trees provides opportunities for intercropping, which would be shaded by the coconut trees⁵⁶.

⁵⁴ PV capacity has been assessed at a percentage of peak demand that provides the optimum fit between affordability, ability to find suitable space on the site and best provision of renewable energy to minimise CO2 emissions

⁵⁵ Hebbar, K. et al. (2013), Plantation Crops Response to Climate Change: Coconut Perspective. In: Singh, H., Rao, N., Shivashankar, K. (eds) Climate-Resilient Horticulture: Adaptation and Mitigation Strategies. Springer.

⁵⁶ Krishnakumar, V. (2018), Coconut based multiple cropping – Concepts, models and impact. In: Bhat, R., Subramanian, P. (eds) Coconut Based Integrated Farming System: Training Manual. Central Plantation Crops Research Institute, 6-14.

Overall, the VC has a medium sensitivity to climate change.

Coconuts require a well-distributed annual rainfall of 1,300-2,300 mm, annual mean temperatures of 27-29 °C and around 5.5 hrs/day of sunshine (2,000 hrs/year)⁵⁷. Increased temperatures as a result of climate change could impact the functional leaf area and photosynthetic rates (important for high productivity in coconut) as well as dry matter accumulation and nut yield. Additionally, the infrastructure and delivery systems involved in coconut processing (equipment, buildings, transport routes etc.) must be resilient to climate change, including flooding, so the relevant risk assessments must be undertaken. This VC has a medium exposure to climate change.

Potential adaptation options include:

- > Using drought resilient varieties of coconut;
- > Adoption of soil moisture conservation or drip irrigation practices; and
- > Growing cover crops/using mixed cropping systems to prevent extreme evapotranspiration and improve soil moisture content as a result of reduced soil temperature.

This VC has an overall medium vulnerability to climate change; it is not expected that climate change will affect the viability of this VC, providing adaptation measures are included in implementation.

Gender and Social Inclusion Assessment

While production and harvesting of coconut is perceived as a male activity, family work often supports these processes as well as other agricultural activities that might take place in that land. Hence, it is likely that women and youth actively participate in these activities (for example, planting coconut seeds, working in plant nurseries), yet with roles that are invisible and unpaid. Moreover, due to social norms, low literacy levels, and competing community and

domestic obligations, these groups often lack access to new technologies and extension services and consequently they deploy labour-intensive methods.

Women and youth only access land where coconut trees are planted through their parents or spouses, further complicating their access to finance. Other SIGs face similar barriers in their access to land, agricultural and market information, capital, and resources, which severely hinder their engagement in economic activities.

Despite these limitations, the coconut processing VC has a significant potential for generating jobs in value added links, with oil extraction and production of charcoal and flour, with scope to expand into creams and milks, soap, shampoo, drinks, flakes, etc.

Women already have the know-how to produce coconut oil and other coconut by-products, and enhancing this VC allows for their professionalisation and empowerment. However, they often lack adequate technologies, market information to support their production, or the skills and knowledge to engage in alternative coconut products when needed.

The development of this VC also offers opportunities for the inclusion of elderly people, youth, and PWD, offering a variety of physical and non-physical jobs.

Below there is a summary of the findings from the GeSI study regarding the coconut VC in Lamu Municipality. The detailed study is presented in the GeSI study (Appendix C).

Case Study 4.5 - Promoting inclusion of people with disabilities (PWD) in cocoa, coffee and palm oil value chain (VC) in Tanzania⁵⁸

Despite the coconut VC often being considered as an activity dominated by young men, there are significant opportunities for PWD inclusion, especially in value-added links of the VC. An initiative working towards integrating PWD, currently under implementation, has the objective of: a) providing PWD sustainable livelihood opportunities, b) improving PWD access to markets, and c) generating awareness about the importance of PWD inclusion at the community level.

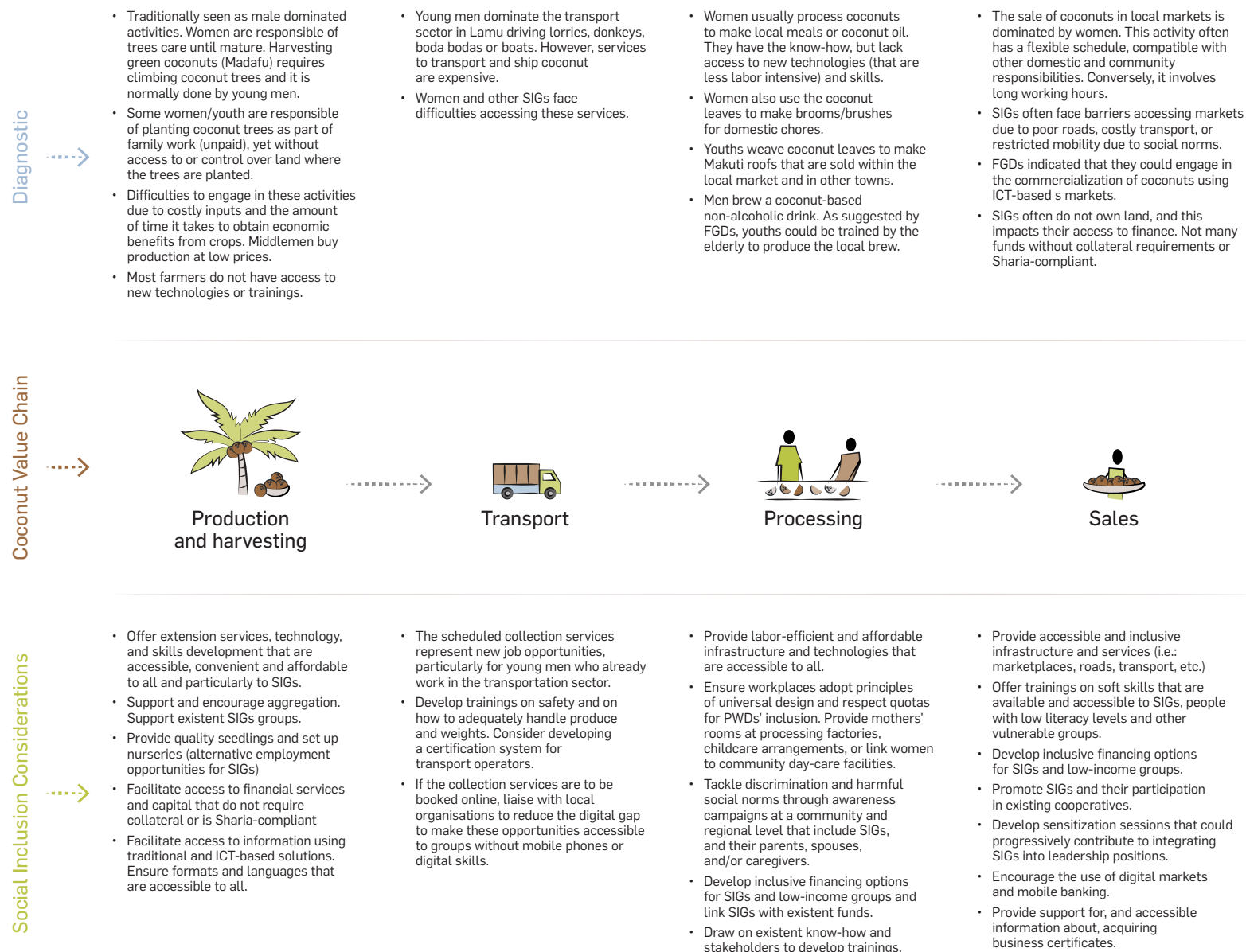
To achieve this, the involvement of PWD starts in the production stage, engaging PWD and disability organisations. For the processing of raw materials, PWD work with equipment and tools that are accessible. For marketing and trading, PWD and PWoDs (people without disabilities) are organised as economic groups. The programme trains PWD in soft skills such as leadership, entrepreneurship and business skills. It also links them to providers of financial and business development services, and existing government programmes.

Sensitisation campaigns, guided by Behavioural Change Communication (BCC) strategy, were also developed to overcome the preconception that PWD cannot successfully engage in agriculture, targeting the general public and PWD themselves. Moreover, the project implemented awareness campaigns to develop solidarity among PWD. Finally, the programme also learned that local knowledge is key to developing successful inclusion measures (for example, sign language might not be used in rural areas, but family members can act as interpreters). as interpreters).

⁵⁷ Ranasinghe, C. (2012), Climate Change Impacts on Coconut Production and Potential Adaptation and Mitigation Measures: A Review of Current Status. In: Marambe, B. (ed) Proceedings of the Workshop on Present Status of Research Activities on Climate Change Adaptations. Sri Lanka Council for Agricultural Research Policy, 71-82.

⁵⁸ Trade craft exchange, Disability inclusion in mainstream value chains (2021). Available at: Project: Disability Inclusion - Traidcraft Exchange, (Accessed: 20/12/2021).

Figure 4.11 GeSI Assessment of the Coconut VC Fishing and Marine Sector Action Plan



Source: Atkins analysis

4.3 Fishing and Marine Sector Action Plan

LC's fishing and marine sector signifies a key economic driver for the Municipality, performing a major role in supporting livelihoods and contributing to food security. It is estimated that fishing and fishery-related activities account for more than 70% of household incomes in Lamu East, Lamu Island and the fishing villages of Lamu West. Fish products are marketed locally to grocers, restaurants, hotels, supermarkets and trade markets, as well as being exported to China, Hong Kong, Saudi Arabia and the European Union.

As with most coastal communities in Kenya, marine fishing in LM is mostly artisanal in nature and subsistence-based. At present, artisanal fishers are incapable of carrying out deep sea fishing, resulting in substantial unexploited potential for fish production and thus wealth creation owing to a lack of modern equipment and training. Importantly, Lamu's vast offshore resources have not yet been targeted, with a focus on nearshore fishing due to a lack of modern equipment and training. Consequently, there is an opportunity for further development of the fishing sector through the Sector Action Plan, in terms of employment and fish production.

LM also offers noteworthy opportunities for the development of Blue Economy activities – including the building and repairing of boats and other vessels, marine research and other tourism-related activities – potentially with support from the LAPSET corridor programme. The Sector Action Plan seeks to further strengthen the role of the Municipality as a fishing and marine centre; however, this must be carried out in a sustainable manner, in line with the Blue Economy principles. These investments in the Blue Economy will support socio-economic benefits, such as increased employment opportunities and improved food security, and will enhance the training opportunities and livelihoods of Lamu's residents.

From the Diagnostic Report analysis, the following key strengths, weaknesses, opportunities and threats were established. These were used to determine the actions proposed in the following section.

Table 4.9 Fishing and Marine SWOT

Strengths	Weaknesses
LC is endowed with a range of endemic marine biodiversity - including coral reefs, seagrass beds, mangroves and lagoons	Lack of modern equipment and training means fishing is predominantly concentrated in the nearshore, limiting access to fish stocks available to be harvested
The coastal fishing area includes 40 traditional fishing grounds and 32 landing sites, with a vast array of commercial and rare fish species	Lack of stock assessment monitoring data necessary to determine health and availability of fish stocks
Fish is exported to China, Saudi Arabia and Europe, although this is fairly limited currently	Very limited market infrastructure, cold storage facilities and processing facilities in LC, resulting in considerable post-harvest losses
When compared with the other coastal counties, Lamu performs well in the area of marine fish and crustacean harvesting	Brokers determine and control produce pricing at both the fishing and distribution stage
Opportunities	Threats
LAPSET will include the development of a new fishing port, which will allow for more modern fleets and technologies to be utilised	Climate change: increasing sea temperatures, acidification, shifting ocean currents, coupled with ongoing degradation of mangroves
Lamu County provides significant opportunities for Blue Economy activities – including marine research and marine tourism-related activities	Conflict with LAPSET projects, including clearance of important fishing habitats and existing landing sites for port infrastructure
Expanding fishing activity further offshore could provide an opportunity to increase the productivity of the sector	Foreign fishing vessels encroaching on territorial waters and undertaking illegal fishing
Potential for synergies with other sectors to create opportunities for added value, for example taking tourists	Increasing levels of sports fishing within the County, for instance as a result of tourism projects, could pose a threat to commercial fishing and local fish stocks

Source: Atkins analysis

The Sector Action Plan, outlined in Table 4.10, should be viewed as a practical sequence of actions to support the development of the fishing and marine sector, taking account of the Municipality's existing strengths and weaknesses, as well as opportunities presented by the Blue Economy. The Plan commences with the soft initiatives, these are training and capacity-building interventions (section 4.3.1) recommended to best position Lamu's fishing and marine communities to benefit from the inclusive and climate resilient infrastructure proposals (section 4.3.2) and the sea-based aggregation model (section 4.3.3), which are proposed to enable sector growth across LC.

The VC opportunity of fish processing is presented as a potential pilot scheme for the sector to catalyse development (section 4.3.4). The individual actions are presented in detail at each stage, including several best practice case studies to exemplify how these schemes can be implemented effectively within Lamu.

In addition to the infrastructure projects presented in this Action Plan, a series of cross-sectoral interventions are outlined in section 4.6, with the potential for specific benefits for the fishing and marine sector.

Table 4.10 Fishing and Marine Action Plan

Economic ambitions	Actions
Protect and maximise benefits from Lamu's marine resources	4.3.1. Soft initiatives, training and capacity building
Enhanced sector resilience towards climate change	A7: Preparation of an Integrated Water Quality Protection Plan
Inclusion of SIGs, particularly youth, women and PWD	A8: Undertake training and establish ongoing fish stock assessment to form development of a Sustainable Fisheries Management Plan
	A9: Enhance regulation, enforcement and monitoring of the fishing sector
	A10: Grow the number and capacity of fishing cooperatives
	A11: Improve access to modern fishing equipment/infrastructure
	A12: Undertake a market study and increase the marketing of fish and other products accordingly
	A13: Feasibility study for establishment of integrated aquaculture / mariculture systems to take pressure off nearshore fisheries and to increase food security
	A14: Investigate opportunities for synergies with other Blue Economy Sectors
	A15: Undertake natural capital valuation to determine value of ecosystems and associated services in order to support future development and management decisions
	4.3.2. Climate resilient infrastructure projects
	Project 2: Mangrove restoration
	Project 3: Solar refrigeration cold storage and ice making
	Project 4: Upgrading of landing sites and jetties
	Project 5: Marine Spatial Planning Pilot Project
	Project 6: Establish Blue Economy Innovation Centre
	4.3.3. Aggregation model
	Sea-based aggregation model for fishing-related produce
	4.3.4. Value Chain opportunity
	Fish processing VC to catalyse development
	Project 7: Fishing cluster and Mokowe landing site upgrade

Source: Atkins analysis



4.3.1 Soft Initiatives, Training and Capacity-building

This section outlines the soft initiatives, training and capacity building interventions proposed to protect and maximise benefits from Lamu's extensive marine and freshwater resources, improve inclusion of excluded groups and increase the resilience of the sector. Ultimately, the aim of these initiatives is to position the sector to maximise the potential benefits of the recommended climate resilient infrastructure projects (section 4.3.2), aggregation model (section 4.3.3) and the identified VC opportunity of fish processing (section 4.3.4). While not a definitive roadmap, the initiatives are presented in a logical sequence for implementation, starting with actions that can be introduced immediately and following through to longer-term interventions.

A7: Preparation of an Integrated Water Quality Protection Plan

Waste from a variety of land-based sources, including wastewater, litter and plastics and terrestrial run-off (including sediments) are having an impact on the health of critical marine habitats such as mangroves, coral reefs and seagrass beds (for example in Mokowe, Lamu Town, Pate and Manda islands). These habitats provide key ecosystem services such as natural coastal protection and carbon sequestration, as well as underpinning key economic sectors such as fisheries and tourism. Furthermore, the inadequate treatment of wastewater in the nearshore area around Lamu Town can result in increased levels of bacteria in coastal environments, risking people's health. As such, surface water management and wastewater treatment and disposal are a concern in Lamu and its improvement is highlighted as a priority in the Lamu County Integrated Development Plan 2018-2022 for the health of the public and the environment.

The development and implementation of a comprehensive Integrated Water Quality Protection Plan (IWQPP) (including monitoring and enforcement) including solid waste, point sources from industry, marine pollution from ports and

vessels, sewerage outfalls and non-point source pollutants (such as pesticides entering the marine environment through agricultural surface run-off), is seen as key to halting environmental degradation and protecting critical marine habitats and resources for sustainable utilisation by the current economic sectors and for future generations. In addition, the protection of these marine and coastal ecosystems will support the ongoing provision of vital ecosystem services which are critical in the context of climate change.

The IWQPP should also include provision of restrictions and best practice for current and future port operations. For example, mangrove habitats are extremely sensitive to changes in water level and increases in the level of suspended sediment in and around their aerial roots. As such, activities such as regular wave action caused by vessel movements and capital and maintenance dredging can have detrimental impacts upon the health of coastal ecosystems. Appropriate management of these activities will need to be incorporated within the IWQPP. In addition, the IWQPP should incorporate the actions targeting wastewater and solid waste under the Tourism and Heritage Action Plan (section 4.4.4).

A8: Undertake training and establish ongoing fish stocks assessment to inform the development of a Sustainable Fisheries Management Plan

The fisheries sector is vital for local food security and livelihoods, but the management of fishing resources is hampered by insufficient data, human resources, equipment and capacity for assessment, monitoring, research and enforcement.

A comprehensive training programme for fishers, those involved in fisheries services (e.g. sustainable fishing practices, processing) and for the Department of Fisheries (with some training modules combined) would support the sustainable growth of the sector. The programme would include:

- > Training and development for fishers to improve safety, catch quality and non-destructive fishing methods – safety at sea⁵⁹, business and financial management, as well as marketing and post-harvest activities to add value and which could offer additional work opportunities to women along the value chain, and a co-management approach with regulators (for example in Marine Protected Areas); and
- > Training of the Department of Fisheries staff in safety at sea, data collection, stock assessment, marine data management (including new technology), and co-management approach with fishers. Some specific components of the training could be undertaken at the regional scale where other countries with similar priorities would benefit (e.g., capacity building for effective monitoring and surveillance to tackle illegal, unreported and unregulated fishing).

There are currently very limited training centres across the County, with the majority of training taking place in nearby counties, for instance at Liwatoni Fishing Complex in Mombasa⁶⁰. As a result, there is scope to develop additional training centres in the fishing communities of LC, such as Mokowe, which could be operated by cooperatives or community groups (see Action 10). To promote social inclusion, it is recommended that a cohort of young people are trained as peer educators⁶¹, as individuals will be more likely to engage in training if developed by peers.

Training a youth cohort could also represent an opportunity for additional income. This system could also be implemented with other SIGs. A clear and well-designed communication strategy should be implemented to inform communities about training opportunities and the benefits they can get in terms of increased catch capacity, resilience and revenues.

This action combines a series of individual interventions aimed at improving the capacity of the fisheries sector, for both the community / private side, as well as that of the government. This action should result in the establishment of a Sustainable Fisheries Management Plan, underpinned by robust monitoring data and accompanied by the development of a necessary training modules to ensure sustainability of the fisheries sector in the future.

A9: Enhance regulation, enforcement and monitoring of the fishing sector

Historically, there has been inadequate collaboration between the national government and the LC government in terms of the policing of Kenya's territorial waters. As a result of this ineffective monitoring and surveillance, illegal fishing has occurred by fishing vessels from other countries, contrary to international law. Illegal, Unreported and Unregulated (IUU) fishing has posed a major threat to Kenya for several decades, with an estimated \$200 million loss in revenue annually due to illegal fishers invading East African Waters.

IUU fishing also decimates rapidly-diminishing fish populations, undermines vulnerable ecosystems and threatens marine species. Fishing trawlers use a number of methods to evade law enforcement in areas where maritime security is weak, such as falsifying vessel licenses and registration information, underreporting catch size, using illegal gear and incorrect vessel names, and turning off their transponders to avoid detection.

As a result, there needs to be greater regulation of Lamu's fishing area to reduce fish stock depletion and to protect local fisherfolk from these impacts. While the Beach Management Unit (BMU) was initially established in Lamu to strengthen the management of fish-landing stations, fishery resources and the aquatic environment, the BMU is currently under-resourced

59 Open water fishing can be risky. Safety at sea can be improved through training in the use of safety equipment such as navigation lights, personal equipment, signals, and sound-signalling devices, as well as risk assessments of vessel, engine and weather conditions, and training in international best practice (e.g. watchkeeping, communications, collision avoidance, fish catch handling, night working on deck, etc.), together with emergency procedures.

60 Kilimo News, Training Deep-Sea Fishers in Mombasa (2021), Available at: <https://kilimonews.co.ke/agriculture-policy/training-deep-sea-fishers-in-mombasa/>, (Accessed: 29/11/2021).

61 OECD, The Future of Rural Youth in Developing Countries: Tapping the Potential of Local Value Chains (2018).

with regards to staffing and budget, with limited capacity to address the issues of IUU. The Kenya Coast Guard Service, established in 2018, has had some positive impacts on health of fish stocks, however further local support will be needed to monitor and regulate other destructive practices such as bottom trawling. There needs to be greater enforcement in the area, for instance, in the form of sea policing or the establishment of a regional control and surveillance centre.

Understanding, mapping and monitoring fishing grounds will also be critical for resource management. Local experts who can sample catch from these grounds will also be important in helping to understand stocks and trends. Stock assessments will provide vital data to better inform decision-making for policy and management measures (see A8 above)

A10: Grow the number and capacity of fishing cooperatives

Fisherfolk in Lamu have pushed for the revival and empowerment of key fishing cooperatives such as Faza, Kizingitini and Kiunga. Such cooperatives have remained dormant for many years, with several unsuccessful efforts by area leaders and locals to revive them. It is evident that cooperatives in the small-scale fisheries sector have the potential to maximise long-term community benefits to deal with the pressures of fisheries management, livelihood insecurity and poverty – harsh realities for many of Lamu's fisherfolk. Indeed, the 2008 Global Conference on Small-scale Fisheries acknowledged that “while for historical reasons the term ‘cooperatives’ can have a negative connotation, it is generally accepted that cooperatives could improve the resilience and stability of fishing communities”⁶².

Increasing the number and capacity of fishing cooperatives may contribute to Lamu's fishing sector in the following ways⁶³:

- > Enhancing fishers' negotiating power with market intermediaries, helping stabilise markets, upgrading post-harvest practices and facilities, supplying marketing logistics and information, and enabling investment in communal infrastructure like cold storage and fishing processing facilities;
- > Engaging excluded groups such as women, youth, elderly people, and PWDs in fishing activities and decision-making processes;
- > Benefitting from economies of scale, with respect to the transportation of catch to markets and agri-processing facilities. This is particularly relevant for transport to the fish processing facility (section 4.3.4) through the sea-based aggregation model (section 4.3.3).
- > Exploiting their stronger negotiating power to enable cost-saving bulk purchases of fishing gear, engines and fuel and to advocate with government; and
- > Providing microcredit schemes for fisherfolk, to lessen their dependency on intermediaries and delivering them greater freedom in selecting buyers.

Case Study 4.6 - Regional Monitoring, Control and Surveillance Centre, Gulf of Guinea⁶⁴

The Fisheries Committee for the West Central Gulf of Guinea (FCWC) has established a Regional, Monitoring, Control and Surveillance Centre (RMCSC) to help counter illegal fishing in the Gulf of Guinea. Headquartered in Tema, Ghana, the centre will support FCWC member countries Benin, Cote d'Ivoire, Ghana, Liberia, Nigeria and Togo to manage their fishing sectors.

The RMCSC will play a critical role in coordinating and supporting activities and initiatives to end IUU fishing. Building on the success of the FCWC West Africa Task Force, the RMCSC provides an operational hub to support operational cooperation, improve communication and build regional capacity to stop illegal fishing. Key activity areas include:

- > Vessel monitoring and analysis to support coordinated efforts of fisheries inspection at port and at sea;
- > Developing a Regional Record of Authorised Fishing Vessels, to maintain an up-to-date, easy-to-access list of authorised and IUU listed fishing vessels;
- > Coordinating regional and joint at-sea patrols, to identify vessels operating illegally, without authorisation or in contravention of national or regional conservation and management measures;
- > Establishing a Regional Observer Programme, to provide first-hand scientific and compliance information; and
- > Training and capacity building, to strengthen capacity for monitoring, control and surveillance.

62 FAO, Report of the Global Conference on Small-Scale Fisheries: Securing Sustainable Small-Scale Fisheries (2009), Available at: www.fao.org/docrep/012/i1227t/, (Accessed: 27/11/2021)

63 FAO, Increasing the Contribution of Small-scale Fisheries to Poverty Alleviation and Food Security (2005), Available at: <http://www.fao.org/docrep/009/a0237e/a0237e00.htm>, (Accessed: 27/11/2021).

64 FCWC, Regional Monitoring, control and surveillance centre (2021), Available at: [Regional Monitoring, Control and Surveillance Centre – Fisheries Committee for the West Central Gulf of Guinea \(fcwc-fish.org\)](http://www.fcwc-fish.org/), (Accessed: 03/12/2021)

The FAO outlined a number of key recommendations for strengthening fishing cooperatives, including supporting mechanisms such as special policies and strategies. With regards to the context of Lamu, stakeholders can undertake the following actions to support the revival and empowerment of the County's fishing cooperatives⁶⁵:

- > Fisherfolk and fisherwomen could engage in cooperatives as a social self-help movement. It is recommended to promote the creation of SIGs groups and their participation in existing cooperatives;
- > Donors and international agencies could support increasing the capacity of fishing cooperatives. For instance, in supporting the creation of microfinance schemes. In doing so, it will be particularly important to acknowledge women's and men's different roles, social norms, potential inequalities in their access/control of assets, and gendered access to income-earning opportunities.
- > Government agencies (including the County Fisheries Department), through enabling legislation and policy development, could initiate strategies to revive cooperatives to promote better and fairer options for fishing communities. Focused interventions to enhance the accessibility and effectiveness of cooperatives' infrastructure and services are critical.
- > NGOs and civil society organisations (CSOs) can lobby for government and donors to drive the creation and assistance of cooperatives through extension programmes. Knowledge-sharing and exchange programmes with other cooperatives could be provided, for instance, by forming regional and global networks of fishing cooperatives.
- > To avoid unintended negative consequences associated with these measures and to enhance SIGs' access to its benefits, it would be important to consider the recommendations in the GeSI Assessment for the fish processing VC.

A11: Improve access to modern fishing equipment and infrastructure

LC has an extensive coastal area available for fishing, including a range of commercial and rare fish species. However, at present, Lamu's vast offshore resources are currently not targeted. This is predominantly due to the inadequate modern equipment and infrastructure available. In particular, the narrow continental shelf limits fishing activity to the shallow waters, as a lack of modern equipment does not permit deep sea fishing. There is also a pressing requirement for increased cold storage at all landing sites. The unavailability of such facilities at present has resulted in post-harvest losses and constrained income generation. This, in turn, also limits opportunities for development of added value, as it is difficult to distribute products onwards without appropriate storage or processing. In most cases, fish harvested is sold in raw form and thus highly perishable, leaving fisherfolk at the mercy of potential buyers.

Consequently, there is a clear need to better-equip Lamu's fishing sector to increase capacity, to expand fishing activities further offshore over deep water, and to reduce post-harvest losses. Above all, the business surveys identified the following equipment and infrastructure as critical in enhancing both productivity and resilience of fisherfolk within the County:

- > Appropriately placed cold storage facilities, as outlined in section 4.3.2.1. This is a cross-sectoral intervention and leaders across the agriculture, energy, education and food sectors must work together to ensure the successful integration of cold chain technology. There needs to be careful consideration around what cold storage will best suit Lamu's climate, value chain projects, energy and transport infrastructure. To successfully integrate cold storage into the aggregation model (described in sections 4.3.2.2 and 4.3.3), there needs to be significant supporting services and skills development such as logistics, maintenance capabilities, education and management skills; and

- > Development of a local fleet of fishing boats capable of deep-sea fishing, with the potential to increase fishing catch, as well as equipment that allows longer fishing ventures and improved quality of catch. Such boats could integrate technology to improve efficiency and encourage sustainable fishing in line with the Sustainable Fisheries Management Plan described under A8 above.

A viable solution for improving access to modern equipment and infrastructure is the availability of communal resources, for instance through the cooperatives outlined in Action A10, which fishers can book to use. Local small-scale fisherfolk could be grouped together to jointly invest in such equipment, thus reducing the upfront capital cost for the individuals and encouraging collaboration. This would increase sector efficiency, maximise productivity and boost incomes for fishers. In line with Action A8 and A9 above, fishers should be trained in sustainable and safe fishing techniques, as well as the threats to Lamu's valuable marine resources posed by unsustainable fishing practices and challenges like bottom trawling, ghost fishing and bycatch.

A12: Undertake market study and increase the marketing of fish and other products accordingly

Once Lamu's fisherfolk are positioned in cooperatives with access to modern equipment, a market study should be undertaken to identify those fish species and associated products in demand in both the domestic and international export markets. The business consultation process identified a significant lack of knowledge of effective marketing techniques amongst local fisherfolk, with the majority relying on word of mouth and referrals to publicise their produce. As such, there is scope for the development of a fishing business support platform in Lamu, which would focus on aspects such as marketing (targeted at the species and products identified through the market study), accounting, access to finance and business management.

⁶⁵ FAO, Cooperatives in Small-Scale Fisheries: Enabling Successes through Community Empowerment (2012), Available at: <https://www.fao.org/3/ap408e/ap408e.pdf>, (Accessed: 27/11/2021).

This could also include expeditions to other coastal towns to exchange ideas on marketing and establish contacts in the industry, as currently organised to Mandera by Lamu Youth Alliance. The platform could be established and operated by fishing cooperatives, in collaboration with the public and private sector, to include a team of fishing experts and technologists. The ultimate goal of the platform would be to holistically develop fishing businesses, ensuring that productivity, sustainability and resilience are all maximised through access to information, knowledge and skills.

Foundation of a Lamu Fishing Export Board could also play a major role in increasing the marketing of fish to international markets. An Export Board could provide advice to businesses on export promotion, negotiate shared deals with brokers and develop a branding strategy around Lamu's fishing sector. The Board should be developed in close cooperation with the public and private sector and include local businesses, fishing cooperatives, representatives from the Chamber of Commerce and Lamu County Government trade and fishing officials. This could involve working alongside the Kenya Fish Processors and Exporters Association (AFIPEK), a national association formed to promote Kenya's fisheries resources trade in both the domestic and export markets, to identify issues that constrain exports from Lamu and to develop solutions to facilitate and maintain trade ⁶⁶. The Board should also drive forward social inclusion and climate resilience, as well as Blue Economy principles, to ensure the longevity of the fishing sector.

As part of its operations, the Board could provide fisherfolk with a centre within the Municipality where they can obtain information on fishing/boat licenses and business certificates, as well as sustainable fishing practices to align with various international requirements. This centre could be integrated with a training premises for fisherfolk (as discussed in Action A8). Such a facility should be located in an accessible and convenient location for the sector, for instance in Mokowe, which currently represents the central point of the fisheries supply chain in the County – in line with the fish processing

VC. Alternatively, a business centre for fisherfolk could be incorporated within the proposed Blue Economy Innovation Centre (Project 6). Crucially, it will be important to ensure the centre provides information in a language and format that is accessible to all.

The GeSI assessment also indicated that many women in LM engage in the sale of fish. Hence, it would be important to include women and understand their needs when developing these measures. Further recommendations can be found in the GeSI assessment for the fish processing VC and the GeSI study (Appendix C).

A13: Feasibility study for establishment of integrated aquaculture / mariculture systems to take pressure off nearshore fisheries and to increase food security

The aquaculture / mariculture sector has the potential to provide income and food security for communities/cooperatives and small business across the LC. There is also potential to expand exports, while creating new jobs and supporting income diversification.

However, a feasibility assessment to inform aquaculture development will depend on the state of development of the industry in the County.

This action includes the review of existing studies to determine the current state of understanding / development. Investigation of potential sites for aquaculture / mariculture development will depend on the species proposed. The species proposed will depend on the market evaluation, skills assessment and financial options available for Lamu (see A12 above).

- > Market evaluation – commerciality, scale, price setting (high volume/low value versus low volume/high value), export market (regional/international), marketing (joint marketing, brand development – country/regional cooperative marketing);

- > Skills assessment and gap analysis – what training is required for husbandry, processing, marketing, business management;
- > Financing options – what support could be available to fund mariculture development – government support for training, for business start-up / support. Possibly integrating into different elements of feasibility assessments outlined above;
- > Consideration of climate change and extreme event resilience – modelling may be required;
- > Needs to link to EIA, spatial planning policies, LAPSET corridor, tourism – to avoid and minimise conflict, and to consider potential for colocation of activities;
- > The feasibility study could include high level mapping for potential locations, based on GIS information, satellite, bathymetry, currents, etc. – with technical support from UK Agencies (Cefas, NOC, UKHO); and
- > Identification of sites for development of sustainable aquaculture and mariculture sites.

This action will support diversification of the economy, rural, fishing, and further employment opportunities and development of a local supply chain. It will also support sustainable food production and economic resilience.

⁶⁶ AFIPEK, Providing Leadership to Support and Strengthen Kenya's Trade in Fish and Fish Products (2019), Available at: <https://www.afipek.org/>, (Accessed: 29/11/2021).

A14: Investigate opportunities for synergies with other Blue Economy sectors

For economic sectors to grow, they must either adapt to the new market requirements or identify synergies with other sectors in order to create added value and new jobs. The Figure 4.12 illustrates an example of how synergies could bring high added-value to Lamu through existing sectors, such as fisheries, or alternatively, new sectors with potential, like mariculture by boosting Research and Development (R&D) and operations for advanced bio-tech production, fostering regional partnerships for distribution and exploiting infrastructure activities for the same purpose. It is also proposed to explore and support potential synergies with other activities as a result of energy dispersion in processing activities (e.g. tourism or marine renewable energies).

In Lamu, there is potential to develop synergies between the fisheries sector with other activities, such as tourism, agriculture, marine surveillance and Marine Protected Areas to create more jobs and capture more value.

The development of these synergies with growing/emerging activities (yachting and marinas, aquatic sports) implies the improvement and sustainability of existing infrastructure (roads, ships, ferries, etc.) and strengthened sustainability of in/out-bound routes and local assets (traditional vessels) in order to foster capacity to promote offers with high added-value (i.e. focus on greater local economic gains) and lower ecosystem impact. In line with the diversified tourism offer outlined in the Tourism and Heritage Action Plan (section 4.4), it targets the improvement of the diversification and greater quality of the current offering (cultural heritage, nature) and the expansion to in-land attraction (easing pressure on sensitive local areas) and link to new (non-coastal) products (e.g. tourism). Examples of such synergies could include the greater value of fishing as sport activity and associated quality catering services, use of by-products from agricultural processing to produce fish aggregation devices, and the use of marine-derived products as natural fertilizers to reduce harmful runoff from agricultural practices.

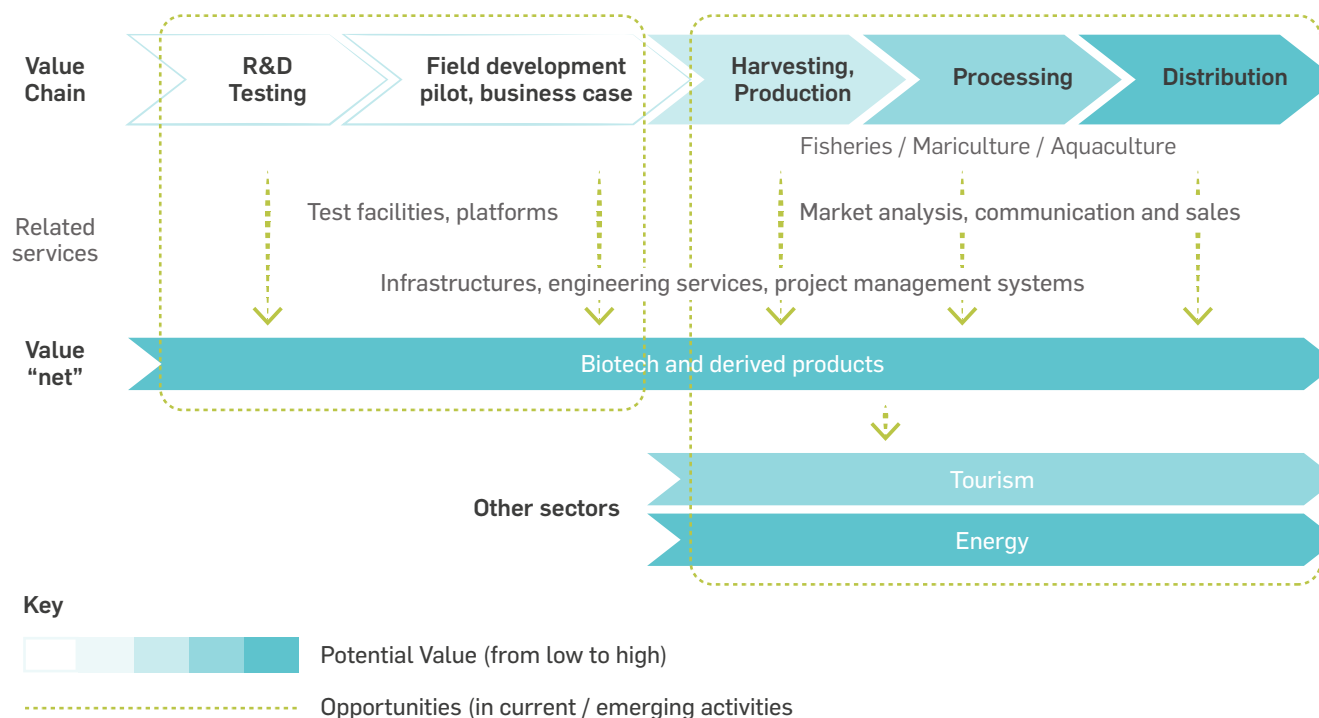
A15: Undertake natural capital valuation to determine value of ecosystems and associated services in order to support future development and management decisions

Coastal and marine ecosystems provide a variety of ecological functions that directly and indirectly translate to economic services and value to humans. However, the value of ecosystem services is often difficult to quantify as it is not easily captured in 'traditional' economic balance sheets. It may not be immediately visible in markets, business transactions, or national economic accounts and it may only be perceived when services are diminished or lost ⁶⁷.

The importance of natural assets can be disregarded if they are undervalued, and they may become overused or depleted. In turn, this may have real and significant, if unintended, knock-on effects to economic sectors.

Valuation of ecosystems and development of a transparent monitoring scheme is the building block to accessing international payment for ecosystem services.

Figure 4.12 Proposed sector synergies for production of bio-products



Source: *Stratégies Mer et Littoral, 2021 Blue Economy Assessments [Unpublished]*.

⁶⁷ Pascal, N., Molisa, V., Wendt, H., Brander, L., Salcone, J., and Seidl, A., (2015) Economic assessment and valuation of marine ecosystem services: Vanuatu. A report to the MACBIO project. GIZ/IUCN/SPREP/Suva/Fiji.

4.3.2 Climate-resilient Infrastructure Projects

4.3.2.1 Project 2: Mangrove Restoration

Project Overview

Mangrove forests are biodiverse, productive ecosystems that deliver important ecological and socioeconomic benefits. The services provided by mangroves include acting as breeding, spawning and nursery grounds for commercial fisheries; they aid the regulation of floods, storms, and coastal erosion; they aid prevention against saltwater intrusion; aid water purification; and help climate regulation through carbon sequestration. Between 1990 and 2019 at least 1,739 ha of mangroves were lost as a result of coastal deforestation and pollution from urbanisation and industrialisation, which equates to a loss of 60 ha per year⁶⁸. The main threats to LC's mangroves are from dredging, urbanisation, commercial harvesting, oil spills and pests⁶⁹.

This proposal sets out ways to implement mangrove restoration projects that increase the health and coverage of mangrove forests across LC. Restoration of mangroves can provide climate benefits (mitigation and adaptation), reduce coastal flooding, enhance biodiversity and fish stocks, and thus support livelihoods. Under a hybrid approach to coastal protection, mangroves and seagrass beds can act as a buffer to reduce the impact of waves and when used alongside infrastructure solutions such as levees, allow for lower levee design heights to achieve the same protection thereby reducing the visual obtrusion effect and investment needed for coastal protection⁷⁰.

This project has three proposed components:

- > **Planning:** Identify areas where mangrove degradation could lead to a loss of mangrove goods and services. Decide which action to take (i.e. planting new trees or safeguarding natural regeneration. Identify and engage with key stakeholders to discuss objectives, participation, benefits of restoration, and integration into the water quality protection plan.
- > **Implementation:** Undertake the relevant environmental and socio-economic assessments to identify features that could impact mangrove establishment, select sites, establish a mangrove nursery and transplant the saplings into the restoration area. Provide training on mangrove restoration and conservation including how, where and when to plant mangroves, and how to monitor their degradation.
- > **Monitoring:** Long-term monitoring is essential to maximise long term success and provide lessons for future projects.

Enhanced public understanding and awareness with regard to the mangrove's ecological and economic values are also vital to ensuring the proper implementation of the rehabilitation plan. The importance of environmental education should be considered as a potential tool to elevate the residents' knowledge, understanding and awareness of the mangrove system⁷¹. The International Day for the Conservation of the Mangrove Ecosystem, adopted by the General Conference of UNESCO in 2015, is celebrated annually on 26th July⁷². This presents a major opportunity for promoting the issue of mangrove degradation in Lamu, for instance through conferences and seminars with global expert speakers to share their knowledge on sustainable solutions and best practice examples.

These community awareness events could include contributions by local NGOs like Lamu Youth Alliance, who have previously organised major clean-up events and awareness campaigns to coincide with World Environment Day, as well as other international initiatives. Community members should also be encouraged to actively engage in the management and conservation of Lamu's mangroves through stewardship. This could include training communities in the collection and storage of ecological information and data to monitor the mangroves, as well as developing a programme for local involvement in replanting, maintaining and protecting mangroves⁷³. Such training could be provided through Mtangawanda, who are already experienced in mangrove conservation and restoration, which in turn represents an income-generation activity.

Location

Potential locations for mangrove restoration projects include:

- > Coastline surrounding Mpeketoni;
- > Coastline surrounding Mokowe; and
- > Coastline surrounding Kikmani/Lamu-Manda Airport

The final locations will need to be determined through a detailed feasibility assessment and stakeholder engagement.

Linkages

This proposal has the potential to link with the all weather access roads (project 1), Lamu Old Town waterfront improvement (project 9), Lamu Municipality drainage masterplan (project 18), Discovery trail (project 8), Wiyoni Bay clean up (project 10), Marine Spatial Planning Pilot Project (project 5) and Blue Economy Innovation Centre Project (project 6).

68 Kairo, J., Mbatha, A., Murithi, M., Mungai, F. (2021) Total Ecosystem Carbon Stocks of Mangroves in Lamu, Kenya; and Their Potential Contributions to the Climate Change Agenda in the Country. *Frontiers in Forests and Global Change*. 4.

69 Based on stakeholder feedback

70 Deltares, Coastal vegetated ecosystems essential for keeping coastal protection affordable in low income countries (2021), Available at: <https://www.deltares.nl/en/news/coastal-vegetated-ecosystems-essential-for-keeping-coastal-protection-affordable-in-low-income-countries/> (Accessed: 03/12/2021).

71 Rahman, M.A. and Asmawai, M.Z., Mangrove Degradation: Issues and Awareness (2018), Available at: <https://pdfs.semanticscholar.org/a916/ae3634399f7e9d516a747a77357d02713dc6.pdf>, (Accessed: 25/11/2021).

72 Rwanda MAB Youth, Celebration of the International Day for the Conservation of Mangrove Ecosystems (2021), Available at: <https://www.rwandamabyouth.net/post/celebration-of-international-day-of-mangrove-ecosystem>, (Accessed: 25/11/2021).

73 UNEPSCS, Community Involvement, Public Awareness and Education for Mangrove Conservation and Restoration in Trat Province (2016), Available at: http://www.unepscs.org/components/com_remository_files/downloads/MRT-4-D1-Trat.pdf, (Accessed: 25/11/2021).

This project is aligned with national priorities on climate change and biodiversity, and will provide climate, environmental and job creation benefits, while at the same time being targeted to support the inclusion and empowerment of SIGs and marginalised groups. Specifically, the proposal aligns with:

- > Priority adaptation actions for the Environment sector outlined in Kenya's Intended Nationally Determined Contribution (INDC 2015); 'Enhance the resilience of ecosystems to climate variability and change'⁷⁴. It also contributes to the mitigation activities of the INDC through the role of mangrove forests in carbon sequestration which supports a low carbon, climate resilient development pathway; and
- > The strategic direction and actions for protecting mangrove forests as an important natural resource in CSP and CIDP.

Recommendations in the recently published The Landscape of Climate Finance in Kenya (2021)⁷⁵ which provides recommendations for climate-relevant expenditures needed to achieve Kenya's INDC, and highlights investment in Blue Economy and climate adaptation as key priority areas. The objectives of Kenya's National Mangrove Ecosystem Management Plan (2017-2027)⁷⁶; are in particular 'To manage and protect mangrove areas for fisheries, erosion control, coastal stabilization and biodiversity conservation'.

Additionally, mangroves present an opportunity for blue carbon finance. These ecosystems have a high CO₂ sequestration rate of approximately 603tCO₂e/km²/year, and a substantial carbon stock, estimated at 104,710tCO₂e/km²^{77,78}. This carbon sequestration potential can be used to attract private investment to fund mangrove conservation through voluntary carbon markets where businesses fund the

conservation projects that lead to carbon sequestration and in that way offset their own emissions. This is similar to the ecosystem service payments that national governments currently make to other nations in order to protect areas of the rainforest in other parts of the world. This project will learn from and build on the progress achieved by existing projects, such as the Mtangawanda Mangrove Restoration Women's Group. Through this initiative, women receive small loans to start businesses within their community and, in return, they must undergo training on mangrove restoration and conservation. This not only acts a women's economic empowerment strategy, but also strengthens women's roles as agents in climate action and in decision-making processes. The replication and expansion of this model has the potential to include other SIGs and marginalised groups. There are a number of existing mangrove projects and restoration groups based in Kenya which provide an opportunity for this proposal to learn from and work with:

- > Mtangawanda Mangrove Restoration Women's Group – in partnership with the Kenya Forest Service (KFS), The Nature Conservancy (TNC) and Northern Rangeland Trust (NRT);
- > The Mikoko Pamoja Community-led Mangrove Conservation and Restoration Project based in Gazi Bay, South Kenya. In partnership with Plan Vivo;
- > The Sheldrick Wildlife Trust working with Eden Reforestation Projects, Lamu Conservation Trust (LCT) and Kenya Forest Service manage a terrestrial reforestation project on Amu and Witu Ranch and are expanding their efforts to restore severely-degraded mangrove forests along the coast. The project began July 2020 with the aid of volunteers sourced through the Beach Management

Unit which has been instrumental in combatting mangrove deforestation⁷⁹;

- > Pate Marine Community Conservancy;
- > Pate Mangrove Restoration Group;
- > Faza Mangrove Restoration Group;
- > Mtangawanda Mangrove Restoration Group;
- > Siyi Mangrove Restoration Group;
- > Ndau Mangrove Restoration Group;
- > Kizingitini Mangrove Restoration Group;
- > Kiunga Community Wildlife Association;
- > Awer Community Conservancy;
- > PRATTI; and
- > Rasini Environmental Organization (REO).

Alongside their role in coastal ecosystems, disaster risk management (against coastal erosion, storms and flooding) and climate regulation, mangroves provide opportunities for livelihoods in coastal communities through fisheries, ecotourism and beekeeping. Mangrove flowers provide a food source for bees which in turn pollinate the mangroves and aid the regeneration of the forests. Beekeeping is an opportunity for farmers and fishers to diversify their income and supplement their earnings from seasonal fishing. This has been trialled in Da Loc commune in northern Vietnam by 40 families who received professional training and food to settle two colonies of breeding honeybees. One farmer has managed to expand their colony to ten hives that are continuously producing more and better-quality honey and provides an increasing source of income⁸⁰. There are several examples of green investment into mangrove restoration and coastal protection projects, and this proposal is designed to be able to attract sources of climate and sustainable finance.

74 Ministry of Environment and Natural Resources, Kenya's Intended Nationally Determined Contribution (INDC) (2015).

75 The National Treasury and Planning, The Landscape of Climate Finance in Kenya: On the road to implementing Kenya's NDC (2021), Available at: <https://www.climatepolicyinitiative.org/wp-content/uploads/2021/03/The-Landscape-of-Climate-Finance-in-Kenya.pdf>, (Accessed: 06/12/2021).

76 Ministry of Environment, Natural Resources and Regional Development Authorities, Republic of Kenya National Mangrove Ecosystem Management Plan: Summary for Policy Makers (2017).

77 Atwood, T., Connolly, R., Almahasheer, H., Carnell, P., Duarte, C., Ewers Lewis, C., Irigoien, X., Kelleway, J., Lavery, P., Macreadie, P., Serrano, O., Sanders, C., Santos, I., Steven, A. and Lovelock, C. (2017). Global patterns in mangrove soil carbon stocks and losses. *Nature Climate Change*, 7(7), pp.523-528.

78 Breithaupt, J., Smoak, J., Smith, T., Sanders, C. and Hoare, A. (2012), Organic carbon burial rates in mangrove sediments: Strengthening the global budget. *Global Biogeochemical Cycles*, 26(3).

79 Sheldrick wild life trust, Reforestation Initiative in Lamu County (2020), Available at: <https://www.sheldrickwildlifetrust.org/news/updates/reforestation-lamu>, (Accessed: 03/12/2021).

80 The World Economic Forum, Honeybees are transforming the lives of mangrove farmers in Viet Nam – here's how (2021), Available at: <https://www.weforum.org/agenda/2021/07/bees-viet-nam-farmers-mangroves/>, (Accessed: 26/11/21).

Table 4.11 Project 2 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
Stakeholder engagement	Total cost = KES 3.64 million⁸¹	Aligned with the Blue Economy approach	Donor/IFI or private sector	National Land Commission (NLC)
Social and environmental analysis	Benchmark KES 280,000 per ha, assumption of 13 ha to be rehabilitated	Improved carbon storage		National Environmental Management Authority (NEMA)
Development of implementation plans		Reduced flood risk		Kenya Forest Service (KFS)
Training on mangrove management techniques		Social inclusion and economic empowerment opportunities		LC Government
Development of monitoring plans		Improved opportunities for fisheries		The Nature Conservancy (TNC)
				Kenya Marine and Fisheries Research Institute (KMFRRI)
				National Mangrove Management Committee (NMC)
				Lamu Conservation Trust (LCT)
				Kenya Wildlife Service (KWS)
				Kenya Forest Research Institute (KEFRI)
				Northern Range Trust (NRT)
				Community Based Organisations (CBO)

Source: Atkins analysis

Table 4.12 Project 2 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Ensuring sufficient staff to implement project	Environmental surveys and site investigations	Short term
High demand for forest products from logging	Secure funding for implementation and monitoring	
Protection of the mangrove forests from heat stress and extended drought periods		

Source: Atkins analysis

⁸¹ Total cost includes capital and operating costs, also cost for seedling component is included and estimated at 0.96 million KES assuming cost of 15 KES per seedling, and 4900 seedlings planted per ha.



SUED principles for implementation

Climate-resilience recommendations

- > Mangroves provide mitigation against erosion and flooding from storm surges and increasing sea levels;
- > Mangrove restoration could have beneficial impacts on surrounding coral reefs as the mangrove forests provide shading which may mitigate the severity of coral bleaching from thermal stress⁸²;
- > Mangroves provide a vital nursery and breeding ground function to numerous marine species which are subsequently recruited to coral reefs and seagrass beds and maintain the health of these ecosystems;
- > Extreme weather conditions including heat stress, prolonged drought events and reduced sea level as a result of extended drought periods can cause mangrove dieback⁸³. Similarly, climatic variations associated with El Niño Southern Oscillation (ENSO) phases, particularly drought conditions and increased salinity, can cause dieback⁸⁴; and
- > Mangrove forests are one of the largest carbon sinks storing on average 937 tC per hectare⁸⁵ and accounting for 14% of carbon sequestration by the global ocean⁸⁶. Most of the carbon in mangroves is stored below ground in dead roots. Site selection for restoration projects should consider drivers that may affect carbon sequestration, for example seagrass beds and coral reefs directly adjacent to mangrove forests can enhance mangrove soil carbon stocks by protecting mangroves through reduced wave action⁸⁷.

Social inclusion recommendations

This initiative represents opportunities for economic empowerment of SIGs and other disadvantaged groups. Moreover, it contributes to their empowerment as agents in climate action and with their participation in decision-making processes. Most of these groups have local knowledge that should be recognised, valued, and enriched.

- > It is recommended to integrate local NGOs that are currently working with environmental protection and conservation. In this way, this project does not compete with similar initiatives, but builds on them. For example, seeds to grow mangroves for the mangrove bed for wastewater treatment can be obtained from the Mtangawanda Women's group;
- > The process for distributing loans in exchange for mangrove restoration training should be done in a transparent way, carefully selecting beneficiaries. It is recommended to continue the example of local initiatives and prioritise the integration SIGs in these activities and the development of additional economic empowerment opportunities;
- > Mangrove restoration sites should be carefully considered to avoid negative impacts on fuel supply which particularly affects women and livelihoods of local communities more generally; and
- > The monitoring and evaluation phase of the health of the mangroves and their potential carbon credit should be carried out in a transparent and participatory manner. Ensure SIGs are heard and develop targeted consultation strategies when needed.

Case Study 4.7 - Mtangawanda Mangrove Restoration Women's Group

Mtangawanda Mangrove Restoration Women's Group is a community-led project on the Lamu archipelago. The group works with women and provides training on mangrove restoration including learning about different mangrove species and how, where and when they should be planted, and how to monitor their degradation.

In return, the women are offered loans of US \$250 (KES 25,000) which are repayable in ten-month periods and can be used to open small businesses. Following this, the women then qualify for larger loans. The restoration has seen a recovery of marine breeding grounds with the return of fish and crabs. Controlled harvesting of mangrove provides construction materials for the group which can be sold⁸⁸.



Peter Prokosch, 2014 - <https://www.grida.no/resources/3877>

82 Johnson, J., Dick, J., Pincheira-Donoso, D. (2021), Mangrove forests mitigate coral bleaching under thermal stress from climate change. bioRxiv.

83 Duke, N., Kovacs, J., Griffiths, A., Preece, L., Hill, D., Oosterzee, P., Mackenzie, J., Morning, H., Burrows, D. (2017), Large-scale dieback of mangroves in Australia's Gulf of Carpentaria: a severe ecosystem response, coincidental with an unusually extreme weather event. *Marine and Freshwater Research*. 68(10), 1816-1829.

84 Holbrook, N., Claar, D., Hobday, A., McInnes, K., Oliver, E., Gupta, A., Widlansky, M., Zhang, X. (2021), ENSO-Driven Ocean Extremes and Their Ecosystem Impacts. *El Niño Southern Oscillation in a Changing Climate*, Geophysical Monograph. 253. 409-428.

85 Tonnes of carbon per hectare

86 Alongi, D. (2014), Carbon sequestration in mangrove forests. *Carbon Management*. 3(3). 313-322.

87 MacKenzie, R., Sharma, S., Rovai, A. (2021), Environmental drivers of blue carbon burial and soil carbon stocks in mangrove forests. *Dynamic Sedimentary Environments of Mangrove Coasts*. Elsevier. 275-295.

88 Kenya bulletin, Green growth: the save-the-mangrove scheme reaping rewards for women in Kenya (2021), Available at: <https://kenyanbulletin.com/2021/05/24/green-growth-the-save-the-mangrove-scheme-reaping-rewards-for-women-in-kenya-global-development/>, (Accessed: 03/12/2021).

Case Study 4.8 – Tahiry Honko community-led mangrove carbon project, Velondriake

The Tahiry Honko mangrove carbon project promotes locally led conservation, reforestation and sustainable use of mangroves, as well as initiatives for developing improved and alternative livelihoods such as sea cucumber and seaweed farming, and beekeeping.

The project also generates carbon credits which provides a sustainable income to the project villages and Velondriake management association, which supports fisheries management and the development of infrastructure and community services. The project is implemented by the Velondriake management association with technical support from Blue Ventures and in partnership with the Government of Madagascar. Funding is provided by the Darwin Initiative, the Global Environment Facility (GEF), the MacArthur Foundation and UK Aid.

Creating the benefit-sharing arrangement was identified as one of the key parts of the project development process that led to a successful, long-term project. Fifty percent of the funds are invested into social investment projects in the villages within the area, projects such as solar panels, safe drinking water projects and improved buildings for schools.

The key lesson from the project was that each process needed to be conducted in a transparent, participatory manner. This includes the development of the benefit-sharing scenario and the monitoring and evaluation which affects the number of carbon credits and project income⁸⁹.

89 The Commonwealth Blue Charter, Tahiry Honko – Community-Led Mangrove Carbon Project, Velondriake Locally Managed Marine Area, Madagascar (on-going) (2020), Available at: Tahiry Honko – Community-Led Mangrove Carbon Project, Velondriake Locally Managed Marine Area, Madagascar (on-going) – Commonwealth Bluecharter (thecommonwealth.org) (Accessed: 26/11/2021).

4.3.2.2 Project 3: Solar refrigeration cold storage and ice making

Project Overview

Post-harvest and post-catch losses are a significant problem across the agricultural and fishery sectors. For agricultural produce, cold storage can extend the shelf life of perishable food by between two and 21 days, reducing post-harvest losses by up to 80% and increasing small farmers' income by 25%⁹⁰. For fishing, deterioration and spoilage of fish are accelerated in hot ambient conditions. Cold storage will be useful, however fresh fish still degrade whilst being stored at 30C, so ice is an important component in keeping the catch fresh for as long as possible⁹¹.

The current situation for the northern fish landing sites at Kiunga and Kiwayu is as follows: The smaller boats (rowing boats, traditional dhows) have a capacity of less than 100kg and are usually at sea for less than a day but do not carry any ice. Medium-sized boats (9 m in length) have ice coolers and a capacity of about 400 kg and are at sea for three to four days. They get their ice from an existing facility at Faza. Both small and medium boats sell their catch directly to the larger 40-tonne vessels moored in port at a price of around KES 100 per kilo in Kiunga and KES 200 per kilo in Kiwayu. The larger boats can get their ice from as far as Mombasa. Once full, they can travel down to Lamu and sell their catch at KES 300 to 500 per kilo. Ice storage in Kiunga and Kiwayu would benefit smaller fishers who can take ice on their trips, and cold storage would allow them to sell produce locally at higher rates.

This infrastructure project aims to provide solar-powered cold storage and ice-making systems in strategic fishing and agricultural hub locations to support local fishers and farmers who currently have no access to cold storage and ice and therefore lose part or all of their product due to spoilage. This project is linked with the aggregation models described in sections 4.2.3.

Modular solar-powered cold storage is becoming popular in small farming communities where grid electricity is not available or expensive. The facilities are run by specialist private sector companies who use a subscription model service whereby farmers pay a flat daily rate for each crate of food they store (about KES 5 per kg). Some providers use mobile phone apps to communicate to farmers about the availability of space in the store and to process payments. The revenue created goes towards maintenance of the facility and employment of a facility manager. Many providers target job creation for women.

Modular solar-powered ice making is not as popular yet as it has less application, however the technology exists and is being deployed in the fishing communities of developing countries. It should be noted that ice making plant depends on water. This could be delivered periodically by a water bowser, but an alternative solution may require a borehole water supply and desalination plant (Project 17).

This project will provide a number of small, solar-powered cold stores and ice-making facilities (a half to full-size shipping container each) that will act as hubs to local farmers and fishers who currently have no access to refrigeration or ice services. All farmers and fishers can use the facilities whether they are linked to the VCs or not. Such facilities would also support any aquaculture/mariculture initiatives should they be established also.

The key locations of the agricultural and fishing hubs are already known in LC. Table 4.13 indicates each hub, the services it requires, and its priority.

90 Cold Hubs, Cold Hubs solution and social impact (2012), Available at: <https://www.coldhubs.com/>, (Accessed: 29/06/2021).

91 FAO, Reducing post-harvest fish losses for improved food security (2014), Available at: <https://www.fao.org/3/bs226e/bs226e.pdf>, (Accessed 29/11/2021).

Table 4.13 Project 3 Location, requirements and priority details

Location	Hub type	Cold Storage	Ice-making	Priority
Kiunga	Agri/ Fish	Yes	Yes	Medium-term
Kiwayu	Fish	Yes	Yes	Short-term
Kizingitini	Fish	Yes	No	Medium-term
Shangarubu	Fish	Yes	Yes	Long-term
Mtangawanda	Agri/ Fish	Yes	Yes	Medium-term
New Manda jetty	Agricultural	Yes	No	Medium-term
Mokowe	Agri/ Fish	Yes	Yes	Immediate
Wiyoni/Langoni	Agri/ Fish	Yes	Yes	Immediate
Matondoni	Agri/ Fish	Yes	Yes	Long-term
Kipungani	Agri/ Fish	Yes	Yes	Long-term
Hindi	Agricultural	Yes	No	Short-term
Mkunumbi	Agricultural	Yes	No	Medium-term
Mpeketoni	Agricultural	Yes	No	Short-term
Mpeketoni	Agricultural	Yes	No	Short-term

Source: Atkins

- > The Lamu Port development has not been considered in this assessment; and
- > The existing ice facility at Faza serves the fish landing site at Kizingitini

This project has several proposed components:

- > The size of the facilities will be based on determining the following:
 - > The number, size and location of arable farms and livestock holdings and their seasonal outputs, the current status of their storage facilities and refrigeration needs, and current produce sales practices;
 - > The number of small and medium-sized fishers, their daily and seasonal catches, their ice and refrigeration needs, and current produce sales practices;
- > Preparation of designs for solar refrigeration systems and ice-making systems as well as a procurement and deployment plan (for ice-making this includes determining the best option for supply of water);
- > Selection of land and deployment of systems to selected locations; to include construction of facility, roll-out of payment mechanism, selection, and training of managers; and
- > Capacity-building with selected locals to ensure maintenance and operation of systems.

Location

These systems will be located in the 13 sites identified in Table 4.13.

Linkages

- > Linkages with some VCs, specifically fish processing.
- > Linkages with sea-based and land-based aggregation models
- > Project 17 desalination plant

Table 4.14 Project 3 Summary Information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
Establishment of needs for solar refrigeration and ice-making systems	Total cost = KES 13.75 million	Reduced produce spoilage leading to higher revenues for small farmers/fishers.	Donor funding is available from numerous sources, including Self Help Africa and AGRA	Site selection – LM with assistance from national agricultural specialists
Preparation of design brief for refrigeration systems	Cold storage benchmark: KES 750,000 per system	Ability of fishers to sell direct to local communities	Public sector funding may be available from the central government via the Ministry of Agriculture, Livestock and Fisheries	Equipment selection – LM with assistance from cold chain specialists
Development of procurement and deployment plan	Actual cost: KES 9.75 million based on 13 systems	Employment opportunities for women and other SIGs		Construction and implementation – LM
Develop training plan, for management, operation and maintenance	Ice-making benchmark: KES 3-500,000 per system Actual cost: KES 2.4-4.0 million based on 8 systems			Operation and maintenance – responsibility of LM

Source: Atkins analysis

Table 4.15 Project 3 Basic Analysis and Timeline

Challenges	Data gaps	Time frame, key dependencies
Obtaining comprehensive data on the current situation	Limited knowledge of current scale of demand for cold storage facilities in each site	Short, medium, long-term (refer to Table 4.13)
Obtaining funding for an initial construction		Aggregation models
Developing a business model to ensure long-term sustainability		

Source: Atkins analysis

SUED principles for implementation

Climate-resilience recommendations

This project contributes to both climate change and social inclusion objectives. The project targets small farmers and fishers who currently suffer losses in potential earnings, and adverse effects on their livelihoods, from spoilage of produce before it can reach market and monopolistic practices. As both extreme, and average, temperatures in Lamu have increased, and will continue to do so under all emissions scenarios, the incidence of high temperatures causing products to spoil is likely to increase. Providing cold chain solutions that are powered by renewable energy and which target small-scale farmers and fishers will help increase their resilience to climate change, and as such strengthen their livelihoods.

Social inclusion recommendations

This project also represents employment opportunities and local communities, particularly for women and other SIGs. In terms of access, FGDs in Lamu have indicated that SIGs face several barriers to access infrastructure and technology opportunities. To tackle this, it would be important to:

- > Prioritise ICT-based solutions that could minimise access barriers that women and other SIGs face. Complement these initiatives with campaigns to foster digital skills, particularly among disadvantaged groups;
- > Develop a communication strategy on local radios, in markets, and through mobile campaigns to disseminate information about existent opportunities. Ensure this strategy is in a language and format accessible to all, particularly to SIGs and SIGs organisations;
- > Ensure the employment opportunities associated with the project, such as maintenance staff, and facilities managers, prioritise employment of SIGs and other vulnerable groups.

Case Study 4.9 - Solar cold storage in Wakatobi and Pacitan, Indonesia⁹²

Contained Energy successfully developed and deployed stand-alone, off-grid, 100% solar-powered cold storage facilities with thermal energy storage technology in combination with ultra-efficient compressor packages.

The 20 m³ unit was designed to keep 500 kg of fish at -2°C, with the capacity of adding and cooling 200 kg of 'un-iced' fish per day (for a total cooling load of 30 kWh per day). It is powered by a 6.4 kW solar array backed up by a relatively small 10 kWh valve regulated lead-acid battery bank.

The unique feature of the system is that it deploys a large volume of Phase Change Material in the ceiling, capable of storing and releasing 15 kWh of cooling capacity at -4°C. This thermal energy storage technology allows the compressor package to do most of its 'cooling work' during the day, when the solar power is available, saving a substantially larger quantity of battery storage that would otherwise be required. The cold storage helps local fisherfolk to keep their catch fresh for longer once they have returned from fishing.



92 FAO, Renewable energy and reducing food loss and waste in fish value chains (2020). Available at: <http://www.fao.org/flw-in-fish-value-chains/flw-in-fish-value-chainsresources/articles/renewable-energy-and-reducing-food-loss-and-waste-in-fish-value-chains/es/> (Accessed: 23/04/2021).

Case Study 4.10 - High-tech solar ice making machine, Indonesia⁹³

Indonesia's small-scale fisherfolk in disadvantaged regions will be able to sell their products nationwide with the help of seamless refrigeration chains. This is being made possible by a solar-powered machine for the production of ice blocks. This innovative type of unit was developed as part of a multi-year German-Indonesian cooperation arrangement. Indonesia is the world's leading tuna producing nation and second largest fish producer overall. However, small-scale fisherfolk who practice environmentally-sound fishing methods are often unable to transport their fish to consumers due to a lack of refrigeration facilities.

Indonesia's policy aims to conserve fish stocks and secure the income of fisherfolk in remote areas. The key to achieving this is to keep the catch continuously refrigerated. German Development Agency (GIZ) initiated and provided support for the development of a solar powered ice-making machine. Together with a number of Indonesian, German and other European companies, the production of these machines was also established in Indonesia. Development began in 2016 and the pilot plant started up successfully in 2018. The first commercial unit went into operation in Indonesia in 2021. The innovative technology ensures the production of up to 1.2 tons of block ice per day, dynamically and automatically adapted to the amount of solar energy available. This does not require either a power connection or an expensive, large battery storage system, allowing ice blocks to be produced in locations away from power grids and used for cooling locally-caught fish.



93 Ziehl-Abegg, High-tech solar ice-making machine (2021). Available at: <https://www.ziehl-abegg.com/en/company/press/press-releases/news-content-detail/innovative-solar-ice-making-machine-for-indonesian-small-scale-fishermen>, (Accessed: 20/11/2021).

4.3.2.3 Project 4: Upgrading of landing sites and jetties

Project Overview

There are about nine jetties in LM, the most prominent being the Kenya Ports Authority (KPA) customs jetties on Lamu Island and Mokowe on the mainland⁹⁴. These two jetties are the busiest recording high numbers of boats carrying passengers and goods. Mokowe jetty is the main gateway to Lamu Island and other islands. Manda jetty connects Manda airport to Lamu Island, Faza Island and the mainland. Besides these, other jetties are found in Mkunumbi, Magogoni, Kizingitini, Mtangawanda, and Matondoni. Landing steps are provided in various locations on Lamu Island, Shela, Kipungani and Mokowe. Jetties around Lamu Island are shallow and only allow for small vessels to anchor, however arrivals and departures are often affected by tides. Larger vessels anchor in the far sea, and operators use small vessels to bring goods closer to the island.

A wide improvement programme is needed to enable jetties to serve current passengers and goods traffic, future traffic generated by the aggregation network (section 4.3.3) and the proposed ferry services (project 16). The key jetties that will interface with ferry services and aggregation network are shown in Figure 4.13.

Figure 4.13 Key jetties along water transport network



Source: Atkins analysis

94 Lamu County, CIDP (2018).

A phasing plan should focus first on improving the primary jetties within Lamu Island and Mokowe which mark the main entry and exit points into Lamu. Once developed and operations are streamlined, further growth could be accommodated by upgrading critical jetties based on demand volumes. Complementary facilities to support the function of these jetties should also be considered. This will range from intermodal facilities that interface with land transportation, passenger and cargo facilities, cold storage, refuelling stations and repairing facilities for vehicles and boats.

Location

Lamu Island, Mokowe and Lamu Municipality.

Linkages

- > Livestock, Agriculture and Agri-Processing Sector;
- > Project 16 Ferry services; and
- > Aggregation models.



Table 4.16 Project 4 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
<p>Carry out a demand-supply capacity assessment of the existing jetties and landing site and prioritise upgrades</p> <p>For each of the prioritised jetty/landing sites the following should be considered:</p> <ol style="list-style-type: none"> 1. Develop the architectural design for new jetties and landing steps 2. Assess the need for supporting infrastructure i.e., fuelling stations, waiting areas, parking spaces for boda boda and donkeys and access ramps for goods and PWDs 3. Conduct an Environmental and Social Impact Assessment for the proposed jetty project 4. Conduct geotechnical site investigations, bathymetric and hydrographic surveys 5. Seek development approval for relevant authorities for construction of the jetties/landing site 	<p>Total cost = KES 40 million</p>	<p>Improved accessibility to the islands and mainland for residents, tourists, fisherfolk, farmers, and suppliers. Accessible options for PWD</p> <p>Improved goods handling, hence reduced transportation cost</p> <p>Controlled oil spillage with appropriate ancillary infrastructures i.e. fuel stations</p>	<p>Kenya Port Authority, Development Partners and LC government</p>	<p>Partners and Kenya Port Authority (KPA)</p> <p>LC government</p> <p>Kenya Maritime Authority (KMA)</p> <p>Public Private Partnerships</p> <p>Boat Owners and Operators Associations</p> <p>Maritime logistics companies</p>

Source: Atkins analysis

Table 4.17 Project 4 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
<p>Lack of capacity need assessment for jetties across Lamu</p> <p>Funding constraints</p> <p>High environmental impact associated with reconstruction works</p>	<p>Lack of data on volume trends of logistics and passengers' inflows and outflows from islands and mainland</p>	<p>Medium-term</p>

Source: Atkins analysis

SUED principles for implementation

Climate-resilience recommendations

The principal climate resilience issue is to ensure that jetties and landing sites are designed to consider sea-level rise, avoiding the risk that they gradually become more prone to flooding over their life-time. Jetties can increase the risk of coastal erosion on the down drift side. Measures to armour the coastline may be necessary to control erosion and dissipate wave energy.

Social inclusion recommendations

Accessible jetties and landing sites will contribute to enhancing transportation services in Lamu, hence improving connectivity and fostering economic growth.

- > It is recommended that the jetties follow principles of universal design and ensure PWDs accessibility (i.e.: install wide entrances for wheelchair users, ticketing machines at an accessible height, ramps, step-free accesses, adequate signage, and use non-slippery surfaces). Complement these measures by ensuring there are transport options that accessible to PWD;
- > Ensuring timely communication to local residents and adjacent businesses on the implementation schedule of different projects is recommended in order to mitigate any disruption of traffic, everyday life, and economic activities. This communication should be in formats and languages that are accessible to all.
- > Prioritise employment for local communities and SIGs whenever possible. Communicate these opportunities to, and liaise with, existent local NGOs and cooperatives.

4.3.2.4 Project 5: Marine Spatial Planning Pilot Project

Project Overview

The competition for marine and coastal resources and space is increasing around Lamu and is expected to continue to do so, despite the fact that the ocean is still under pressure from pollution, overexploitation and biodiversity loss. This increase in competition will further risk conflict and degradation of resources. To support decision-making about the sustainable management of the marine space at the County level, one option could be the development of a Marine Spatial Plan (MSP) pilot project for Lamu, that would complement the existing County Spatial Plan, forming a natural continuation seaward from the coastline. This MSP would strengthen ocean governance and reduce conflict between the numerous activities and users of the sea, such as tourism, fisheries, marine transport, conservation, or mariculture. The MSP will provide the necessary framework for planning and regulatory efficiency, while safeguarding valuable marine habitats and ecosystem services. This would be the first Marine Spatial Plan in Kenya. Any lessons in design and implementation of a pilot MSP in Lamu could be adjusted, replicated, improved, or expanded in Mombasa, Kilifi, Tana River, and Kwale.

The MSP for Lamu could outline, for example, significant and potential areas for underwater natural values and cultural values, energy production, fishing, aquaculture, shipping and tourism, as well as guidelines for long-term sustainable development. This should not be intended to reserve areas for a particular purpose and should not be interpreted as such, but rather to guide environmentally-sound development of activities. The aim would be to reconcile the needs of different sectors of the Blue Economy operating in the marine environment and thus enhance the management of maritime industries and the state of Lamu's valuable marine environment.

To develop an MSP for Lamu, the marine spatial planning process should be participatory and involve wide community engagement, in order to be inclusive and equitable in the distribution and maximisation of space and benefits to all groups, including those traditionally underrepresented in decision making such as youth. This consultation should be developed in extensive cooperation with various national and local stakeholders involved in the blue economy and the management of Lamu's ecosystems – including the LAPSET Corridor Development Authority, Kenya Ports Authority, Lamu government agencies, NGOs and other community and civil society organisations. If stakeholders are involved within the design and development of the MSP for Lamu, it will have higher acceptance and success.

Development of the MSP should include the application of an ecosystem approach, based on goals related to the marine environment and linked to the SDG14 'Life under water'. Such goals should determine growth limits for operations in Lamu's marine areas, as well as ensuring the sustainability of its maritime activities. In order to mitigate impacts upon the County's marine resources, the interaction between its Blue Economy sectors and the environment should be assessed, as well as the interaction between sectors. This will require a comprehensive understanding of Lamu's socio-ecological system, including a detailed knowledge base regarding the marine environment and the pressures to which it is exposed. Stakeholder involvement will therefore be important in terms of collecting a sufficient knowledge base, ensuring transparency, communicating uncertainties and mitigating conflicts between sectors early on in the process.

The outcome will be that the use of coastal and marine resources and space continue to support Lamu's Blue Economy development while integrating sectoral activities and contributing to social inclusion.

The MSP pilot project for Lamu, should be aligned with marine spatial plans developed for neighbouring regions, and integrate with the National Spatial Plan (2015) that covers the entire territory but also 21 km² of Kenya's Exclusive Economic Zone.

The project has four phases:

- 1. MSP initial preparation** – In this phase, the public is informed of the intention to develop an MSP for Lamu, that will complement the existing CSP (2016-2026). This is intended to allow people and communities to organise themselves to be involved in the coming development and implementation of the MSP. During this stage a lead organisation should be identified through a consultative process.
- 2. MSP development process** – This phase involves the definition of principles and objectives for the MSP, and the data collection and analysis of the existing environment, to support the design of future scenarios and the necessary regulatory instruments. Once data of the existing marine and coastal resources and human activities has been collected and formatted, it should be displayed in a draft map covering the geographical scope area of the MSP pilot, to facilitate stakeholders' visualisation and analysis of potential conflicts and future scenario formulation. Every MSP development process is different, and it is likely that more than one draft of the MSP will be developed and put to public consultation through which it will be progressively refined.
- 3. MSP formal adoption** – The MSP needs to be formally adopted by the authority that will oversee the implementation of the plan and published in the official gazette. It is recommended that the publication of the adoption of the final MSP is also carried out through complementary means, such as local newspapers or the civic centre.

- 4. Implementation, monitoring and enforcement** – The final phase involves the enforcement of the regulations derived from the MSP for the different areas and activities taking place in the marine environment. The MSP will be accompanied by a series of approved guidelines, policies, and regulations that will need to be monitored and enforced. Finally, after a period of monitoring and implementing the MSP, the plan should be reviewed, and adjusted, if necessary, to account for new activities, needs and regulations. The period of review should be established as part of the MSP participatory development process.

Location

The MSP pilot would cover Lamu County, including the archipelago, and the marine area around the LAPSSET Corridor development. However, the final design and geographical coverage of the pilot should be agreed in the MSP development phase.

Linkages

- > Linkage to Blue Economy Innovation and Training Centre Project 6;
- > Linkage to Mangrove Restoration Project 2;
- > Linkages to Upgrading of Landing Sites and Jetties Project 4;
- > Linkage to Ferry Services Project 16;
- > Linkage to Training and Capacity Building initiatives (several actions under section 4.3.1);
- > Linkages to Aggregation Model (section 4.3.3);
- > Linkages to Lamu Old Town Waterfront development Project 9; and
- > Linkage to Development of Tourism Offer (section 4.4.1)

Table 4.18 Project 5 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
MSP initial preparation	Total cost = KES 550 million	It is likely that this project will contribute to the development and economic growth of: sustainable tourism, fisheries, aquaculture and mariculture, development of marine renewable energy, maritime transport, and conservation efforts	International Donors / IFI	Implementation agency / leading partner:
Public communication			Central government	County government of Lamu with external support
MSP development process			Co-finance public sector at County level	Supporting stakeholders including:
Identify lead organisation				Non-governmental Organisations
Define principles and objectives				Community-based organisations
Data collection				Kenya Maritime Authority
Mapping of marine and coastal resources, and human activities				Kenya Wildlife Service
Stakeholder consultation				Kenya Navy
Draft Marine Spatial Plan				Kenya Marine and Fisheries Research Institute
More stakeholder consultation				Survey of Kenya
MSP formal adoption				National Land Commission
Recognition by competent		Greater planning certainty to attract investor opportunities		Ministry of Environment and Forestry
Implementation				National Environment Management Authority
Monitoring				LAPSSET
Enforcement				Ministry of Tourism
Periodic review of the MSP				Private sector
				Others

*For instance, in the past (2006), Kenya Wildlife Services has had the mandate to manage Kenya's marine parks and reserves while the Fisheries Department oversees the exploitation and management of the fisheries within the marine parks and reserves. In this scenario, it is notable that while the Fisheries Department promotes sustainable use, Kenya Wildlife Services only allow preservation. This conflict in the management approach has resulted in confusion on the ground in terms of what activities to permit and what to prohibit⁹⁵.

SUED principles for implementation

Climate resilience recommendations

The MSP process should include climate change and its potential impacts to Lamu as an integral part of the mapping and formulation of future development scenarios and should be embedded from the start.

Climate change will affect the quantity and distribution of marine and coastal resources in LC, with increases in ocean temperatures, changes in storminess, and potential changes in currents and upwelling, all changing the mix of resources available, as well as the level at which they can be sustainably harvested. There is a need, therefore, to include different scenarios of change as part of the development of the MSP, and to include consideration of climate change as part of the adaptive management approach taken.

Table 4.19 Project 5 Basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Limited capacity at local level to carry out MSP development and implementation	Limited environmental data and information available	Medium term three to five years
Potential for some stakeholders influencing the MSP over others if the process is not equitable and transparent	Limited regulatory harmonisation	
Mandate for institutions and organisations involved in the MSP implementation should be clear and specific to ensure institutional liability and accountability (see example below)*		
Focus on terrestrial planning and limited knowledge on marine planning activities		

95 Swanson, R., Menczer, K., and Michaels, G., (2006), Kenya Forest and Coastal Management Programs: Mid Term Evaluation. USAID

Social inclusion recommendations

The MSP process should:

- > Involve wide stakeholder consultation and offer engagement opportunities to SIGs and other marginalised groups who may have lower levels of representation or face barriers to access traditional consultation events. Ensure publication of notices for participation and review of the draft MSP are displayed at the local level, in a format and language accessible to all, to enable equitable access;
- > Be transparent during the entire design and planning process. Develop community co-management agreements with the government for specific areas of coastal resources; and
- > Support capacity-building of communities to increase the level of engagement in the MSP and empower them.

Case Study 4.11 - Ecosystem-based approach to Integrated Marine and Coastal Environment Management (EIMCEM) - Marine Spatial Planning pilot project in Ghana⁹⁶

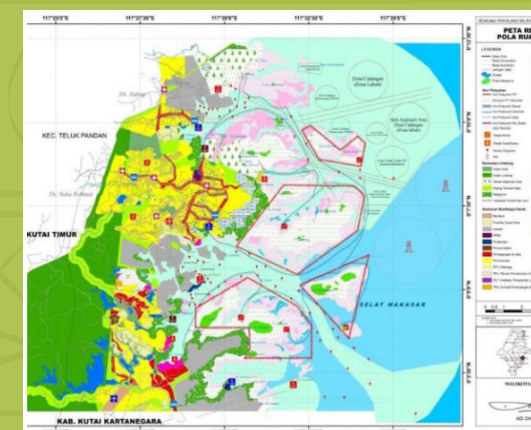
The pilot project in Ghana involves analysing and allocating space for economic activities, ecosystem services and conservation values in Ghana's maritime area, to achieve the economic objectives set by the country's medium-term economic policy.

The project's overall goal is to contribute to sustainable economic growth by ensuring an integrated management of Ghana's coastal and marine environment. This is being done by strengthening national capacity for ecosystem-based management of the marine and coastal environment by preparing a state of the marine environment report, as well as by developing a marine spatial plan for the country's territory waters. In addition, a transboundary objective entails collaboration with Ghana's neighbour to the West, Côte d'Ivoire, in a process that could be replicated around the continent.

⁹⁶ Mami Wata, Ecosystem-based approach to integrated marine and coastal environment management (EIMCEM) (2018), Available at: Ghana Pilot Project – Project description – The Mami Wata Project, (Accessed: 20/12/2021).

Case Study 4.12 - Implementation of Integrated Coastal and Marine Spatial Planning of Bontang, Indonesia⁹⁷

In 2012, the new integrated spatial plan of Bontang City in Indonesia, was adopted by the local parliament and has been implemented in stages. It now includes both land and marine areas with its mangroves, coral reefs and seagrass beds located within four miles of the shoreline. It is the first example of the implementation of the Indonesian Law No 26/2007 on Spatial Planning and Law No 27/2007 on Coastal Area and Small Islands Management to be applied in coastal districts/cities in Indonesia.



⁹⁷ Mami Wata, Implementation of integrated coastal and marine spatial planning of Bontang (2015), Available at: Implementation of Integrated Coastal and Marine Spatial Planning of Bontang – The Mami Wata Project, (Accessed: 20/12/2021).

4.3.2.5 Project 6: Blue Economy Innovation and Training Centre

Project Overview

With maritime activities projected to grow, there is an increasing need to provide adequate maritime training and qualifications to fill jobs locally. The introduction of new technologies (e.g. renewable energies, new fishing methods) and larger vessels (e.g. container ships, ferries), together with additional requirements to comply with multilateral agreements (e.g. waste water, safety at sea, etc.), require an 'upgrade' and update of skills and knowledge of the local and regional human capital.

Currently there are limited training opportunities in LC. As a result, people have to travel to Mombasa, Nairobi, Watamu or Kisumu to access training courses linked to the Blue Economy and maritime sector.

A Blue Economy Innovation and Training facility which offers upskilling of traditional learning curricula and includes highly relevant maritime topics such as vessel servicing, renewable energy (e.g. salt water air conditioning, photovoltaic panels, electric water taxis), coastal risks and climate change could create sustainable jobs (with a focus on youth, and potentially on women), and support economic sectors across the County. The Innovation and Training Centre could foster youth's entry into maritime jobs, and lead to sustainable economic growth of the Blue Economy sectors in Lamu, in areas such as tourism, fisheries, maritime transport, port operations, inter-island ferries, maritime surveillance, mariculture, environmental monitoring and marine habitat protection.

This new learning centre would offer an environment that encourages and enables the development of new techniques and innovation, and could include the following areas of focus:

- > Ocean monitoring – learning about ocean health / water quality to inform decision making and conservation initiatives such as mangrove management, dredging, coral reef diversity and restoration, among many others. Training in monitoring of sea level rise, ocean acidification, and other

effects from climate change to inform decision-making can be supported by the Association of Commonwealth Universities and international agencies, such as the UK National Oceanography Centre;

- > Integrated mariculture system – the adoption of new mariculture practices that are 'clean' and sustainable and aligned to the local demand, exploring the use of by-products from agriculture, such as the use of coconut husk or bagasse. Products from the integrated mariculture systems could also be used to support the agriculture sector as natural fertilizers, thus minimising potentially harmful runoff from entering the marine system;
- > Blue carbon valuation – data collection of seagrass beds and mangroves to quantify carbon storage could help value conservation projects and support the national greenhouse gas inventory. Ecosystem services valuation of terrestrial habitats has been a source of financing for some time, which now has potential to be expanded into the marine and coastal habitats; and
- > Sustainable fishing practices – development of new techniques, management approaches and use of alternative materials could benefit and grow the artisanal fishing sector, potentially enabling it to expand activities further offshore over deep water, and also making it more resilient to climate change and economic shocks. This can be supported by training in fish stock assessment and the development of a Sustainable Fishing Management Plan.

Training and learning courses can be tailored to specific, contemporary needs and run on a demand-led programme. Additionally, there is potential for the training to be linked to education programmes from the national education centres, such as universities in Nairobi, while placing the facility in Lamu Island, which offers an opportunity for decentralisation and has economic expansion plans driven by the LAPSET Corridor development which will require skilled labour in numerous areas. Furthermore, the new Blue Economy Innovation and Training Centre could complement the work currently being carried out by:

- > the Institute of Chartered Shipbrokers in Mombasa, which covers a wide range of maritime disciplines but focuses on freight and port operations (agency work, surveying broking, insurance, ship operations, etc.);
- > the Indian Ocean Maritime Training Centre in Watamu, which focuses on boat handling and vessel safety courses; and
- > the Kisumu Marine School in Lake Victoria, which provides education and training for professionals and technicians in a variety of maritime aspects.

If successful, the Blue Economy Innovation and Training Centre could provide much-needed training and capacity building at the national and regional level to support both current and future needs of the Blue Economy, with the potential to increase upstream and downstream benefits (e.g. students from the interior requiring accommodation, travel, etc.), 'exporting' trained staff to other coastal localities or African countries. Importantly the Blue Economy innovation and training centre should also create an enabling space to support new and innovative ideas and approaches to enhance sustainability and added value of local Blue Economy sectors.

The project has four phases:

- > Feasibility study to establish the blue economy innovation and training centre in Mokowe;
- > Location selection and design (could be an existing facility);
- > Facility establishment (either re-conditioning of an existing building or a new building and incorporation of innovative approaches to make it as energy efficient and sustainable as possible); and
- > Curricula design (based on most pressing need / demand in the Lamu County).

Location

The new Innovation and Training Centre could be located in Mokowe, where it will benefit from the proximity to the services of town, such as transport links to facilitate students access to their training courses.

Linkages

- > Linkage to Ferry Services Project 16;
- > Linkage to Marine Spatial Planning Pilot Project 5;
- > Linkage to Mangrove Restoration Project 2;
- > Linkage to Solar Desalination Project 17;
- > Linkage to Training and Capacity Building initiatives (several actions under section 4.3.1);
- > Linkages to Lamu Old Town Waterfront development Project 9 (e.g. 'living' quay walls);
- > Linkages with the Fish Processing VC opportunity (section 4.3.4); and
- > Linkage to Development of Tourism Offer (section 4.4.1).

Table 4.20 Project 6 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
Feasibility study to establish maritime Innovation and Training Centre in Mokowe	Total cost = KES 1 billion	It is likely that this project will help to contribute to sustainable tourism, fisheries, maritime transport, conservation efforts and renewable energy initiatives	The centre could be financed through a mix of donor/IFI funding for the establishment of the facility, followed by a funding blend from a private public partnership (PPP) (including academia) for demand-led courses and centre' operation	Funding through development partners
Location selection and design (could be through refurbishing of an existing facility)		The tourism sector is an important contributor to the national economy (c. 8% of GDP in 2019) ⁹⁸		Operation through PPP with one of Kenya's universities
Facility establishment		Women constitute 52% of total employment in services, including tourism ⁹⁹		Support from NGOs on specific learning topics, for example mangrove conservation, sustainable aquaculture, etc.
Curricula design (based on most pressing need / demand in Lamu area)		Fishing annual turnover is over KES 1.5 billion for Lamu County ¹⁰⁰		Employ local SMEs for boating services, centre maintenance, catering

Table 4.21 Project 6 Basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Find a suitable place to host the Blue Economy Innovation and Training Centre	Potential locations for the centre	One to two years (start)
Develop a curriculum that responds to the specific needs of the communities and receives a critical mass of students	Capacity of self-finance of the centre	Three years onwards (operation)

Source: Atkins analysis

⁹⁸ World Travel & Tourism Council, Kenya – 2021 Annual Research: Key Highlights (2021)

⁹⁹ KNBS, Economic survey 2017, Women and Men in Kenya facts and figures (2017).

¹⁰⁰ Lamu County, CSP (2017)

SUED principles for implementation

Climate resilience recommendations

The new Blue Economy Innovation and Training Centre should integrate climate change resilience within all its training modules and courses as a principle.

Social inclusion recommendations

Consultations in Lamu Municipality have indicated that a lack of adequate skills is one of the main barriers SIGs face to engage, or when engaging, in the Blue Economy. Learning, innovation and training opportunities have the potential to create local jobs while acting as a regional centre to support development of skills in emerging Blue Economy areas, such as mariculture or marine renewable energy. They could also strengthen job security in traditional Blue Economy sectors, such as fishing and maritime transport.

To maximise benefits for local communities, SIGs and other marginalised groups, however, it is recommended that:

- > The curricula focuses on providing courses and training that target SIGs and other vulnerable or underrepresented groups to increase their participation and skills. In this vein, it is recommended to develop affordable options for low-income communities such as the ILO's C-BED programme¹⁰¹;
- > Training venues, materials and information about available courses are made accessible to all. For example, venues should consider principles of inclusive design and ensure materials are in an accessible format and language; and
- > Develop awareness sessions at the community level and within the centre on gender awareness to work towards progressively tackling taboos and social norms that prevent women's participation the sector.

This training has also the potential to improve the health and safety of those engaging in fishing activities as well as fish consumers. For example, training in sustainable fishing practices could also include training that targets adult and young men who currently engage in fishing and related activities (boat owners, fishing crews) to sensitise them about predominant risks and possible actions to improve health and safety in the sector and measures that can be taken to ensure hygienic standards of fish. These training opportunities should be also used to sensitise, discuss, and understand ways to prevent, gender-based violence (GBV) in the sector.

Case Study 4.13 - Antigua and Barbuda Centre of Excellence in Oceanography and the Blue Economy¹⁰²

In 2021, the Commonwealth Blue Charter Action Group on Sustainable Blue Economy, the University of the West Indies, the Association of Commonwealth Universities, and the Government of Antigua and Barbuda established a new Centre of Excellence in Oceanography and Blue Economy, in the University of West Indies Five Islands Campus in Antigua and Barbuda.

The centre aims to advance intellectual progress and strengthen institutional capacity in the areas of Blue Economy and marine science for the Caribbean region. As part of the Commonwealth Blue Charter, Antigua and Barbuda, alongside Kenya, co-champion member-driven actions that encourage better stewardship of the ocean's 'blue resources' and marine environment.

The centre will draw on the private sector, industry and academic expertise to demonstrate the strengths of collaboration and best practice in Blue Economy activities. The centre will be supported by the Association of Commonwealth Association, to which many Kenyan Universities belong, including the Kenyatta University, Kibabii University, Kisii University, Machakos University, Maseno University, Moi University, South Easter Kenya University, Strathmore University, University of Nairobi, the United States International University (Africa), and the Technical University of Kenya.

¹⁰¹ International Labour Organisation, Community-Based Enterprise Development (C-BED) (2015), Available at: https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/documents/publication/wcms_372761.pdf, (Accessed: 20/12/2021).

¹⁰² The commonwealth, New Caribbean centre for oceanography, blue economy welcomed (2021), Available at: New Caribbean centre for oceanography, blue economy welcomed | The Commonwealth, (Accessed: 16/12/2021).



4.3.3 Sea-based aggregation model

The Fisheries and Marine sector is supported by various stakeholders including fisherfolk, fish traders, boat owners and fish processors. The management and regulation agencies include beach management units (BMUs) and a fisheries department. Most of the fishing communities in LC are in remote area at considerable distance from markets. Currently fisherfolk use small boats such as rowing boats, traditional dhows or medium-sized boats. The typical capacity of these boats range between 50 to 400 kg. Fish catch suffers perishability problems and requires cold storage. Due to poor onboard cold storage facilities fishing boats are usually out at sea for less than a day and sell their day's catch directly to larger 30 to 40 tonne vessels with onboard cold storage anchored at either Kiunga or Kiwayu or seven to ten tonne boats anchored at Faza and Shangarubu. Sales are usually done on order, but fisherfolk can sell directly at a negotiated price. Once full, the large boats travel down to Lamu and Mokowe where they sell their catch.

Locating collection centres with solar powered cold storage and ice-making systems in strategic locations (as described in Project 3) along the water transport route is critical. There is a small-scale ice producer at Faza that supplies local fishing boats with ice, but major ice producers are in Lamu Island which is the primary source of ice for large boats. However, their capacity is limited, and large boats can go as far as Mombasa to restock ice. The only cold storage located along the water route can be found at Kiwayu, with a capacity of one tonne and primarily serves small catch and products to supply the local markets. Once fish is landed at the main markets on Lamu Island and Mokowe, the cold chain breaks where there is a great need for cold storage.

Nine fish collection centres are identified as necessary along the water route, where there are pre-existing fish markets and produce aggregation activities. These are Kiunga, Kiwayu, Kizingitini, Shangarubu, Mtangawanda, Lamu Town, Mokowe, Matondoni and Kipungani as shown in Figure 4.14. The network will need to be complemented with a series of infrastructure facilities to become functional:

- > Cold chain storage from the moment fish is caught together with careful handling will be critical to minimizing spoilage. On-board cold storage will be required on fishing boats. Currently caught fish is stored in iceboxes until the boats return to shore. As fishing boats can be out at sea for long periods of time before catching enough fish to sell, the quality of fish can be severely compromised as these facilities cannot maintain temperature for prolonged periods. Expansion of ice production facilities at Faza are necessary as well as introduction of similar facilities at Kiwayu and Kiunga to support the larger vessels that anchor at these locations;
- > Cold storage infrastructure at Faza, Kiwayu and Kiunga to serve small catch and product destined for local markets could be considered and expanded based on the growth of the aggregation network;
- > Collection vessels with cold storage to aggregate from the collection centres will be required to meet the daily fish demand. The collection vessels will be required to do 'milk runs' from smaller vessels and collection centres to aggregate the required daily volumes. Currently, there are large vessels docked at Kiunga, Kiwayu, Kizingitini, Faza and Shangarubu that serve as mobile cold storage facilities and handle the bulk of fish sold in the area, however they take approximately three days to fill and transport fish to markets. Planned fishing markets at Faza and Kiunga and the processing plant in Mokowe will increase the number

of fish sold locally. In the past fish used to be trucked by road in refrigerated vehicles from Kiunga to Mokowe, but this ceased due to insecurity and the road has since deteriorated. Improvement of security along the Kiunga – Mokowe road link could revive the link as a viable route to market and warrant investment in its rehabilitation;

- > Once landed at Lamu or Mokowe, fish is usually sold directly to local restaurants and hotels or retail at open air markets or on the sea front by traders. Hotels create local niche markets with specific customer preferences requiring some form of primary processing. This typically takes place at landing sites where filleting, drying or smoking happens before being directly marketed to hotels and local markets. The use of ice at these domestic markets is little and fish stock is prone to high spoilage levels. Lamu's Integrated Transport Masterplan recommends the upgrade of Langoni and Wiyoni jetties to cargo jetties (along Lamu Town), the provision of cold storage and pre-processing facilities will also be needed. Similar provisions will be needed at Mokowe;
- > Fish landed at Mokowe is sold to local markets on Lamu mainland or trucked to other parts of the country such as Mombasa for sale. Temperature-controlled trucks would be needed to collect the fish and transport it to markets from the proposed fish processing plant VC (section 4.3.4). Good road access will be required to landing sites along the mainland; and
- > A good public transport connection will be needed to the collection centres for both the fisherfolks and traders from other areas delivering or buying products at the collection centre. A ferry service along the water route would be preferable.

Figure 4.14 Proposed fish collection centres



Source: Atkins analysis

4.3.4 Priority VC fish processing to catalyse development

This VC project is for the establishment of a processing facility for fish and crustacea, together with supporting infrastructure development such as improving key landing sites and cold storage (section 4.3.2.1).

In addition to the substantial employment opportunities including scope for employing special interest groups (SIGs), the benefits of the project include:

- > Improved and stable prices for fisherfolk, supporting investment in boats and equipment;
- > Providing a steady off-take for pond fish farmers and mariculturists, supporting investment and expansion of these activities subject to protecting mangroves;
- > Reduction in post-catch losses by providing an outlet for excess catch (particularly needed in March);
- > Supporting the potential for other fish processing activities;
- > Providing a commercial platform for:
 - > branding and marketing Lamu fish and crustacea;
 - > providing sharia-compliant financing (e.g. through diminishing musharaka supported through catch sharing) for vessels and equipment;
 - > funding to supporting the management and rehabilitation of mangroves;
 - > Providing a raw material (process waste) for a potential feed mill; and
 - > Supporting deep sea fishing vessels landing catch at Lamu and the development of a local fleet to improve safety and quality of catch.

4.3.4.1 Base Assessment

Lamu County has an extensive coastline has been a rich fishing ground supporting inshore and offshore (deep sea) fishing. Sea fishing, and related activities, form one of the most important economic sectors in Lamu Municipality and the wider County. There is an estimated 7,000 fishers and 4,700 fishing boats catching a vast array of both commercial and rare fish species from 40 traditional fishing grounds along the coast. LC accounts for over one quarter of Kenya's landings of fish and crustacea, with an annual catch of around 4,500 tonnes and potential for landings of over 80,000 tonnes per year. In addition, there is an established pond fish farming sector located around Lake Kenyatta and Lake Witu, plus great scope for developing mariculture (see Box 4-1 below).

Despite this strong resource base, the sector faces a number of serious issues:

- > Degradation of mangroves and coral reefs are reducing the ability of stocks to be replenished;
- > Unregulated fishing and overfishing are further reducing stocks;
- > Foreign fishing vessels encroaching on territorial waters;
- > Poor facilities, with the 32 landing sites along the coast having limited, and often inadequate, infrastructure;
- > Little local processing of catch providing in limited local value added and price volatility; and
- > Poor handling along the supply chain resulting in significant post-catch losses, estimated at up to 30% of total landings¹⁰³.

The potential of the sector to develop, together with the issues faced, have been known for some time, and several plans have been formulated. Under the last CIDP the County government has invested in improvements in fishing equipment and vessels and has built modern fish markets in Faza and Kiunga, developed a hatchery and upgraded a boat yard. The Sector Plan for Blue Economy 2018-2022 proposes the development

of a fishing port and market in the County, and the County Government has identified a range of further developments under the 2018-2022 CIDP, including improvements in infrastructure, processing, marketing, and training. In addition, the Lamu Municipality identified the development of sustainable fisheries as one of two projects forming part of their SUED application.

As well as sea fishing, Lamu has potential to develop a mariculture sector along the coast, as well as expand pond fish farming activities inland. Both of these would link into and support sea fishing processing and marketing.

While action is required in many areas to transform the fisheries sector and assist it to reach its potential in terms of value-added and sustainable employment (see section 4.3.4.4), a processing facility has been identified as a key first step in enabling this transformation.

Development of the fish processing and seafood value chain was identified by the LM in their SUED submission and is supported by:

- > Lamu CIDP: which identified the need for action in a range of areas to support and develop the fisheries sector;
- > Sector Plan for Blue Economy 2018-2022: outlining the strategy for developing the sector across Kenya;
- > Marine Fisheries and Socio-Economic Development Project: a €90 million EU-funded project to develop the sector along the coast, supporting all areas from regulations, to capacity building, infrastructure and training.
- > Big Four' agenda: prioritises all areas of agri-processing and value added; and
- > Sector Plan for Blue Economy 2018-2022.

¹⁰³ The World Bank, Kenya Marine Fisheries and Socio-Economic Development Project, integrated safeguards data sheet (2017).

Fish catch and potential landings

Fish catch in LC has been reported at around 2,300 tonnes per year¹⁰⁴ with the total for Kenya reported at 9,000 per year. However, in 2014 substantial under-recording was recognised as an issue and the State Department of Fisheries, Aquaculture, and the Blue Economy introduced a new catch data collection methodology. Under the new system the catch in Lamu County was estimated at over 4,600 tonnes per year, while that for Kenya was estimated at 22,000 to 24,000 tonnes for the period 2014 to 2016¹⁰⁵.

Discussions with fishers during stakeholder consultations identified under-recording as still being an issue. There are three sets of charges applied to reported landed volumes which provide an incentive for under-recording: cess (KES 1 per kg), BMU landing fees (KES 3 per kg), and SACCO fees (KES 1 per kg).

Lamu County accounts for just over 30% of Kenya's overall marine fisheries resource base, indicating that annual catch should be around 6,800 to 7,400 tonnes. The much lower reported level being due to a combination of under-recording and lower level of exploitation due, probably to the higher costs of taking catch to market (Mombasa, Nairobi and exports).

In terms of what could be achieved in the sector, the Kenya Marine and Fisheries Research Institute (KMFRI) estimates that marine fishing in Kenyan waters has a potential catch of up to 270,000 tonnes per year¹⁰⁶. Assuming that the waters off Lamu County are as productive as those to the south, there is potential for landings in Lamu of over 80,000 tonnes per year. These estimates include catch from deep-sea fisheries, where there is substantial illegal catch by foreign vessels, valued at around \$100 million per year¹⁰⁷.

In addition to the sea fisheries potential in the County, there is scope for substantial harvests from mariculture and pond fish farming.

4.3.4.2 Production Potential and Supply Chain

The linkages and interactions between the activities in the fisheries sector, and with the wider economy, are many and complex. The fisheries sector benefits from being developed as a cluster, with the development of each activity supporting growth in other areas. Figure 4.15 provides a simplified version of how the fisheries sector in Lamu could develop.

The central activity that drives investment and expansion across the cluster, is processing. This provides a stable off-take for catch, increases local value added, and cuts post-catch losses due to spoilage. A commercial-scale processing facility will also have a strong financial incentive to take the lead in two essential areas:

- > Standards: to market processed fish and crustacea, the facility will need to ensure hygiene standards and quality control along the supply chain. This could include training for fishers and investments in ice machines, cold storage, landing sites, etc; and
- > Marine management: to support its seafood brand, the facility will have a strong incentive to ensure that all catch is sustainable, and this extends to supporting the work of the BMUs, mangrove restoration groups and the management of mangroves as the nurseries for many of the species caught. As well something that is necessary for sustainability, actions in this area could help gain internationally recognised certification, such as the Marine Stewardship Council's marks, which would strengthen the Lamu brand and support marketing.

104 Lamu County, statistical abstract (2015).

105 EU, Marine Fisheries Socio-Economic Development Project (2017).

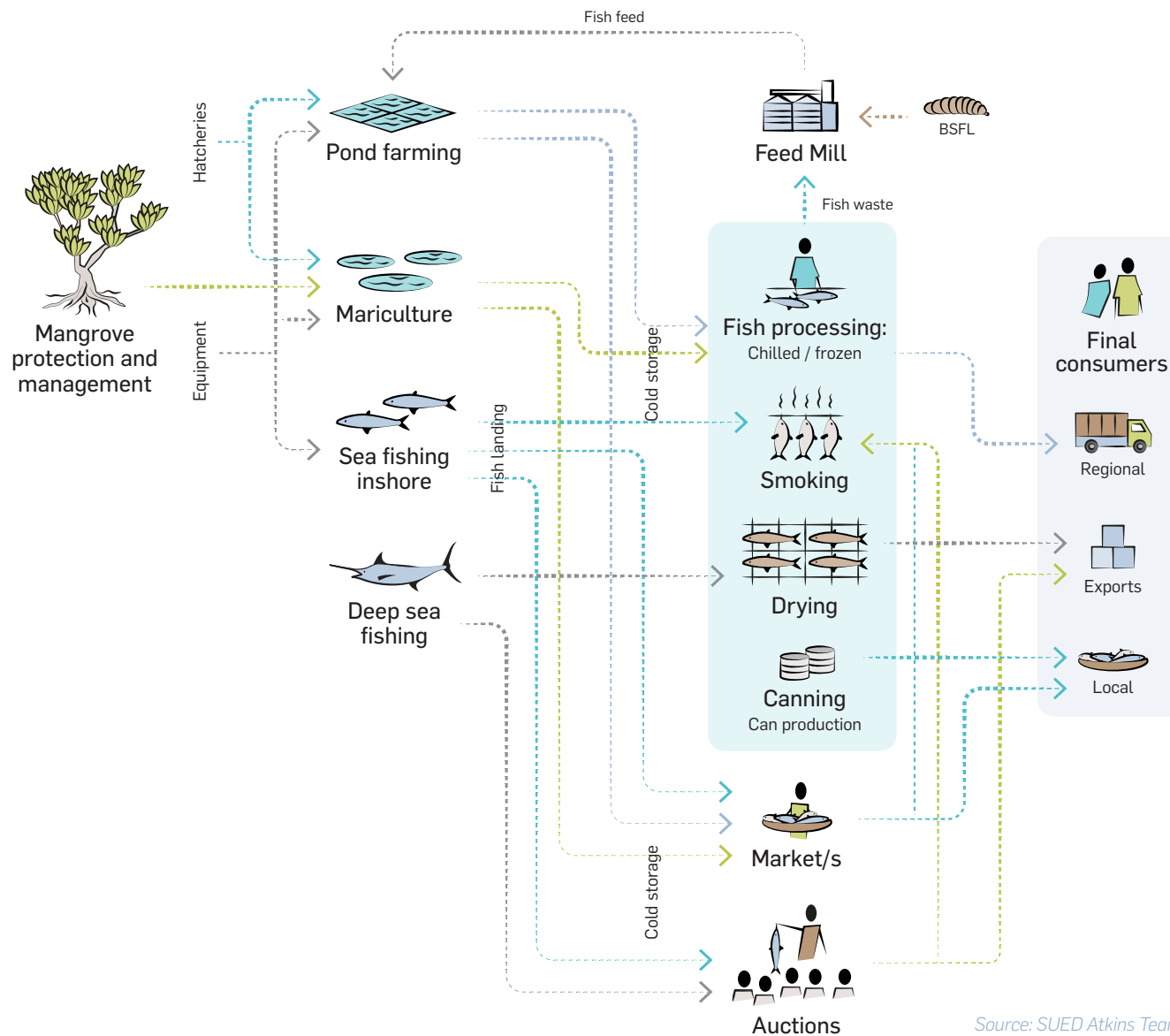
106 Kenya Marine and Fisheries Research Institute, Technical report on fish biomass and the environment of Kenya's exclusive economic zone (2017).

107 Unregulated and unrecorded fishing loss to Kenyan economy estimated by Marete and Benkenstein. South African Institute of International Affairs, Prospects for the Kenyan Blue Economy (2018).

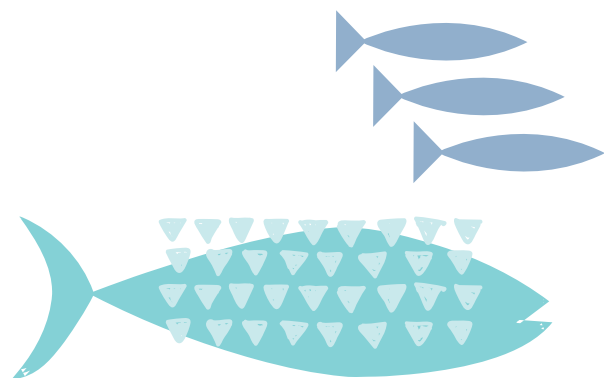
The VC can benefit from links with other fishing groups along the coast, in particular the Malindi sea fishing cooperative which represents directly the fishers in Kilifi County, and indirectly many of the traders and small-scale processors. Fishers do not follow county boundaries and regularly move along the coast throughout the season, in particular fishers from Kilifi County move up to Lamu during their local off season. There are therefore potential benefits to be achieved through joint action in:

- > Coordination over joint fisheries;
- > Combined virtual auction;
- > Joint marketing and sales, targeting export markets;
- > Joint dispatch, e.g. higher value fish by air freight (Malindi fish traders have experience in this that can be built upon);
- > Coordination of seafood festivals and other market promotions; and
- > Coordination of training and accreditation activities.

Figure 4.15 Future fisheries cluster and linkages



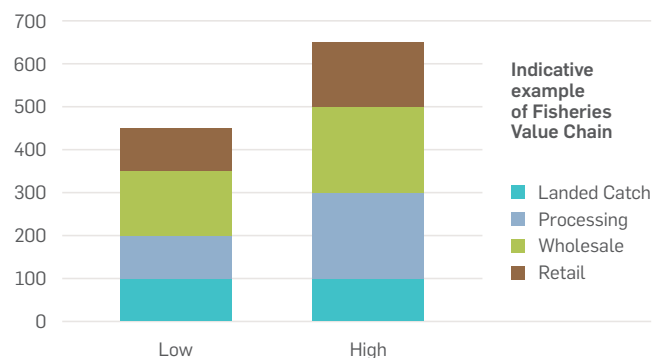
Source: SUEd Atkins Team



Production process

Processing and packaging of fish and related products often has a value added in excess of the initial catch. A review by the FAO showed that in general for fish, the processing value added ranges from 100% to 200% of the value of the initial catch. Generalised indicative prices/value added for fish are shown in Figure 4.16.

Figure 4.16 Fisheries value chain



Source: SUEA Atkins Team

The processing facility would source supplies from fishers, taking a range of commercial species, and producing a mix of chilled and frozen products, and canned, packaged for wholesale and retail customers. Processing would include:

- > Cleaned (gutted, trimmed) fish;
- > Fillets – plain whole and portioned;
- > Shrimp – whole, deheaded, deveined, etc;
- > Lobster – tails and whole;
- > Crab – dressed;
- > Octopus and squid: dressed, sliced;
- > Other – crab sticks, fishfingers, etc.;
- > Fish stock (shelf-stable gels); and
- > Fish waste – (dried for feed mill use).

While there is little pond fish farming in Lamu, and almost no mariculture, the facility would also source produce from these activities. This would then allow the facility to operate throughout the year, rather than be restricted to the main fishing seasons.

In the longer term, there is also potential for taking catch from deep sea fishing vessels that are berthing at Lamu Port.

Fish and seafood processing

The overall process flow, outlined in Figure 4.17, comprises three distinct and clear stages:

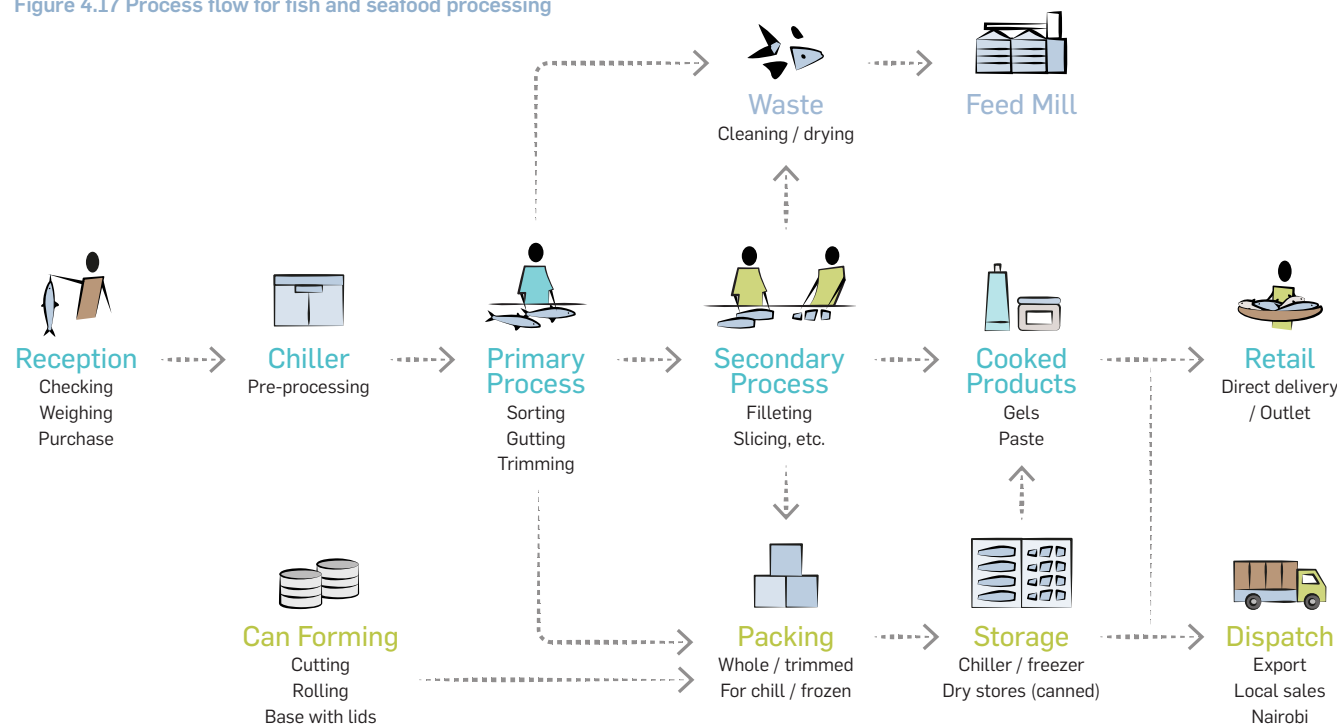
- > Initial processing comprising sorting, gutting and trimming. Some products would then go straight to packing;

- > Secondary processing which would include filleting and other cuts; and
- > Cooked products would be a separate process, taking materials from storage and the processing line.

There would be chiller storage for products coming into the facility, and then chiller and freezer storage for processed, packed products awaiting further processing or dispatch. Given the wide range of species available in Lamu, the facility would include a canning line which is suitable for tuna and tuna-like species, as well as crab meat.

There would be potential for the can forming line to supply cans for other agri-processing (e.g. coconut milk, tomatoes, roast cashew, etc.).

Figure 4.17 Process flow for fish and seafood processing



Source: SUEA Atkins Team

Capacity

The initial processing capacity of the facility is estimated at around 1,250 tonnes per year. This is based on existing landings, and assuming that the facility processes around 25% of total reported catch. Fish processing is labour-intensive and there will be scope to expand employment as the catch increases (as a result of increases in mariculture, pond fish farming and landings).

Table 4.22 Processing capacity inputs

Target capacity for processing facility	Tonnes/ per day	Tonnes/ per year
Sea fish (full range)	3.8	940
Other (lobster, crab, etc.)	1.0	250
Freshwater fish (tilapia, catfish)	0.2	60
Total	5.0	1,250

Source: Atkins

The volume process flows are outlined in Table 4.22. With an input of 1,250 tonnes of raw fish and crustacea per year, annual dispatched product (including packaging) would be just under 1,000 tonnes.

The main process waste (trimmings, heads, tails, bones, etc.) are high in protein and would be suitable for use in a feed mill. These would be dehydrated to stabilise them before dispatch. It is expected that the guts would be kept separate and composted, though there might be potential for combining with other waste streams and processing in an anaerobic digester to produce a biogas and soil improver.

Table 4.23 Capacity and volumes for fish processing

Process volumes and waste	Tonnes/ per day	Tonnes/ per year
Raw fish/seafood	5.0	1,250
Product		
Cleaned/trimmed	2.3	563
Filleted/other	1.3	313
Packaging		
Cardboard	0.2	59
Plastic	0.2	43
Metal (cans)	0.1	14
Final dispatched weight	4.0	991
Waste		
Fish process waste	1.5	375
for feed mill	1.3	313
for compost (guts)	0.3	63
Water	10.0	2,500

Source: SUEd Atkins Team

Prices and margins

The Kenyan fisheries sector has a low-cost base and can be highly competitive, as supported by the significant levels of exports. Overall trade is roughly in balance with both fish and seafood exports and imports averaging around US\$ 25 million per year. Exports are quite varied with filleted fish accounting for 40% of total value, and other exports being evenly spread between dried fish, molluscs, crustacea and whole fish. Imports are predominantly frozen whole fish (over 80% by value) with much of this being tilapia.

Given the combination of substantial fish catch potential in Lamu, small local markets, limited processing and long distance to main markets, prices in Lamu are significantly lower than further south. Furthermore, prices are lower to the north of Lamu Town. In discussion with fishers, the following indicative price escalation near to the main market of Mombasa has been identified:

Table 4.24 Price escalation near to the main market of Mombasa

Main market	Price	Distance from other main market
Kiunga	KES 100 per kg	56 nm ¹⁰⁸ north of Mokowe
Kiwayu	KES 200 per kg	36 nm north of Mokowe
Mokowe	KES 300 per kg	300 km to Mombasa
Kilifi	KES 4500 per kg	75 km to Mombasa
Mombasa	KES 600 per kg	

Source: Atkins analysis

This VC can then benefit from the lower prices in the north of Kenya.

Demand Outlook

The output from the processing facility will be sold across Kenya and to export markets, which both have strong demand growth outlooks.

The global seafood market is forecast to grow by just under 3% per year to 2027, with no drop in demand due to COVID-19. The rate of growth is expected to be highest in China and the Far East, with rates of under 2% per year in Europe and North America¹⁰⁹. Growth rates are expected to be between 2% and 3% for key market segments, including tuna and tuna type fish, a key export for Kenya.

108 Nm are Nautical miles

109 Research & Markets, Global Seafood Market Report 2021-2027 (2021).

Consumption of fish and seafood is expected to increase more rapidly in Kenya, driven by population and income growth, though this will be constrained by supplies. A market study in 2018 identified a supply gap of over 80,000 tonnes per year, indicating that demand is currently around 28% higher than consumption¹¹⁰.

Supply chain and location

Mokowe is the current central point of the fisheries supply chain in LC, with catch being delivered to the jetty for consolidation and trucking to Mombasa.

Small fishing vessels operating around Kiunga and north of Kiwayu, sell their catch to larger vessels (10 to 30 GWT) which anchor offshore and then travel down to Mokowe when full (after two or three days). These large vessels will have onboard ice-making/chiller capacity, while the small fishing vessels usually have no ice onboard.

Those vessels operating around Lamu and Pate islands generally deliver their catch directly to Mokowe or to agents and brokers operating on Lamu Island. Some of these vessels carry ice, but not all.

Limited access to ice (explained in section 4.3.3 and 4.3.2.1) and limited use, has added to the problem of post-catch losses.

The losses occur along the supply chain from the first storage onboard the fishing vessel, transfer and storage on a consolidation vessel, transfer to trucks and delivery to Mombasa, and the losses result in physical loss of product as well as degradation in quality and therefore value. While there are no studies into the losses in Lamu, indications from other work¹¹¹ show that many of the losses could be reduced substantially through:

- > Local processing – avoiding trucking of fresh product to Mombasa;
- > Improvements in landing sites, providing cold storage before transfer to the processing facility;
- > Training in handling and storage techniques; and
- > Encouraging the use of ice onboard fishing boats

This VC will support action on reducing losses as part of its work to ensure quality control and traceability along the supply chain.

4.3.4.3 Indicative Costs and Revenues

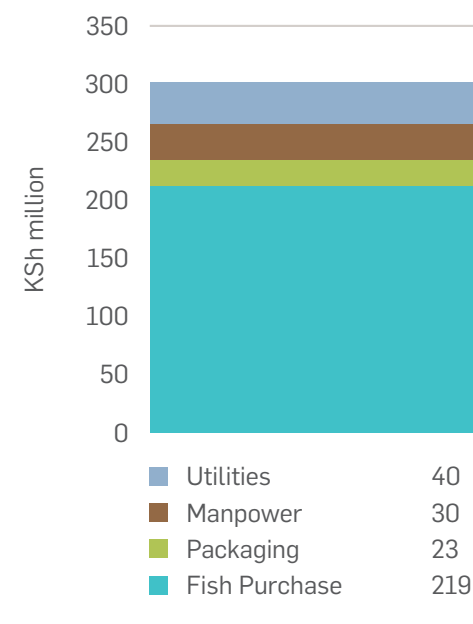
Investment

The total investment required is estimated at around KES 350 million. Of this, just over 40% is for machinery and vehicles, and around 25% is for working capital. The remainder covers buildings and site preparation, marketing, and initial training.

Operating costs

Total operating costs are expected to be around KES 310 million at full capacity, with 70% of this being for the purchase of raw fish and seafood.

Figure 4.18 Operating costs 2026



Source: SUED Atkins Team

Human resources

Fish processing is a relatively labour-intensive activity, with significant jobs required for sorting, cleaning, filleting, deveining, packing, etc.

- > Head count of 108 FTE in total;
- > Monthly salaries of KES 13,000 to KES 25,000 depending on skills; and
- > Additional employment costs estimated at 25% of salary.

¹¹⁰ Ipsos / MSINGI, East Africa fish market assessment, Size, Sustainability and Opportunities for growth in Aquaculture: Kenya, Uganda, Tanzania, and Rwanda (2018).

¹¹¹ FAO, the state of world fisheries and aquaculture (2018).

Raw materials

The project economics are based on tomato processing:

- > Average purchase price of fish and seafood is KES 175 per kg, paid at the landing sites (and collection points from fish farms); and
- > Packaging costs – plastic packaging, metal for the cans, labels, card boxes, etc., is estimated at KES 18 per kilo of processed fish and seafood.

Other Opex

Covers electricity, water and other utilities, maintenance of machinery, marketing and training. The opex also covers transport fuels and vehicle maintenance costs, (based on using one 20-ton refrigerated truck to make deliveries to Mombasa twice a week, and two small, refrigerated vans to cover movements of fresh fish between landing sites, farms, the processing facility, and the local market.

Revenues

Annual revenues are estimated at around KES 440 million by 2026. This is based on an average sales price of KES 500 per kg for processed and packaged fish and seafood products.

The estimate of total revenues excludes any revenues from dried processing waste going for animal feed.

Value added

The value added, calculated as sales revenues less the cost of the fish and seafood, and other inputs (packaging, electricity, water, etc.), is estimated at the equivalent of KES 125 per kg of fish purchased, representing over one third of the sales price.

Table 4.25 Value added

KES per kg of fish equivalent	
Fish purchase price	175
Other inputs (packaging)	18
Other opex (power, fuel)	32
Value added	125
Sales price	350

Source: SUED Atkins Team

Enabling Business Environment and/or Other Catalysts

A broad range of actions are already being undertaken in support of the Blue Economy, and this VC then needs to work with a range of stakeholders. In particular, the VC should liaise with;

- > NAMARET (the National Mariculture Resource and Training Centre) in Kwale, for technical support;
- > Lamu County Implementation Unit, being established as part of the Marine Fisheries and Socioeconomic Development Project;
- > Beach management units (BMUs); and
- > The established fisheries SACCOS at Shela and Faza Rasini.

4.3.4.4 Project 7: Fishing cluster and Mokowe landing site upgrade

Project overview

The fish processing plant VC is proposed to be located near the existing Mokowe jetty.

Mokowe jetty is the southernmost tip of Mokowe town and one of the most important communication and logistic linkages between the mainland and the islands. Current activities such as, collecting and unloading fish from local fishers, the loading of a wide variety of goods for onward transportation to Lamu Island and beyond, visitor ferries and other private boats to/from the mainland share the same jetty and onshore spaces. This shared and highly dynamic location is not actively managed, and therefore it risks becoming a bottleneck to the effective circulation of people and goods. It currently provides a very poor 'gateway' experience from the mainland to Lamu Island.

Access to the jetty is through the recently upgraded A10 that connects with the town centre and Hindi to the north. The A10 is also one of the key links expected to connect the LAPSETT Port and SEZ to the town.

On-going upgrade of jetty platform project – the existing landing platform (30x12m) is being upgraded and modernised (using reinforced concrete). The upgrade, however, is limited to the pier and does not extend to the wider area. The land area to the east of the jetty was recently reclaimed (circa 2010) with evidence of an operational quay in 2012.

Strategic role of the jetty and opportunity to establish a fishing based economic cluster – the area of immediate influence of the jetty covers approximately 2ha with a waterfront development of approx. 250m (east to west) and a variable in-land depth of 30 to 50m. The tidal pattern seems to vary by 1m (high/low) with the low ebb exposing circa 5/6 m of seabed. The site is currently managed in a reactive fashion; however, this offers the opportunity to rationalise spaces and circulation, appropriate uses and robustly plan for future managed growth.

Given the strategic input of the fishing industry to the local economy, a series of dedicated fishing facilities, both addressing current and future demand, could represent an attractive proposal. Expanding the local offering by capturing the wider fishing economy ecosystem such as a fresh fish market and restaurants, staff training and food-based entertainment could find space here. All these are added value activities to strengthen Blue Economy opportunities.

The fish processing plant should preferably be located adjacent to the Mokowe jetty. The plot can be accessed from the A10 road which connects the jetty to Mokowe. This location is chosen due to its proximity to the jetty and the sea, whereby being less than 200m from the jetty will allow the fish to be transported to the processing centre without further cold storage requirement.

The site is located on flat terrain with the access road to the north. There are mangrove forests located to the east and south of the general area where the site is located. As the site is located away from Mokowe town the issue of the potential impacts of fish odour will be mitigated as well.

The total area requirement for the fish processing plant is 4000 sqm. In the first phase 2000 sqm of this site is expected to be developed. It will comprise of 800sqm of buildings which include the cold storage, canning, smoking and other processing facilities and administration blocks. It will also include delivery docks, temporary parking areas and maintenance areas. In future phases when LAPSET is active some of the deep-sea fishing catch will be transported to this site from Lamu Port for processing and further trade. For this function the rest of the site is proposed to be used and further facilities to be built as required. A feasibility study at the time of implementation is recommended.

Proposals

The immediate opportunities of such a strategic location are:

1. To reconsider and rationalise uses and functions of the jetty and immediate surrounding area;
9. To establish two distinctive activity zones: a) trade and cargo and b) leisure and travel;
10. To futureproofing from a climate impact and economic resilience/opportunity perspective;
11. A fish processing plant development and operations.

By rationalising the uses and location of the future small harbour and splitting it into a) trade/cargo and b) leisure and travel, the site will naturally be developed and consolidated around these two activities.

On arrival from the A10, to the east, the harbour's hustle and bustle takes centre stage. The quays are busy with cargo hauled on boats – the traditional activity of the area. As a backdrop, framing the quay, the fishing processing pavilion acts as a natural boundary to the site. Further east a new jetty frames the view of the bay.

To the west, a plaza and the jetty are framed by a series of simple, charming buildings hosting a fresh fish market, restaurants, and a visitor centre along with some small bed and breakfast facilities and other accommodations to host travellers before they move on to Lamu Island and the other islands and heritage destinations.

Project components

Fishing-related activities:

- > A fishing processing centre to capture additional value of the fishing trade: This can further expand into a dedicated pier immediately connected to the processing plant. The allocated plot (4,000 sqm of land) should be sufficient to accommodate the long-term fish processing plant activities, including any additional demand (increased supplies) generated by future deep sea fishing vessels berthing in Lamu Port. An alternative access to the plot directly from the A10 is also proposed to minimise potential conflicts with cargo traffic accessing the East Quay; and
- > A fresh fish market and connected restaurants for visitors to address the retail demand and access fresh quality food ("sea-to-table"). A series of additional activities can be incorporated in such spaces, including socialising and entertainment areas.

Transport

- > A new and properly consolidated bus stop/station and waiting area can be integrated on-site;
- > Distinct separation of movement flows in a) trade/cargo and b) leisure and travel.

Figure 4.19 Diagram showing current elements and issues at Mokowe Jetty

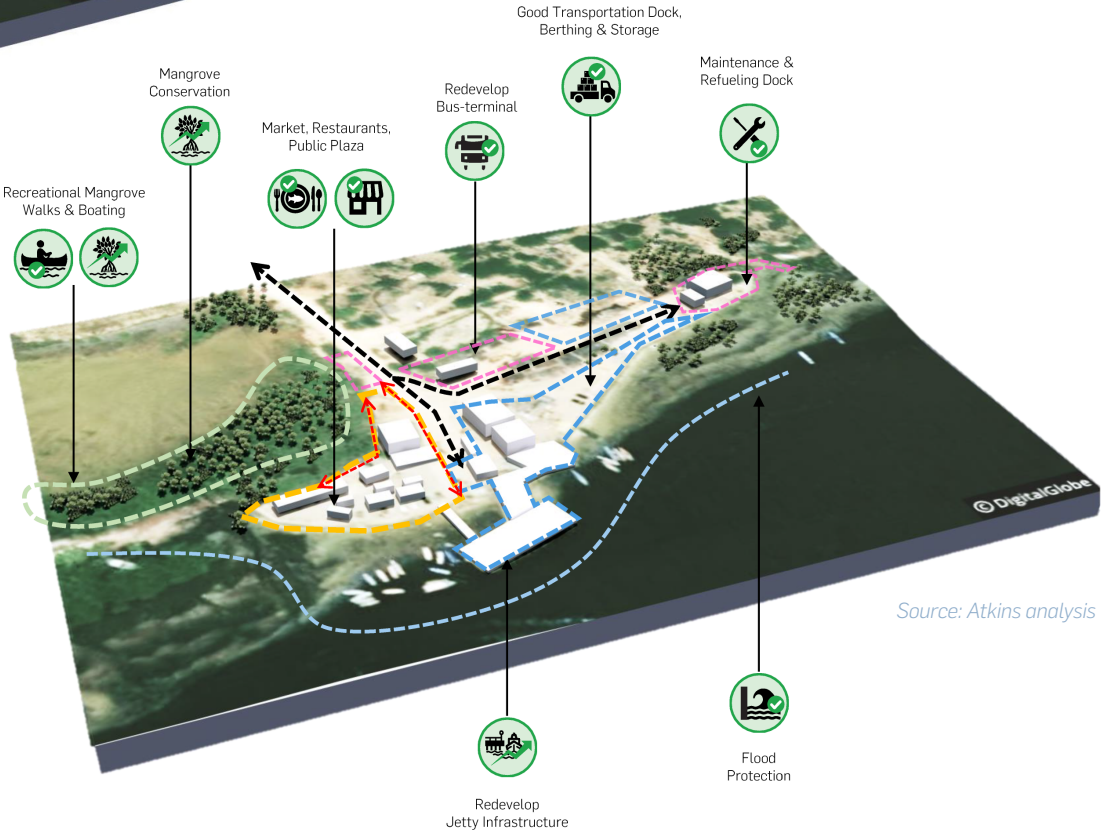
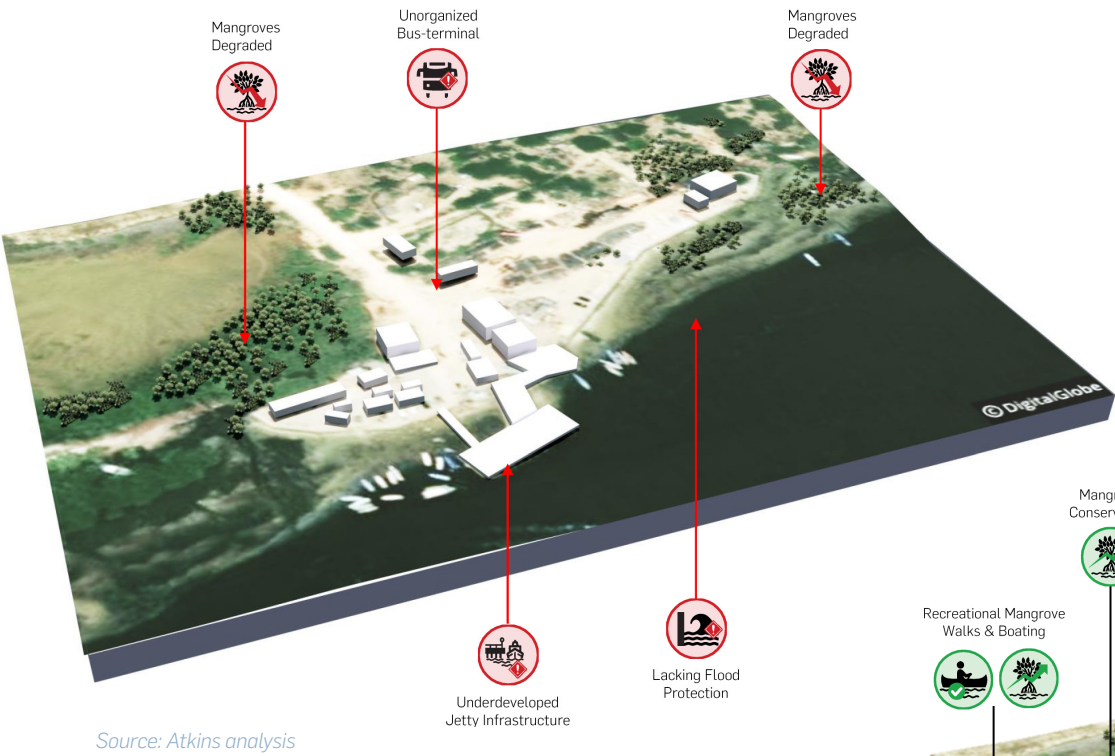


Figure 4.20 Diagram showing proposed zoning and opportunities

Figure 4.21 Diagram showing initial ideas for the Mokowe Jetty upgrade

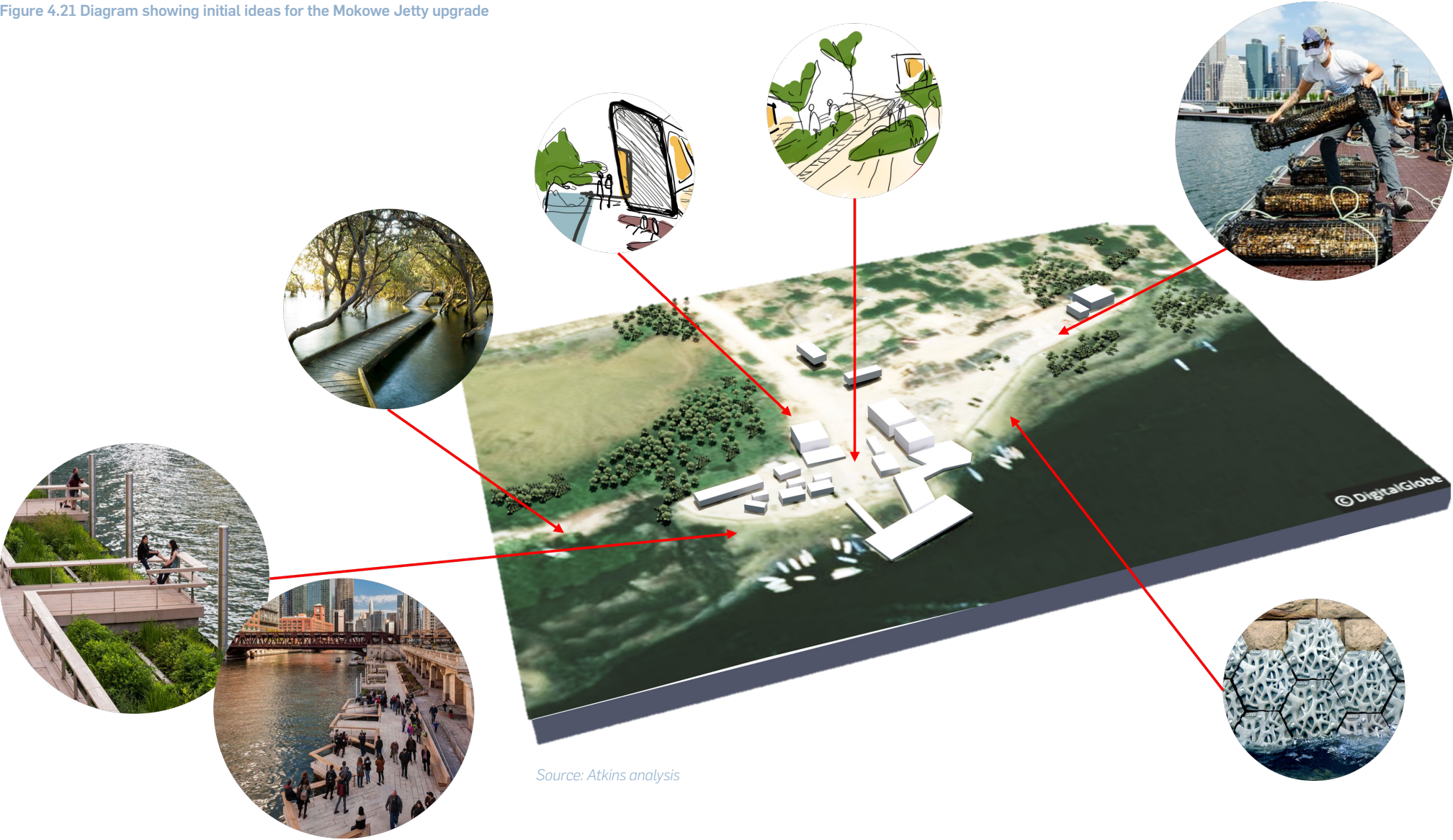


Figure 4.22 Images showing potential Mokowe jetty upgrades





Linkages

- > Fish processing VC;
- > Transport Projects; and
- > Quay wall upgrade Project 9

Table 4.26 Project 7 Summary Information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
a. VC/ fish Processing plant (total site area 4000sqm)	Total cost = KES 730 million	Establishes a well-defined fishing-based cluster including processing plat and complemented with mixed-use amenities and public realm.	Items c, d, e, g	Implementation agency / Leading partner:
b. Road upgrade – access to fishing plant, single carriageway, 9m (7+2) + side walk, street lights	KES 62 million KES 106 million		Enabling infrastructure: PPP/Public Authorities	Kenya Port Authority
c. Quay wall upgrade (3-8m)	KES 225 million		Items a, b, f	Private Investor (partial investment in certain assets)
d. Commercial jetty with 6m wide walkway	KES 76 million	Opportunity for immediate investment and development	Private investor:	Supporting stakeholders: Maintenance responsibility of County/ Municipal government
e. Public realm – cargo & key area, high strength pavers	KES 42 million			
f. Public realm – market Plaza, visitors entrance	KES 37 million	Opportunity to provide local employment	Design Build Operate Maintain (DBOM)	
g. Market and offices / mixed use	KES 83 million			
h. Hospitality and food and beverage	KES 65 million KES 29 million	Opportunity to provide specialised and diversified hand-on-training		
i. Lighthouse/viewing platform	KES 5 million			
j. Natural protective mound				

Source: Atkins analysis

Table 4.27 Project 7 basic Analysis and Timeline

Challenges	Data gaps	Time frame, key dependencies
Concept and detailed masterplan to be developed for the wider site before progressing	Pre-feasibility study	Short to medium term to facilitate early stages of VC projects and enable further development
Funding	Site surveys and technical studies	
Land ownership	Detailed market study	
Limited developable land due to extensive mangrove habitat in the vicinity		

Source: Atkins analysis

Infrastructure Assessment

Water

Fish processing is a water intensive industry since water is used for washing fish, cleaning process areas, and cooling. Based on typical water requirements for the processing of fish in the quantities stated in Table 4.22, the plant would require around 50.8 m³/day of drinking quality water¹¹². A further 5.4 m³/day would be required for the FTE employees in order to maintain a high standard of hygiene¹¹³. Therefore, the total amount of water required for the plant is around 56.2m³/day. The water required should be sourced from a desalination plant in order to meet the high demand for water (section 4.6.1.2).

Wastewater from seafood-processing contains high levels of organic nitrogen, phosphorus and high levels of BOD, chemical oxygen demand (COD), total suspended solids (TSS), fats, oil and grease (FOG). Therefore, it would need to undergo primary, secondary and tertiary treatment in order to meet discharge quality standards. This would require onsite treatment with a specialist package plant so space on-site for this facility needs to be allowed for.

Solid waste

The key waste streams anticipated to arise from the facility will be organic waste. It is estimated that approximately 1.3 tonnes per day or 321 tonnes per year would be generated. This waste can be either dried and used within the feed mill to support the circular economy concept (268 tonnes per year) or composted (54 tonnes per year). Outputs from the wastewater treatment plant could also be combined with the waste being composted, where it is suitable.

There will also be some municipal type waste arising from the daily activities of the workers. Based on each worker generating approximately 0.6 kg of waste per day and

assuming that 60 FTE workers will be employed at the facility, the total municipal waste generation at the facility will be 0.036 tonnes per day or nine tonnes per annum. This waste should be segregated at source into mixed dry recyclables, organics, and residual waste.

Power

Based on the anticipated size of the facility, the general power and lighting demand for the buildings and process load could be in the region of 260-290 kW¹¹⁴ depending on the type and efficiency of equipment installed.

The final location of the facility will be in Mokowe where the grid is more extensive but not very reliable. The demand is quite high, but there should be enough spare capacity in the main substation and a suitable 11 kV grid supply should be available which can be extended to the site to provide the facility with a dedicated connection, however this needs to be confirmed by KPLC. The processing facility will have an 11/0.4 kV distribution transformer on site (1 x 400 kVA capacity). Grid unreliability and power costs are major issues with respect to the successful operation of the plant. A well implemented power resilience solution will allow the continued operation of the plant regardless of events on the local power grid. The solution to ensure some level of reliability when the power is lost and to reduce costs would consist of the following:

- > On-site energy generation. Solar PV should be installed on-site to reduce reliance on the grid and reduce electricity bills. An appropriate installed capacity would be around 75 kW¹¹⁵. This would require an area of about 485 m². This could be located on building roof(s) and possibly some standalone solar arrays if needed. This output will be reduced during cloud cover and at night, so the grid supply will still be sized to cover the peak demand however PV could reduce the cost of grid electricity by up to KES 27,000 per week;

- > Voltage regulation. Spikes, sags or fluctuations in voltage supply can cause damage to equipment and disrupt operations. Regulation equipment integrated into the distribution transformer at the incoming voltage will protect the manufacturing equipment;
- > Battery storage. This should be included to help with any extended power cuts. Lead-acid batteries are appropriate technology for this environment. An appropriate storage capacity of around 440 kWh would provide a suitable level of business continuity; and
- > An uninterruptible power supply (UPS) would be needed to instantaneously bridge between any power cuts and the battery storage.

The battery storage, voltage regulation and UPS equipment would require a dedicated building on site of roughly 9 x 5 m (45m²).

High efficiency motors and drives and other low energy equipment such as LED lamps should be installed throughout to ensure the demand is at the lower end of projections. The plant operation should also ensure it has budgeted maintenance programmes to cover items like regular cleaning of PV panels, servicing of motors, fans and coils and replacing equipment when its performance begins to degrade.

112 SeaFish, Guidance for Fish Processors on water and effluent minimisation (1999).

113 Ministry of Water and Irrigation, Practice Manual for Small Dams, Pans and Other Water Conservation Structures in Kenya (2005), Available at: http://smalldamsguidelines.water.go.ke/technical_reports/, (Accessed: 22/10/2021).

114 The peak energy demand is compiled through a combination of specific equipment required for the process and a unit rate allowance for small power and lighting for building area

115 PV capacity has been assessed at a percentage of peak demand that provides the optimum fit between affordability, ability to find suitable space on the site and best provision of renewable energy to minimise CO2 emissions

Transport infrastructure

Harvested fish has a short life, therefore a cold chain storage from the moment fish is caught together with careful handling will be critical to minimizing spoilage as described in Project 3 cold storage. This should entail on board cold storage on fishing boats, provision of cold storage facility at the landing site and use of temperature-controlled trucks to the processing plant. The site is accessible through the A7 and a spur road that branches of the A7 east of Mokowe and rejoins at the A7 north of Mokowe town. Regular road maintenance will be required to ensure smooth road surface is maintained between the landing site and the processing plant. At the plant site a road network based on the plant development plan should be provided that adequately caters for traffic circulation with dedicated parking spaces and loading and offloading zones.

A good public transport connection will be needed to the processing plant for both the employees and fish folk delivering the products to the plant. A ferry service along the Lamu Faza seaway would be preferable for those travelling by sea from other islands. A significant proportion of trips are also made by non-motorised transport and, end-to-end safe and universally accessible pedestrian facilities to and from the site will need to be provided.

Environmental impact

This project has the potential to be an environmentally-sustainable scheme, through responsible fishing, the re-use of by-products and a source of steady income for fishermen. However, if the project is not managed sustainably, the environmental impacts could be significant. Factors that would need to be considered to ensure the project is sustainable include:

- > Ensure the conservation of the environmentally sensitive marine ecosystem area around Lamu County;
- > Measures should be considered to mitigate against liquid and solid waste from fishing vessels. Some of these measures could include storage of oily mixtures onboard for disposal at port waste reception facilities and regulations prohibiting discharge of solid waste into the sea;
- > Sourcing of fish species should be done responsibly to ensure overfishing of any species does not occur. Sustainable solutions such as modifying fishing gear to ensure fewer non-target species are caught or can escape should be employed;
- > Farmed pond fish (e.g. tilapia and catfish) and mariculture species (e.g. lobster and crabs) should be responsibly sourced, ensuring this does not lead to excessive fish farming which if not operated responsibly could have an impact on the surrounding environment in terms of solid and liquid waste outputs;
- > The processing facility should not be located within close proximity of any residential or tourist areas due to the odour associated fish processing facilities;
- > Given the level of energy demand (260-290 kW) needed for processing, on-site renewable energy systems shall be installed to provide a proportion of the energy needed and supplement the grid supply;
- > Water usage at the processing facility could be reduced by treating wastewater on-site and reusing as much as possible within the facility; and
- > Careful consideration should be given during site selection to ensure there is no impact on local flora and fauna.

Climate resilience

There are climate resilience considerations both for the inputs into the VC, and the infrastructure itself.

There are rich resources of fish available in Lamu County, both inshore and offshore. Lamu County reports catches of around 2,300 tonnes of fish and crustacea annually which offers a strong resource for this VC as it is nearly double the target input of 1,250 tonnes per year.

Fisheries and marine resources are sensitive to climate change, particularly increased temperatures¹¹⁶. Freshwater habitats are sensitive to reduced rainfall as it impacts the input of water that sustains them¹¹⁷. There is also large uncertainty surrounding the dynamics of fish stocks in response to changing properties, such as increasing sea surface temperatures, ocean acidification and changes to ocean currents. This could be an opportunity for the fishing sector, however, as changing species distribution may present new fish breeds available for processing. Owing to the range of species available for input, which provides a degree of built-in resilience, this VC has medium sensitivity to climate change.

Impacts such as drought, sea level rise and increased frequency and intensity of storm events may damage fishery habitats including mangroves, seagrasses and coral reefs. Fisheries that rely on freshwater habitats and wetlands may be impacted by drought which alters the availability of water to these systems and sea level rise may result in saltwater intrusion to low-lying coastal habitats which would alter their productivity. Increased temperatures and flooding of a particular concern for post-harvest management so the transport network and infrastructure involved need to be resilient to the impacts of climate change, and relevant risk assessments will need to be conducted.

¹¹⁶ For offshore fishing, this increases surface stratification and suppresses upwelling of nutrients, which reduces primary productivity, thereby altering food web dynamics and the structure of marine communities. For coral reefs and seagrass beds which serve as nursery areas for many fish species, a greater frequency of extreme temperature events can lead to bleaching and impaired functioning of these habitats.

¹¹⁷ Mahon, R. Adaptation of Fisheries and Fishing Communities to the Impacts of Climate Change in the CARICOM Region (2020), Available at: https://www.researchgate.net/publication/228703108_Adaptation_of_Fisheries_and_Fishing_Communities_to_the_Impacts_of_Climate_Change_in_the_CARICOM_Region, (Accessed: 25/10/2021).

Additional adaptation options that could improve the adaptive capacity of the fish processing industry include:

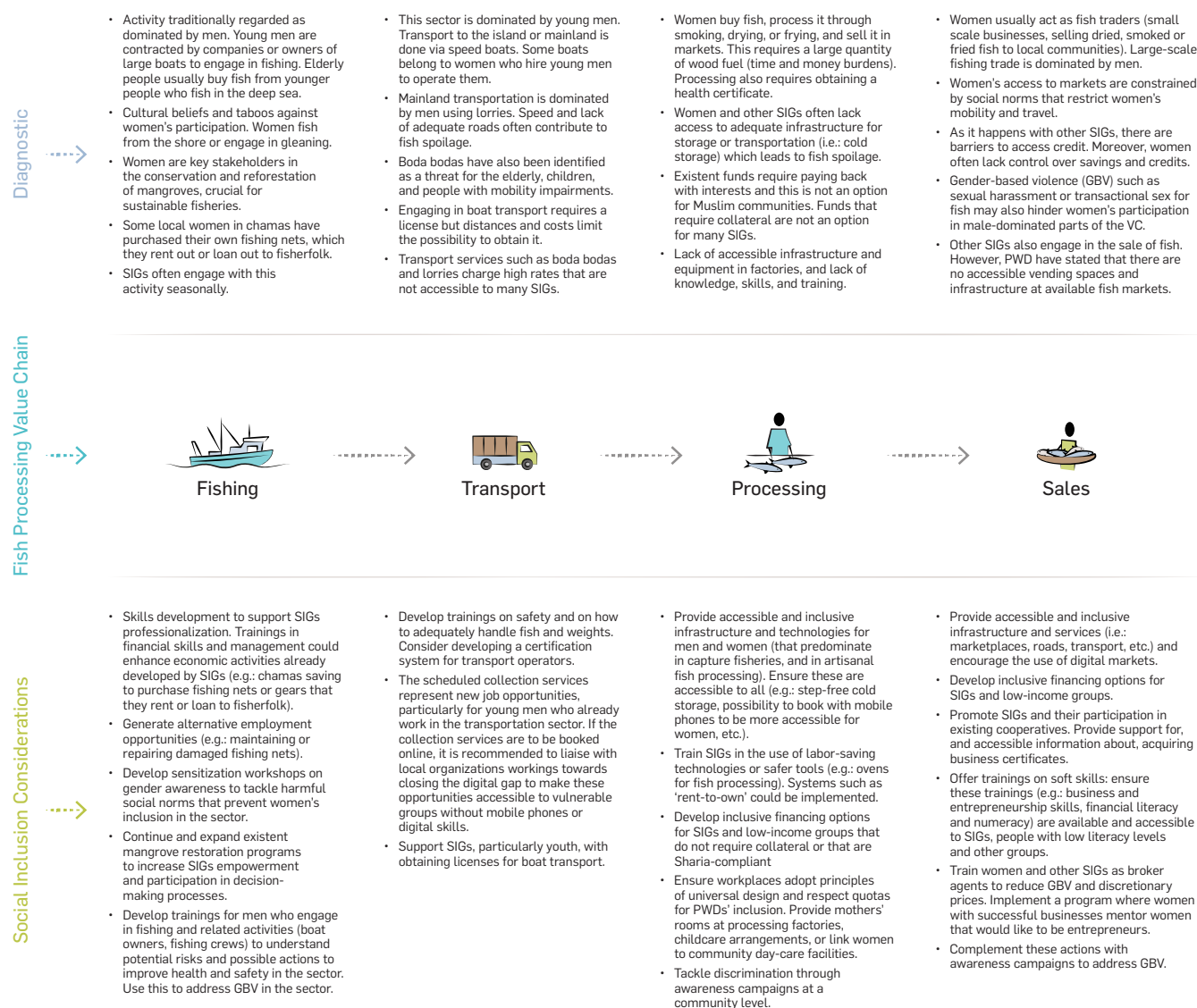
- > Conservation of habitats important for fisheries (mangroves, seagrasses and coral reefs);
- > Assessment and effective management of fisheries to be able to adapt to changes in stock. This may include adaptive management or co-management approaches;
- > Investment in equipment to enable larger vessels for longer trips to reach deep-sea stocks;
- > Marine forecasting and early-warning for storms; and
- > Protective structures (e.g. utilising coconut fibre from Project 3: Coconut Processing) to maintain landing sites against erosion.

This VC has high exposure to climate change, but the design of the infrastructure for the VC includes several measures that increase its resilience to climate change. In particular, coastal flooding is addressed through a combination of measures, including mangrove restoration, a living sea-wall, and breakwaters that will act to dissipate wave energy, and thus reduce flood risk. As such, the overall vulnerability is medium.

Gender and Social Inclusion Assessment

The development of the fish processing VC has immense potential to reduce food insecurity in the region, while generating new employment opportunities and fostering economic growth. As happens in other regions, however, the sector is traditionally regarded as being male-dominated. Yet, women and other groups have key roles in the development of this VC (mainly in pre- and post-harvest activities) and in the protection of marine ecosystems. Hence, this UEP offers the opportunity to mainstream gender and social inclusion, by proposing interventions that have the potential to enhance women, youth, elderly people, and PWD access to, and control over, fisheries resources and related economic activities. These interventions also aim at increasing SIGs participation in value added links of the VC. Below there is a summary of the findings from the GeSI study regarding the fish processing VC in Lamu Municipality. The detailed study is presented in the GeSI study (Appendix C).

Figure 4.23 GeSI assessment of the fish processing VC



Case Study 4.14 - Successful stories of women's inclusion in the fish processing VC¹¹⁸

A recent study from FAO presented the work of the Kolokol Ewola Women's Group (a sub-group of the Turkana Women's Group) in Northern Kenya, a group engaged in the sale of handmade baskets. With a percentage of the savings collected from their basket sales, the group decided to invest in a fishing boat. Now this is their main income, and they sell fresh and dried fish in Nairobi, Uganda and Rwanda. The FAO study quoted the group chairperson: "Culturally and traditionally, Turkana women do not fish. Now that we have a boat, we go out on the Lake with our sons and nephews. we have cut out one of the links in the fish supply chain". This diversification has been particularly relevant to face the declining market of palm leaf baskets in the country.

The same study also highlighted another success story in Kenya. In communities surrounding Lake Victoria men usually catch fish and sell it to processors or traders, who are usually women. These women, as is the case in LM, often face challenges when processing fish; when they dry it in the sun and it is not dried in time, it is sold as animal feed at very low prices. And, when selling fish, they do not have access to information about other markets outside their own villages, and only a few women can travel to other markets since social norms and competing responsibilities often restrict their mobility. Hence, they rely on brokers (often women) who often give them very low prices.

With a project financed by the ILO, the Kenya Marine and Fisheries Research Institute developed a fish market information network, which makes market information accessible to women who can access the network via mobile phone. In particular, this has allowed them to attract and negotiate with brokers, obtaining better prices and more stable incomes.

Case Study 4.15 - Successful stories of youth economic empowerment in fisheries (VijaBiz)¹¹⁹

The **Mayungu High Vision Women's Group** wanted to start a business selling fish in their local markets in Kilifi County. However, they faced challenges associated with the lack of business and entrepreneurship skills, and traditional social norms that restricted their mobility. Thanks to the VijaBiz initiative they worked with their husbands to sensitise them on the importance of their wives having access to training, and they took training courses on book-keeping, record-keeping, and using WhatsApp and social media. The group also faced challenges in transporting produce from the port to their shop. With project support they bought their own boat which, alongside their increased presence on social media, has allowed them to increase sales, and they have also purchased a motorbike to help deliver fish to the shop.

Shibe Delta Enterprises, a group in Kilifi working in fish farming, also attended VijaBiz courses on record-keeping and passed their knowledge onto other group members. When they were ready to expand their business they formed a supply selection committee, and conducted a market analysis (e.g. distance, cost-effectiveness and potential to save money in the long term). This allowed them to expand their activity to five fish ponds, while saving a significant amount of money. They have also started to make their own fish feed.

Njoro Fish Farmers initially sold their fish on-site due to a lack of cold storage facilities. With a VijaBiz grant they purchased deep freezers, an oven, a generator, cooler boxes and a weighing machine. The cold storage increased the shelf life of the fish by five days, increasing their income. The group now aims to install their own fish feed plant and sell produce that they do not need to local farmers to diversify their livelihoods.

¹¹⁸ FAO, Good practice policies to eliminate gender inequalities in fish value chains (2013).

¹¹⁹ CTA, Growing Rural Youth Agribusiness in Kenya: Stories and Best Practices Of The VijaBiz Project (2020).

4.4 Tourism and Heritage Sector Action Plan

The tourism and heritage sector is one of the economic backbones of the Municipality, principally founded on the UNESCO World Heritage Site of Lamu Old Town and its wide array of marine and terrestrial wildlife. This unique offering of both heritage and natural assets attracted many international tourists to Lamu County prior to the COVID-19 pandemic, particularly from Europe and the USA.

For the tourism and heritage sector to reach its full potential, there are several key challenges that must be overcome. This includes a critical requirement for enhanced marketing of Lamu County to improve the public image of the area, both nationally and internationally, as well as upgraded tourism infrastructure – including accommodation, transport links and leisure facilities.

From the Diagnostic Report analysis, site visits, stakeholder engagement workshops and business consultation, the following key strengths, weaknesses, opportunities and threats were established. These were used to determine the actions proposed in the following sections. Any actions implemented should be embedded with climate change resilience and resource efficiency at their core, taking into account the environmental impact of new assets and activities. In addition, social inclusion should be a focus to enhance SIGs and vulnerable groups' access to job opportunities.

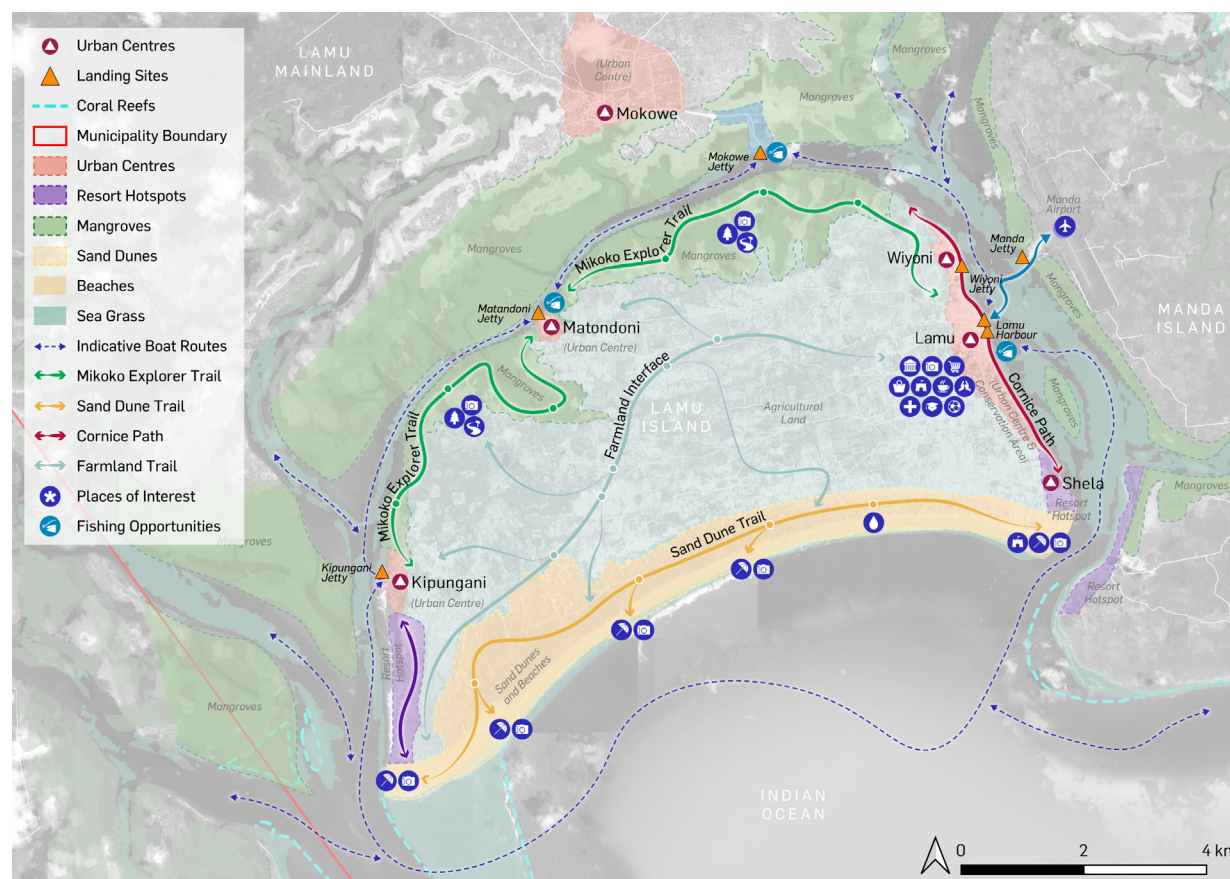
Strengths

Lamu Island's land use can be broadly subdivided into five distinct character areas marked by historic and natural landscape and various landmarks. The island is surrounded by natural channels on its west, north, and east side. To the south side of the island lies Lamu Bay which connects to the Indian Ocean. The land features include a historic urban centre stretching along the eastern coast of the island, with the key hotspots of Lamu Old Town and Shela. To the east across the channel is Manda Island where the local airport is located. To the south of historic Lamu old Town lies the resort town of

Shela which is joined towards to the south and west by sand dunes, a natural gazetted/protected area which also shelters water springs. To the West, a small resort and two fishing villages namely Kipungani and Matondoni are on the island. Mokowe, on the mainland, to the north across the channel, is the main trading centre and ferry link to the island.

The island is surrounded by dense mangrove forest all around its periphery, whilst some key points of interest on the island are Lamu Fort, Shela Fort and the UNESCO-designated World Heritage Site. These, together with the long coastline both on and off the island are the main tourist destinations which have attracted both domestic and foreign tourists. (See Figure 4.24).

Figure 4.24 Lamu Island character areas as main strengths for tourism

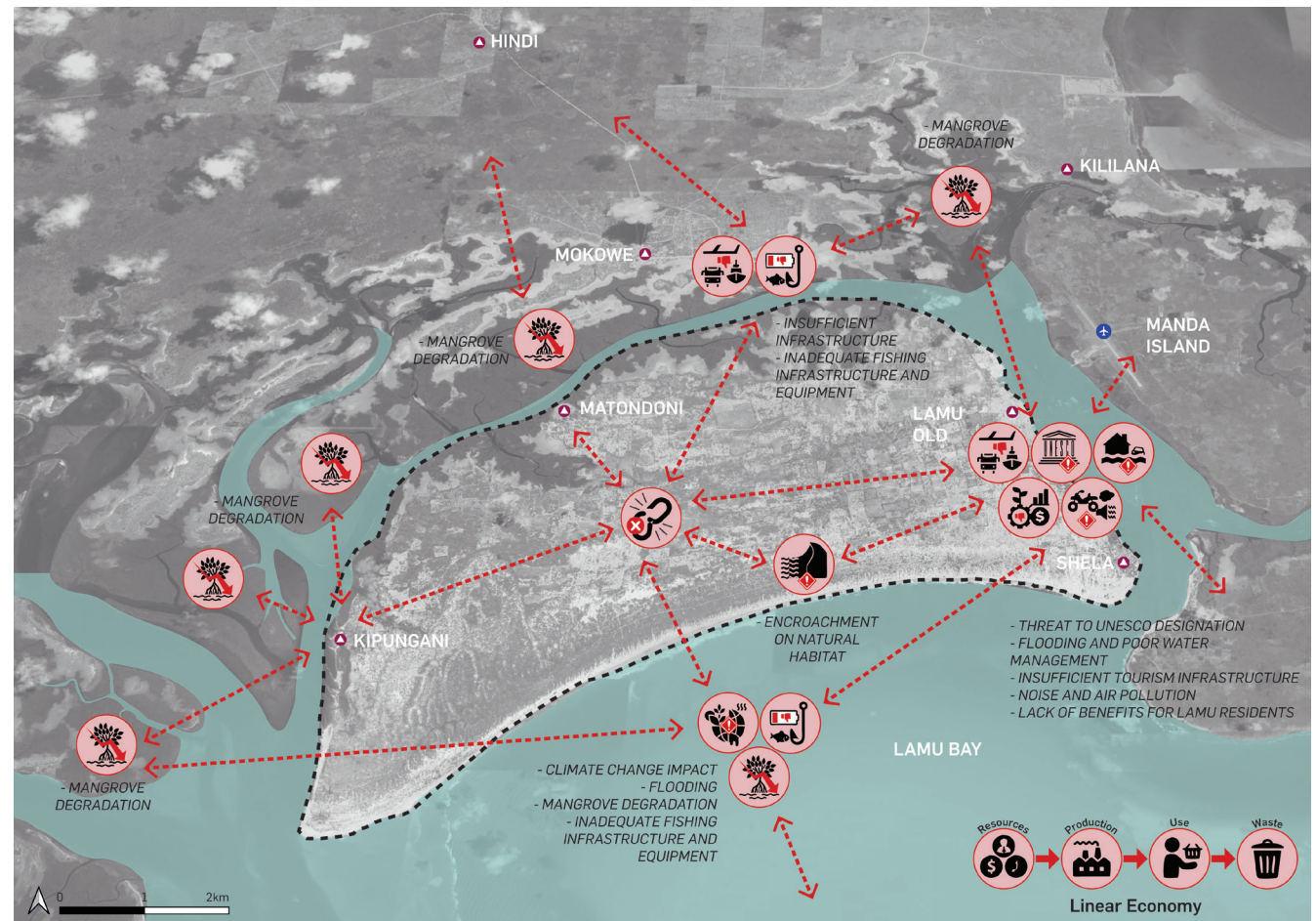


Source: Atkins analysis

Weaknesses

- > Current infrastructure challenges relating to poor waste management and insufficient dumpsite capacity; limited paved roads and poor maintenance of roads, open spaces and public realm; problems with congestion in Lamu Town; limited connectivity across the island; flooding and poor drainage, along with open sewers;
- > Infrastructure issues continue to threaten the town's UNESCO World Heritage Site status, which remains a key driver for the tourism industry in the County¹²⁰;
- > Environmental pollution, encroachment and degradation of natural habitats such as mangroves, beaches and corals, lack of response to managing donkey dung;
- > Insufficient and inaccessible tourism infrastructure and limited market infrastructure;
- > The County's significant tourism potential has previously not been marketed effectively, both internationally and within Kenya; and
- > Lamu's local population does not necessarily benefit greatly from the sector, with locals typically engaged in lower-paid roles.

Figure 4.25 Lamu Island current issues



Source: Atkins analysis

120 UN World Heritage Centre, State of Conservation: Lamu Old Town (2021).

Opportunities

- > The spatial elements of the island present with various unique nodes on the site which take us on a journey to explore and enjoy the natural and historic beauty of the island. Simple interventions such as alignment with Swahili heritage elements (aesthetics, colours, building forms) can help retain the World Heritage Site designation of the site. The public realm can be appropriately upgraded and integrated in areas designated as sensitive from the heritage perspective. Protection measures can be taken on the flood-prone zones. Primary infrastructure can be provided such as covered/channelled drains. Dumpsites could become recycling centres. The jetties can be upgraded, and the waterfront walk on Lamu Old Town could be revisited to address congestion and susceptibility to flood;
- > The LAPSET corridor programme, through its proposed Resort City, will create additional opportunities to expand Lamu's existing tourism offer, including an improved range of accommodation and leisure facilities and the chance to engage with new regional and international markets. This will position Lamu as a major tourism location for Kenya, by increasing the tourism offer and capitalising on Lamu's existing natural environment and cultural heritage. Additionally, national parks on the mainland as well as heritage sites in other islands such as Pate, can provide a diversified portfolio of tourism attractions;
- > The resort and homestay hotspots and the tourist engagement can be improved by providing alternative and extended activities. These can include, but not be limited to, traditional dhow boat cruises, fishing expeditions, homestays, mangrove trails, agri-tourism, sand dune walks and beach camping, and Shela village stays and guided heritage walks. These can be operated by the local community supporting and enhancing the local economy;
- > The County government has recently increased the tourism budget by KES 2 million, with a particular focus on increasing marketing; and
- > There is significant opportunity to develop a strong marine tourism industry within Lamu County.

Figure 4.26 Lamu Island opportunities



Source: Atkins analysis

Figure 4.27 Lamu UNESCO World Heritage Site photo analysis



Source: Atkins site visit

Figure 4.28 Corniche path and quay wall opportunities



Source: Atkins site visit



Figure 4.29 Mangrove walk potential opportunities



Source: www.weekendnotes.com
and www.deviantart.com.

Figure 4.30 Sand dune walk potential opportunities



Source: www.Adelaide-in-photos.blogspot.com and www.hikingtheworld.blog



Figure 4.31 Dhow boat potential opportunities



Source: www.uniquetraveldestinations.wordpress.com and www.hotelbama.com



Threats

- > Increasing non-compliance with UNESCO World Heritage Site standards may invite a review of Lamu Old Town's heritage status. Furthermore, poor protection, maintenance, and management of heritage and cultural sites; unregulated purchase and non-compliant redevelopment of culturally-significant locations by owners; non-enforcement (due to unavailability of funding) of existing regulations, particularly with reference to urban development, are also threatening the UNESCO World Heritage Site status.
- > Encroachment is likely to be exacerbated by the LAPSSET development, including the degradation of fragile mangroves and corals.
- > Tourists continue to threaten the cultural identity and the traditional lifestyles of Lamu.
- > The development of the tourism sector will require careful planning, as it will have an impact on the demand for energy, water, solid waste management and transport infrastructure, which could impede the sector's expansion and have a negative impact on natural resources and biodiversity.

The Sector Action Plan, outlined in Table 4 28, encapsulates the actions to be undertaken to develop and support Lamu's tourism and heritage sector, taking account of the Municipality's strengths and weaknesses, as well as the opportunities presented by the Blue Economy and LAPSSET. These actions include a combination of soft interventions, infrastructure proposals, community initiatives and training and capacity building recommendations, focused on the overarching objectives of developing Lamu's tourism offer and enhancing community involvement (section 4.4.1), and the beautification and decongestion of the Municipality (section 4.4.2).

In addition, a broader series of inclusive and climate-resilient infrastructure proposals to support the growth of the sector are detailed in section 4.4.3. The holistic approach to solid waste management is then presented as a circular economy VC and as an opportunity for an early win to catalyse tourism development and heritage protection as well as creating employment. Each action is explored in detail, including several best practice case studies to guide implementation in Lamu. Further to the infrastructure projects presented in this Action Plan, a series of cross-sectoral interventions are outlined in section 4.6, with the potential for specific benefits for the tourism and heritage sector.

Table 4.28 Tourism and Heritage Action Plan

Areas of intervention	Actions
Developing Lamu's tourism offer and enhancing community involvement in the sector	4.4.1. Developing Lamu's tourism offer
Beautification and decongestion of the Municipality	Project 8: Lamu Discovery Trail
Climate-resilient infrastructure to support sector development	A17: Develop and promote the hospitality sector in Lamu
	A18: Introduce and enhance community-led initiatives
	A19: Establish an inclusive Lamu Tourism Board
	4.4.2. Beautification and decongestion
	A20: Develop Swahili heritage guidance
	Project 9: Lamu waterfront and town centre improvement
	Project 10: Wiyoni Bay Clean-up
	Project 11: Lamu ring road
	4.4.3. Climate-resilient infrastructure
	Project 12: Lamu Old Town drainage and wastewater
	Project 13: Streetlighting
	Project 14: Solar-powered water abstraction
	Project 15: Desludging business and sludge-handling facility
	4.4.4. Value Chain opportunity
	Waste collection and processing

Source: Atkins analysis

4.4.1 Broadening and Developing Lamu's Tourism Offer

As mentioned throughout the UEP, LC has a vast tourism opportunity, with a range of natural and heritage assets. However, it has been suggested that the County's potential has not been marketed effectively, both within Kenya and internationally. There is a pressing need to promote Lamu as a 'complete package' destination, alongside infrastructure investments to enhance the tourism and hospitality offer. In addition, business consultations suggested that the local population of Lamu County does not necessarily benefit from the tourism sector, with limited participation in its economic activities and investment dominated by foreign investors.

In line with the objectives of this Sector Action Plan the aim is to relieve Lamu Town and Shela from the existing tourism pressure they experience by creating a network of hospitality nodes across the island, identified by unique spatial characteristics and cultural features. This will include identification of new tourist locations adjacent to the sand dunes and beaches, farms and other points of interest such as landing sites and fishing villages. In addition, LM should aim to build upon its existing leisure and hospitality offer to accommodate a potential growth in tourism due to the LAPSSET corridor programme, including hotels, restaurants, entertainment and cultural facilities which are suitable for the target market and easily accessible to all.

In order to address these challenges, this section provides details on the soft interventions, infrastructure proposals, community initiatives and training and capacity building recommendations proposed to target the overarching objective of developing Lamu's tourism offer and enhancing community involvement in the sector.

A17: Develop and promote the hospitality sector in Lamu

Tourism is a labour-intensive activity, founded on customer service skills. The higher the standard of the services provided, the better the tourist's experience, thus education and training is of paramount importance to developing the hospitality sector in Lamu.

This does not only apply to services directly related to tourism and hospitality such as hotels and guest houses, but also throughout the wider supply chain – including trade, transportation and recreation, both active and passive. Training courses should be provided to local workers, for instance, through the proposed Lamu Tourism Board (A19), to ensure they understand best practice within the hospitality sector and how to serve customers in the optimal way. These courses might require subsidy or other incentives to encourage locals to attend and develop these skills.

There is currently an existing free hospitality course available at Lamu Polytechnic, however stakeholder engagement suggests that graduate outcomes are restricted by a lack of practical experience within the industry. With the support of the private sector, training courses should encourage students to undertake an internship as part of the course to encourage their integration into the industry. This could be undertaken in Lamu's hotels, guest houses and other hospitality establishments, as well as in travel and tour establishments, in line with individual students' career interests.

While LC does house a range of accommodation and other hospitality facilities, the business consultation process indicated that these facilities are not of sufficient capacity or quality to accommodate the number of visitors that the County would be able to attract with increased publicity and investment.

As such, an assessment of the existing hospitality facilities in Lamu needs to be undertaken to ensure there are sufficient and appropriate accommodation and leisure facilities to serve a wide range of visitors, including family-friendly hotels, business-focused accommodation and affordable hostels. These facilities should be assessed to ensure they conform with expectations with regards to hygiene, cleanliness, comfort and safety, as well as protocols regarding COVID-19.

This process should take account of the tourism developments offered by the LAPSSET corridor programme, as well as its potential implication for the development of the Blue Economy in Lamu. This assessment will prove useful in recognising key infrastructure and sectoral gaps to improve upon, as well as identifying a target market.



Case Study 4.16 - Making the case for an inclusive hospitality sector

FGDs have indicated that PWD are often excluded from the socio-economic activities of Lamu. This exclusion is manifested in several ways, for example in their impossibility or difficulty to obtain employment or start/engage with businesses. There are also barriers related to high levels of stigmatisation, which also exclude them from cultural activities and events happening in the region, such as the Lamu Festival. The development of the hospitality sector in Lamu Municipality, and tourism sector more generally, offers the opportunity to make it more inclusive and accessible to all; not only in terms of employment opportunities, but also for PWD (and other groups such as women, elderly people, people with children, etc.) as tourists.

A recent study held in Australia¹²¹ has demonstrated the economic opportunities of inclusive tourism, particularly considering that it could untap a significant unmet demand (one billion people in the world lives with a disability). The study also presents some case studies that could be adapted to the local context. Main recommendations include accessible infrastructure (i.e. lowered reception desks, touch and sound devices for checking-in, ramps, elevators, step-free access, etc.); accessible communication strategies (mobility maps, marketing brochures in Braille, informative digital campaigns); and disability awareness training for staff. A customised hospitality offer could also present an opportunity for employing PWD in the sector.

¹²¹ Pavkovic, I., Lawrie, A., Farrell, G., Huuskes, L., & Ryan, R. (2017). *Inclusive Tourism: Economic Opportunities*. University of Technology Sydney Institute for Public Policy and Governance, Sydney, NSW.

A18: Introduce and enhance community-led initiatives

The Sector Action Plans for agriculture, livestock and agri-processing (section 4.2) and fishing and marine (section 4.3) encourage local businesses in Lamu to form cooperatives. This is also recommended for Lamu's tourism and heritage sector, in order to include members of businesses, organisations and individuals operating within the Municipality. Cooperatives will enable businesses and individuals to pool together their finances and assets to invest jointly and access finance in targeted interventions that directly benefit local communities.

Community-led development provides local people with the opportunity to influence and become involved within developing their own communities. It brings about improvements in local, social, recreational, environmental and historic amenities for locals and visitors alike, and it creates an environmentally-sensitive and locally-controlled tourism sector, which develops business and employment opportunities for local people, and keeps money within the local economy.

For instance, stakeholder engagement undertaken has highlighted a number of key social and cultural challenges relating to tourism, including the erosion of local Swahili culture, with the local dialect disappearing. Furthermore, there appears to be a lack of public awareness of the cultural and heritage value of Lamu, which has, in part, contributed to the deterioration of Lamu Old Town¹²². As such, community-led initiatives could be designed to generate awareness of the social and economic value of the Old Town's rich history.

One potential option could be the development of a community-based cultural and skills exchange centre in the Old Town¹²³, operated by a cooperative group.

Such a facility could be dedicated to hosting and organising cultural appreciation and sensitisation projects, and art exhibitions and events, with a focus on the celebration of Islamic and Swahili cultures. In addition, the centre could provide information for tourists on accommodation and experiences, as well as a shop selling products made by locals around the archipelago.

The core function of the centre should be to enable access to creative and cultural experiences for both local communities and tourists. This could contribute to the reinforcement of cultural traditions and continuity at a time where these are under threat from globalised communication and media, as well as the effects of tourism and the introduction of western cultures into Lamu. Cultural exchange activities could involve performances and seminars hosted by local foundations like Lamu Arts and Theatre Alliance and Lamu Youth Alliance, including provision of rehearsal and meeting space for such groups.

Crucially, a cultural and skills exchange centre would provide direct employment for the local population, across a wide range of abilities and interests. Furthermore, participation in arts and culture is shown – internationally – to reduce the likelihood of crime or recidivism among youth and can be a motivator towards positive lifestyles and an appetite for learning¹²⁴. The centre could also offer community services like counselling and after school programmes.

In line with this, the centre should be responsive to community needs and it should involve active participation of otherwise excluded groups in the development of its programming, including placing the responsibility for the ownership and management of the facility with local communities.

¹²² UN World Heritage Centre, ICOMOS and ICCROM, Report on the Joint Reactive Monitoring Mission to Lamu Old Town (2019).

¹²³ Accra Cultural Centre, *Our History and Our Mission* (2015), Available at: <http://www.cncaccra.gov.gh/node/1>, (Accessed: 24/11/2021).

¹²⁴ Republic of South Africa Department of Sports, Art and Culture, Policy Document for the Development of Local Arts and Culture Centres and Programmes (2014).

Case Study 4.17 – Accra Cultural Centre, Ghana

Accra Cultural Centre was established by the Ghanaian Ministry of Tourism, Culture and Creative Arts to promote, sustain and develop cultural/artistic excellence within the Greater Accra Region. The centre works in collaboration with industry, commerce and political authorities to promote and increase understanding the cultural, social and economic importance of traditional arts and culture for Ghana.

The core facilities include an art gallery showcasing Ghanaian and African paintings and works on canvas by both contemporary and 20th century artists, as well as an auditorium and open-air proscenium stage which hosts seminars, theatre performance, music and dance events. A key attraction for tourists is the centre's traditional handicraft and textile market, which accommodates wood, metal, bead and textile crafters, with their artworks sold at a commission.

The Accra Cultural Centre hosts a calendar of annual programmes and activities to promote traditional cultures, including Paappoe Thompson Choral Festival, which brings together choirs from across the country to perform songs by Ghanaian composers to celebrate its Independence Anniversary, and Sankofa Drama Competition, where high school students perform plays written by African playwrights. The centre also provides a number of training and mentorship programmes for local artists, including regular seminars to equip artists with marketing skills and strategies to enhance their sales.

A19: Establish an inclusive Lamu Tourism Board

Tourism is an inherently complex sector, involving various stakeholders and key players in delivering services, with an extensive reach in terms of the impact it has on local communities. In Lamu, the local population does not necessarily benefit from the sector, with relatively limited participation in its economic activities and the decision-making process. Investment in the industry is dominated by foreign companies, with local investors often priced-out. Indeed, those local residents involved in the tourism and heritage sector are typically in lower paid roles, for instance working as tour guides or boat drivers.

Consequently, it is crucial that all relevant stakeholders are involved in the future development of the sector from an early stage to ensure informed decision-making and enhanced inclusion of otherwise excluded groups. This could take the form of a Lamu Tourism Board, gathering key stakeholders to provide a plural representation that accounts for various needs and expertise. The ultimate goal of the working group should be to develop a representative tourism offer for Lamu, which provides socio-economic benefits for the local population, and ensures effective levels of cooperation in its delivery. This includes development of initiatives and campaigns aimed at enhancing the marketing of Lamu as a destination.

Key actors could include:

- > Public sector officials from the departments of trade and industry, tourism, environment and transportation are critical to ensuring integrated planning and effective implementation;
- > Private sector and tourism industry representatives and associations within Lamu – including local businesses active within the sector, supply chain businesses (including boat operators, tour companies, tour guides and hoteliers), members of Lamu Tourism Association and financial investors;

- > Community groups, particularly from those areas impacted positively or negatively by tourism, as well as NGOs and other civil society interest groups. In particular, this should incorporate SIGs including PWD, youth, women and elderly people. Representation from all geographical areas of LC should be encouraged; and
- > Additionally, it would be important to maintain close links at a national level with key ministries and agencies, such as the Kenya Tourism Fund and Kenya Airports Authority, as well as representatives for the LAPSET programme.

The Tourism Board should lead on the development of a strengthened, more global and coordinated tourism strategy to ensure the sustainable development of the sector, including a tourism management plan, skills and employment strategy, and a clear and unique marketing strategy.

While the international market should remain a target market, COVID-19 has demonstrated the value of domestic tourism in Kenya and should be regarded as an important source of considerable activity covering different seasons and enhancing the sector's resilience. With a clear strategy in place and development of a unique brand, it would be easier to strengthen media engagement and develop a network of national and international partners that will provide a marketing platform.

This should be supported by a range of image-building activities both nationally and internationally. As proposed in the CIDP, this could involve marketing through tourism documentaries and publicising on various social media platforms and websites¹²⁵, as well as marketing through national radio or magazines.

125 Lamu County, CIDP (2018).

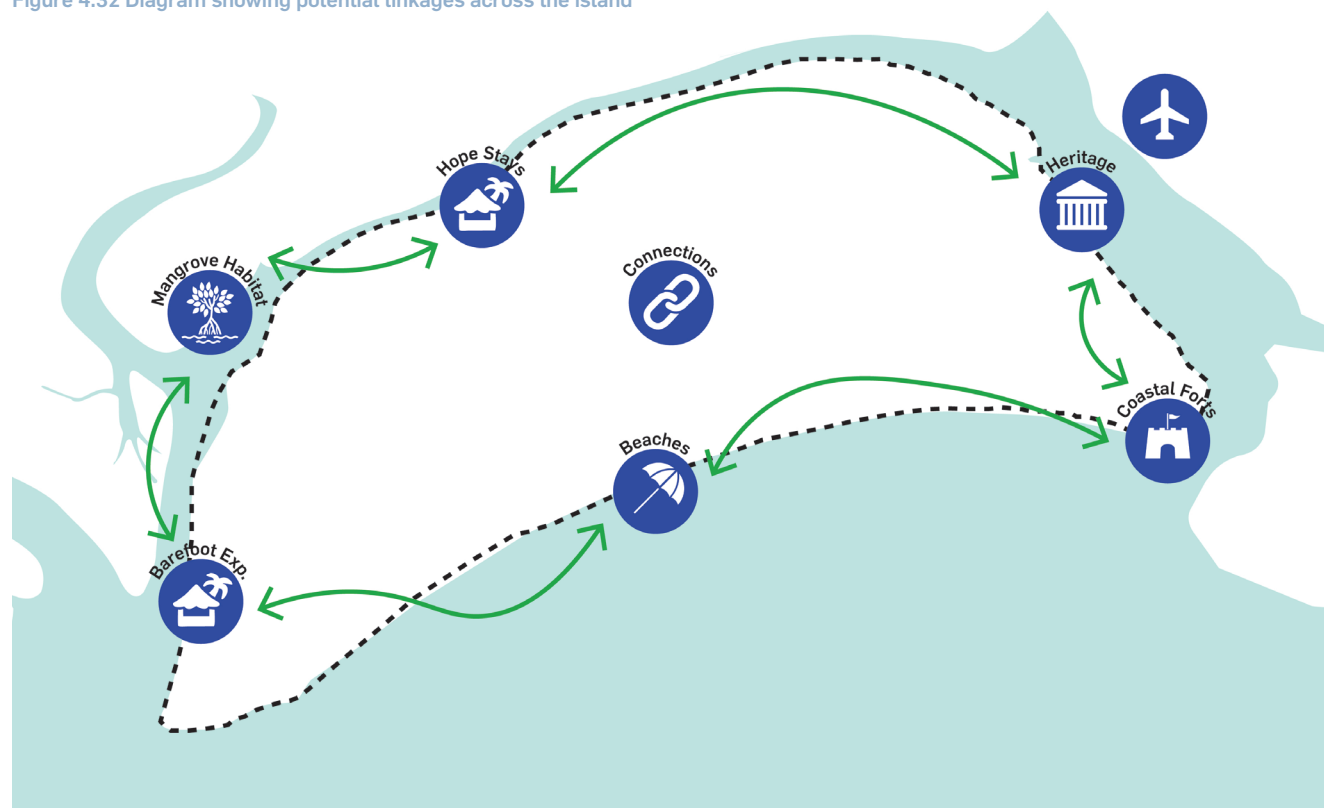
As an extension of the Lamu Tourism Board, a Heritage Task Team should be considered to define measures to tackle the issues facing the Old Town – including conservation challenges, erosion of culture and youth unemployment. This should comprise relevant government agencies from the national and local levels, LAPSET Corridor Development Authority (LCDA) and National Museums of Kenya (NMK), as well as key community groups. Furthermore, the Tourism Board could coordinate community engagement activities to create awareness of the social and economic value of the Old Town's rich history, as discussed in Action A18.

4.4.1.1 Project 8: Lamu Discovery Trail

Project overview

Lamu Island is one of the most important touristic destinations in the entire country. It offers a unique mix of a variety of natural assets, historic heritage, untouched beaches, inland agricultural and offshore fishing experiences. The two dry seasons, the first beginning in July and ending in October and the second beginning in January and continuing through February, are the main times to visit the Island. Lamu is one of the most culturally-rich islands of the archipelago. It is strategically located off the coast of Manda Island which hosts Manda airport. The island is accessible via water from Manda Island and the mainland at Mokowe, only a ten-minute boat ride across the channel. Despite such easy access to the island and its variety of interesting character areas (shown in Figure 4.32), there is a limited tourism offering which doesn't allow the visitor to explore the full potential of the island beyond the known hotspots. Therefore, it is proposed to use Lamu Island as a pilot location to introduce the "Lamu Island Discovery Trail".

Figure 4.32 Diagram showing potential linkages across the island



Source: Atkins analysis

The aim of this trail is to link various natural and manmade landmarks and assets and expand the tourism offer beyond the core town area across the island. (See Figure 4.33) This will help alleviate pressure from Lamu Old Town itself and increase the tourism offering at other locations.

It will also benefit the other local villages such as Kipungani, Matondoni and Wiyoni. Individual interventions are suggested along the trail that most suit the character of that area. The newly established discovery trail will encourage and enable visitors to explore more of the island, and in-turn, support the local economy more.

The discovery trail revolves around the concept of a circular economy and the Blue Economy. It promotes the engagement of local people and local resources. It connects and unlocks already-existing potential and demonstrates how a series of soft and spatial interventions can enhance the local economy. The approximate length of the trail is between 35 and 45km.

The trail begins within the Lamu Old Town area, where the visitor can explore the UNESCO World Heritage Site and some of the historic landmarks such as the County Assembly, Lamu Museum, the Old Fort set within the Old Town, and the Masjid Al Wali Seif which formally marks the end of the Old Town.

As you move inland, the town will offer an alternative to the waterfront buzz and leisure activities with an injection of traditional intricate alleyways and cultural discovery which will elevate the local identity of the area. The Swahili architectural style dominates the town's landscape and forms part of its character.

The trail takes you south towards Shela Village which is a centre for tourist hotels and accommodation and has a pristine beach. The hotels and holiday homes maintain the Swahili architectural style. The south-eastern tip of the island is landmarked by the beautiful Shela Fort. This spot slowly transitions out of the historic area and takes you to the natural heritage of the Island. Traditional dhow boat tours are a speciality in this area, and this node offers an ideal location for such tours.

The next stop on the trail is the Sand Dune Trail. The southern beaches of the island are characterised by beautiful sand dunes stretching over 12 km. This is a protected area and offers an unfettered nature walk along the beach. A few viewing and photo points of interest are recommended along this trail.

The south-western tip of the island marks an end to the Sand Dune Trail. This node is dotted with low-key guest houses and small hotels. They offer an exceptional barefoot experience where the visitor can be at one with nature, and experience the area at a much slower pace.

As you travel further along the trail it takes you to the small settlement of Kipungani and further north the settlement of Matondoni. The area adjacent to both these towns is characterised by dense mangrove forests and presents the visitor with a great opportunity to explore them. A Mikoko Trail is proposed in this area. Timber walkways with information boards can be introduced to explore the mangroves or small private boat rides, provided by local people can be operate as guided tours. These towns can offer local home stays and fishing experiences where visitors can enjoy home-cooked meals with their own catch of the day, made by them during their fishing trip.

The central zone of the island is encompassed by farms and offers agri-tourism opportunities such as farm walks, camping and farm stays. These can be offered and run by local farmers as a supplement to their livelihoods.

The trail loops back into Lamu Old Town where it ends. This trail can be explored in reverse order too, and visitors could undertake certain sections of the trail at the leisure over a number of days.

[Bike share service to complement the trail](#)

Bicycles can offer a low-cost non-polluting transport mode to enjoy the discovery trail. A bike-share provides users access to cycles for a limited amount of time from a network of geo-defined stations spread along a route where they can be borrowed and returned. A bike-share service along the trail can provide residents and tourists access to cycles that can be used to experience the diverse landscapes of open farmlands, mangrove forests, sand dunes and conservation areas along the enchanting trail.

The trail's length is about 40 km and cycling could therefore offer a faster and more convenient way of enjoying the expansiveness of the trail, rather than by foot. A bike-share also improves access to cycles to a large segment of the local residents as well as visitors, offering the convenience of cycling without the burden of ownership and the flexibility to navigate the trail at one's own pace.

Supporting cycling infrastructure would be a good complement to the bike-share service but would not be compulsory for operating it. A blend of compacted earth and paved routes characterise the trail's terrain and the consideration of pedal-assist e-bikes could offer cyclist the easier option to experience the scenic natural environment while still being challenging enough for enthusiasts looking to break a sweat. For residents, the trail not only offers an oasis for reconnecting with their natural surroundings, but it also provides links to important services and activity centres. The bike-share service could support the mobility of residents too, enabling them to better-reach those connected by the trail, while contributing to the general wellbeing and public health of surrounding communities.

Raising the profile of cycling through the bike-share service could also make it a gateway for residents to consider purchasing their own cycle, which can encourage investment in supporting infrastructure and expansion of the system to other parts of the island. This in turn can help strengthen the heritage and conservation image of the town and support increased tourism and an improved business climate.

Wider Municipal and County benefits

Although Lamu Island with its Old Town is identified as the urban centre with a rich culture and history and UNESCO World Heritage Site status, many of the individual interventions as well as the trail concept suggested in this proposal are transferable to various locations in the Municipality and County.

For example, Pate, Siyu and Kizingitini are island villages with rich historic and cultural environments, where their communities have retained their traditions, attracting domestic and international tourists. However, they have poor road networks and lack social infrastructure. With the introduction of such a proposed discovery trail or similar, these villages can achieve an enhanced tourism and economic future.

Other examples include main market towns such as Mokowe, Mpeketoni and rural market towns such as Witu and Mkunumbi, which could be woven into 'off the beaten track' trails experiences for tourists and visitors. Subject to further detailed study, these areas can offer exclusive local produce that is attractive to visitors. This can be funded and operated by locals thus providing a supplementary income to their communities.

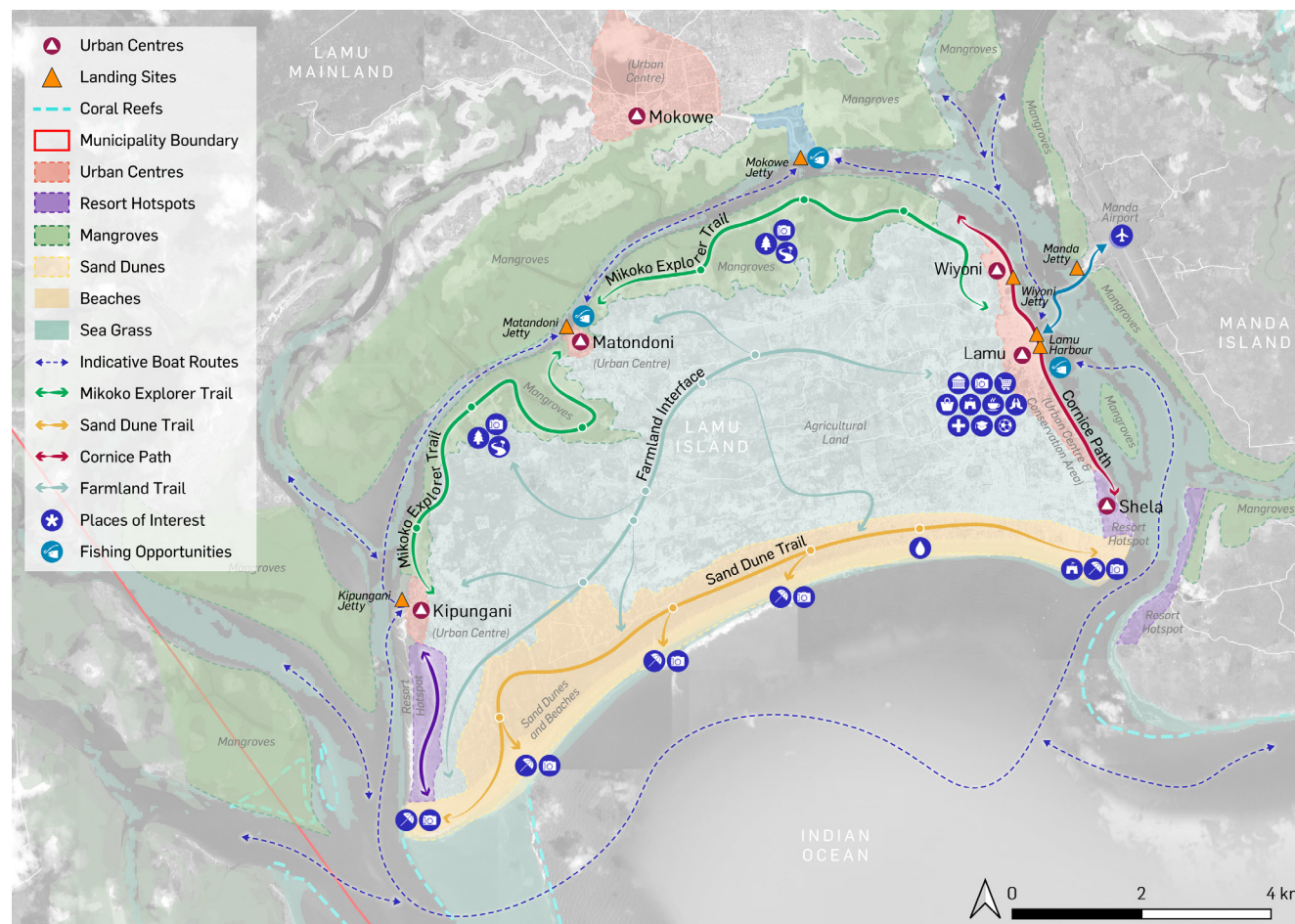
Location

- > Lamu Town and Island

Linkages

- > Tourism and heritage;
- > Urban development; and
- > Project 9 Waterfront and town centre upgrade

Figure 4.33 Discovery Trail showing various nodes and paths to be explored



Source: Atkins analysis

Table 4.29 Project 8 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
Type 1 – Sand Dunes Footpath: 2 m compacted ground, minimum intervention Lighting (every 10 m); PV solar bollard Public realm components (every 800m): off-shelf seating; litter / recycling bin; wayfinding signage to sit on 30 sqm timber deck (extended area from the main footpath) Viewpoints (every 1 km): off-shelf seating; litter / recycling bin; wayfinding signage	Total cost = KES 3.275 billion KES 992 million	Better, safer and more accessible pedestrian and bike access to the wider island area Formalised opportunities for local businesses and employment Attract international and domestic tourists	Private investor: design build operate maintain (DBOM) Public Authority or a mix Public Private such as Business Improvement District (BID) The bike share system can be financed through a one or a combination of revenue sources, including advertising, sponsorships, user fees, and the city budget	Local Authority, IFIs (International Financial Institutions), Central government Value capture following completion: leases on temporary spaces for events and local businesses; guided tours charge; levies on increase of land value of developed / refurbished areas
Type 2 – Farmland Footpath: 2m compacted ground, minimum intervention Lighting (every 10m); PV solar bollard Public realm components (every 800m): litter / recycling bin; wayfinding signage	KES 758 million	Broadening of the Lamu Island tourist experience Promote the use of active transport, helping to improve public health	The municipal government can contract a private operator to install the bikeshare system and handle day-to-day operations and maintenance Alternatively, the municipality can attract private bikeshare companies to independently set up and operate a bikeshare system in the town	Maintenance of bike sharing responsibility of Municipal Government Employ local residents or SMEs for monitoring and operating the bike system
Type 3 - Mangrove Footpath: (W) 2 m raised timber boardwalk (ideally locally sourced timber) Lighting (every 10m); PV solar bollard Resting spots: (every 500m) Wider timber decks with timber seating	KES 893 million			
Type 4 – Generic Footpath: (W) 2 m compacted ground, minimum intervention Lighting (every 10m); PV solar bollard Bike-share Lamu Town Strategy and feasibility study for bike share system and coverage area Non-motorised transport network infrastructure plan	KES 612 million KES 20 million			

Source: Atkins analysis

Table 4.30 Project 8 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Masterplan to be developed for the wider site before progressing	Pre-feasibility study	Short to medium-term
Funding	Site surveys and technical studies	Multi-phase
May require some minimal land acquisition or way leaves		Urban Development Proposals supporting Economic Growth
Extensive Mangrove habitat in the vicinity		Public zones' operations and maintenance) by Municipality
		Security across the island
		Community support and buy-in

Source: Atkins analysis

SUED principles for implementation

Climate resilience recommendations

The design of the trail should make use of shade where possible, with additional planting of local species in selected spots to provide protection against temperature extremes, and regular stops where water is available will increase comfort for trail users. Although the largest numbers of visitors will be in the dry seasons, the trails will also need to include suitable drainage.

There are limited climate resilience considerations for this project. Consideration will need to be given for the location of bike stores to ensure they are not at risk of flooding or exposed to high temperatures which could reduce their comfort to users. Investment into the supporting road and trail network, for example including drainage features, increases the resilience against increased rainfall and flooding which would maintain cycling as a desirable mode of transport.

Bicycles are a carbon emission-free mode of transport so will not impact the air quality of Lamu Old Town.

Social inclusion recommendations

The discovery trail contributes to a more inclusive access to the wider island area. It also allows a type of tourism that does not go against local communities and their cultural traditions, while acting as an economic catalyst.

Bike sharing offers an affordable, more sustainable, and safer mobility alternative for tourists and local communities, particularly benefiting low-income populations. It enhances access to employment and social infrastructure, while contributing to the general wellbeing and public health of surrounding communities. Encouraging this type of mobility also benefits SIGs (e.g.: elderly people and PWD) mitigating health and safety risks associated with boda boda speed.

- > Using ICT-based solutions, like Mpesa, will facilitate bikes usage, yet this needs to be accompanied with digital skills development to tackle the existent digital gap and make this initiative even more inclusive;
- > Related infrastructure will need to incorporate signage to reduce potential accidents. This signage should be accessible to all (e.g. avoid reflective materials, use simple and accessible language, etc.);

- > There is usually a gender gap; women use bike sharing less than men do. This relates to gendered mobility patterns, roles and responsibilities, but also to infrastructure-related aspects. It is recommended to accompany this initiative with adequate streetlighting and bike paths to increase safety (and the perception of safety), particularly for female users. Offer options for women travelling with a child; and
- > Promote transport inter-modality, that is, the connection between different means of transport to enhance positive benefits from this intervention, such as improved access to employment and economic opportunities, and social infrastructure.

Case Study 4.18 - Bike share scheme¹²⁶

In Kenya, an electric pedal assist bike sharing scheme, that can run for an entire day on a single charge, has been launched by Littlecab, a ride-hailing company. The bikes are accessed by scanning a QR code through an app linked to the Mpesa wallet, which allows users to access bikes located at geo-defined stations across a network. The scheme is set to be rolled-out first along popular cycling routes in public parks such as Karura Forest, and then expanded to city streets in future. Similar systems have already been rolled-out in cities, such as London's Santander bikeshare and Paris' Velib Metropole bikeshare. The schemes are credited with having helped to popularise cycling in these cities, improve integration with other sustainable transport modes, and encourage investment in infrastructure that supports increased use of healthy and zero carbon transport modes.



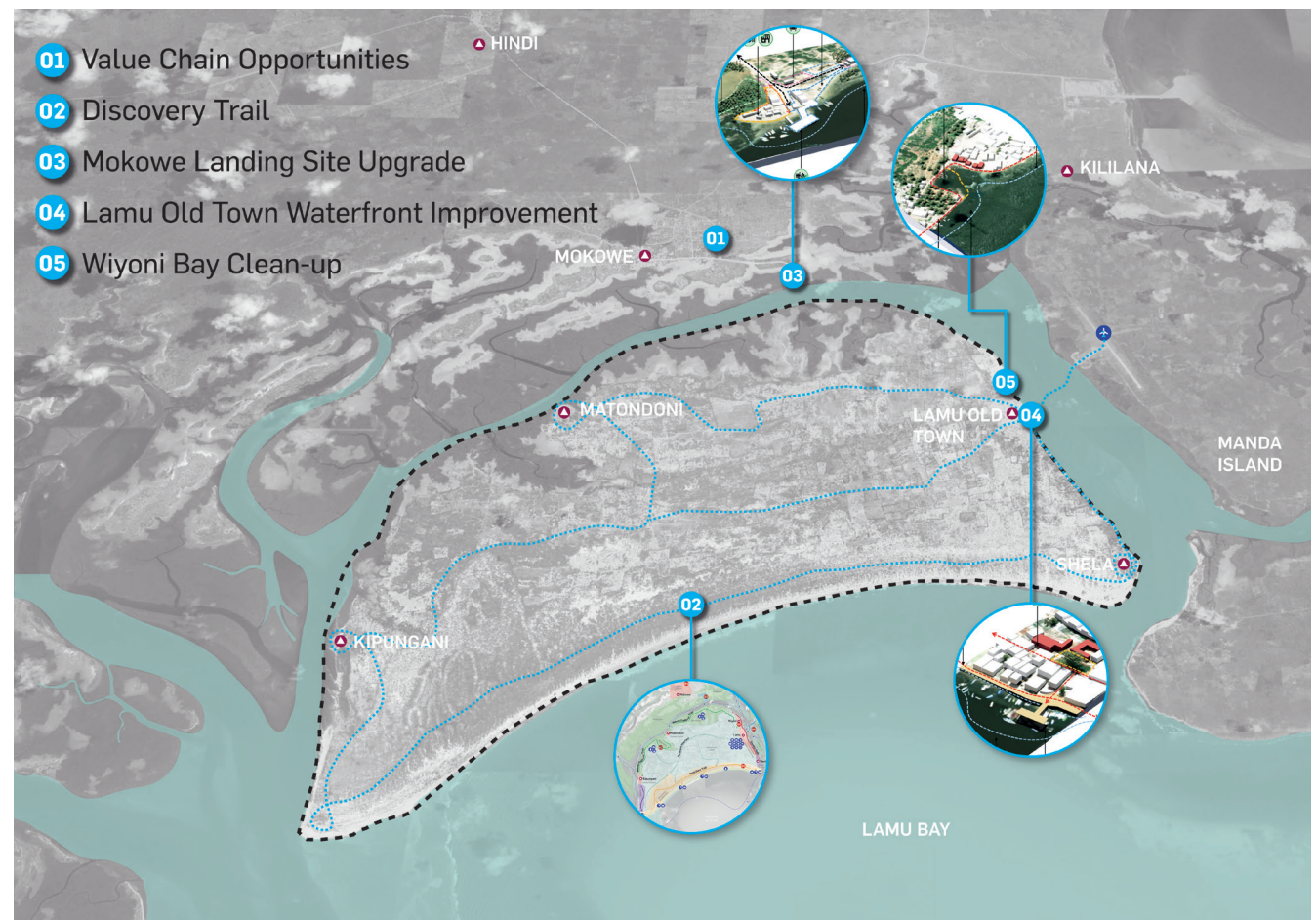
126 Gadgets Africa, Little Kenya to roll out e-bikes (2021), Available at: <https://gadgets-africa.com/2021/10/27/little-kenya-to-roll-out-e-bikes/> (Accessed: 03/12/2021).

4.4.2 Beautification and Decongestion

This section provides details on the infrastructure proposals aimed at the beautification and rationalisation of Lamu Town with the potential to have a positive impact on its attractiveness and inclusivity as a tourist destination. Any new infrastructure should follow the principles of inclusive design

to ensure easy access, safety and use for everyone, as well as climate resilience to reduce vulnerability from extreme weather events. There are specific social inclusion and climate resilience recommendations for each infrastructure project. Locals and businesses need to be consulted and included in the design and implementation of such interventions to ensure they are beneficial to the community, as well as tourists.

Figure 4.34 Map showing pilot beautification proposals of the Lamu Island area



Source: Atkins analysis

A20: Develop a Swahili Heritage Guidance

Swahili Heritage Guidance (Appendix E) seeks to address some of the issues raised by the WHC and advisory bodies in their 2021 property assessment. The recommendations look at identifying quick wins, namely a series of actions that are potentially easy to implement and which, if adopted, might have a relatively big impact on the UNESCO World Heritage Site designation.

The proposals are intended to be implementable by individuals or small groups of citizens and business associations, all with the common objective of preserving the World Heritage Site status and therefore being able to reap their benefits.

Relevant issues identified include¹²⁷:

- > The poor state of conservation of the property and lack of building controls observed by the mission, which pose a threat to its integrity and authenticity, remains of significant concern.
- > The Outstanding Universal Value (OUV) of the property should be thoroughly taken into account in the conceptualization of the three KUSP projects.
- > Decisions adopted by the Committee in 2021:
- > Expresses its concern about the overall state of conservation of buildings within the property, and further requests the State Party to complete the survey of the building stock and strengthen enforcement of building controls to halt the deterioration and use of inappropriate materials;

Figure 4.35 Example of Swahili Heritage Guidance intervention



¹²⁷ UN World Heritage Centre, ICOMOS and ICCROM, Report on the Joint Reactive Monitoring Mission to Lamu Old Town (2019).

Source: Atkins analysis

One of the key observations raised by the heritage bodies indicates that development in Lamu Old Town is inconsistent with the Swahili vernacular, specifically materials palette, spaces and public realm current articulation, clash with local identity and detract from the heritage's integrity.

The following catalogue identifies key issues observable in the town and good examples to help guide further small-scale physical interventions that can be implemented by individuals or small groups of stakeholders.

The underlying objective is to illustrate what small, incremental changes might look like. Other interventions might require a more systemic approach (ie. lighting, paving, or local transport) and a coordinated approach, but these are instrumental in preserving the historical traits of the town.

The review of local influences (which in turn derive from a wide range of backgrounds, namely Swahili building techniques incorporating Arabic, Persian, Indian and European influences) capture both tangible and intangible attributes.

This section illustrates key physical elements (such as carving patterns, walls, materials, doors and architraves, verandas and arcades) as well as the intangible flavour of traditional festivals (and their rites) that capture the Swahili tradition.

The sections cover:

- > Street and spaces;
- > Wayfinding and signage;
- > Lighting;
- > Street furniture;
- > Examples of practical applications

Figure 4.36 Photos of Swahili architecture on Lamu Island



Source: Atkins site visit

4.4.2.1 Project 9: Lamu Old Town waterfront improvement and town centre improvement

Project overview

The tourism-based anchor projects include the upgrading of the waterfront area around the existing jetty which is currently identified for upgrade in the LIUDP. The proposals within this project, whilst leveraging, acknowledging, and integrating the LIUDP infrastructure developments, take a broader view with regards to climate resilient initiatives (mitigations for sea level rise for example) and linking the waterfront with the other activity zones within the town such as UNESCO World Heritage Site and the northern cargo jetty such as Wiyoni Bay and even south to Shela Town.

The proposals are to improve its touristic potential through better access and circulation linking it to the wider area with targeted signage and upgraded streets and public realm. This will open opportunities for the areas cultural and artisanal assets to be developed and exposed to a wider visitor audience. This will also introduce opportunities for local tours, artisan workshops and demonstrations, as well as homestays and accommodation focused on women empowerment and job creation within the local community. A village cooperative can be set up in conjunction with the Municipality to manage the upgrading and future operations within the WHS as well as the neighbouring areas.

The proposal also links with the opportunities discussed within the Discovery Trail (project 8) which stretches across the island. This is considered to be an untouched resource which, when sensitively developed and well-managed, can become a significant added attraction to the Lamu tourism offer. Low impact, eco-friendly facilities have been proposed which will create greater access into the area whilst encouraging visitors to experience the natural coastal beauty in terms of landscape and views. To the north of the town the Wiyoni Bay inlet site clean-up is proposed to supplement the proposed trade and integrated transport development in the LIUDP.

The waterfront also serves as the gateway to Lamu town where docking of passenger and cargo boats, movement of goods, tourism and urban services have developed around maritime trade. With the growth of the town, the mixing of both cargo and passenger activity are straining and degrading the quality of the waterfront space.

To support the waterfront's revitalisation, the separation of the incompatible passenger and cargo activities should be considered. Two dedicated cargo handling facilities have been identified at Wiyoni and Langoni. under the Lamu LIUDP. The modalities of managing the cargo movement and its interaction with the more urban-centric character of the waterfront are elaborated in more detail under the bay rationalisation recommendations.

Waterfront Enhancement (Detail Study)

The eastern coast of Lamu Island is approximately 5 km long and it is the most urbanised area of the Island and the County. The landscape along this stretch of land features well-defined urban centres, jetties, and more natural areas. To the north is Wiyoni, a small settlement focussed on productive and naval activities. Immediately adjacent is Lamu Old Town (part of which is designated as a World Heritage Site), this is the oldest settlement on the island. Two kilometres further south, is Shela, a smaller village known mainly for its touristic vocation. Along the coast are some notable structures, namely the natural inlet of Wiyoni Bay, the County Assembly, Lamu Museum, the Old Fort set within the Old Town, the Masjid Al Wali Seif which formally marks the end of the Old Town. Lamu County Referral Hospital is located half-way between Lamu Old Town and Shela and it is set in a leafy part of the waterfront. Further beyond Shela Town, the Old Shela Fort is the most southernly manmade landmark marking the transition from eastern to southern coast.

The above-mentioned urban areas are connected by the Corniche Path, a coastal route linking the whole eastern coast from Wiyoni to Shela, however only a portion of this is paved surface (approximately 2.5km). Typically, the Corniche Path is raised between 1 and 2 m above the mean sea level. The path varies in width (from 5 to 30m) and aesthetics, however most of the sections falling outside of the urbanised zones are just formed by basic compacted ground. The settlement's urban morphology does not cater for vehicular circulation; hence the Corniche Path has become the most convenient route for users moving between the three main destinations. It is common to see donkeys, carts and boda bodas mixing with pedestrians. However, the path is discontinuous and is abruptly cut off at Langoni where users are forced to walk along the seashore or are diverted into an interior sandy path.

Issues

The Corniche Path is victim of its own success. A combination of attractive location, size, continuous footfall from tourists and locals, and the concentration of cafe, restaurants, bars, and other facilities and attractions draws all-day-long visitors who mix with traders typically busy unloading cargo from the jetties. The Corniche Path along the Old Town is also an active scene for nightlife when the local community comes out to enjoy and socialise in the space. As such, space constraints and congestion are the among the key issues.

From a climate change perspective, recent unusual high tides have submerged and flooded the Corniche Path, and flooding is only likely to increase in frequency with rising sea levels.

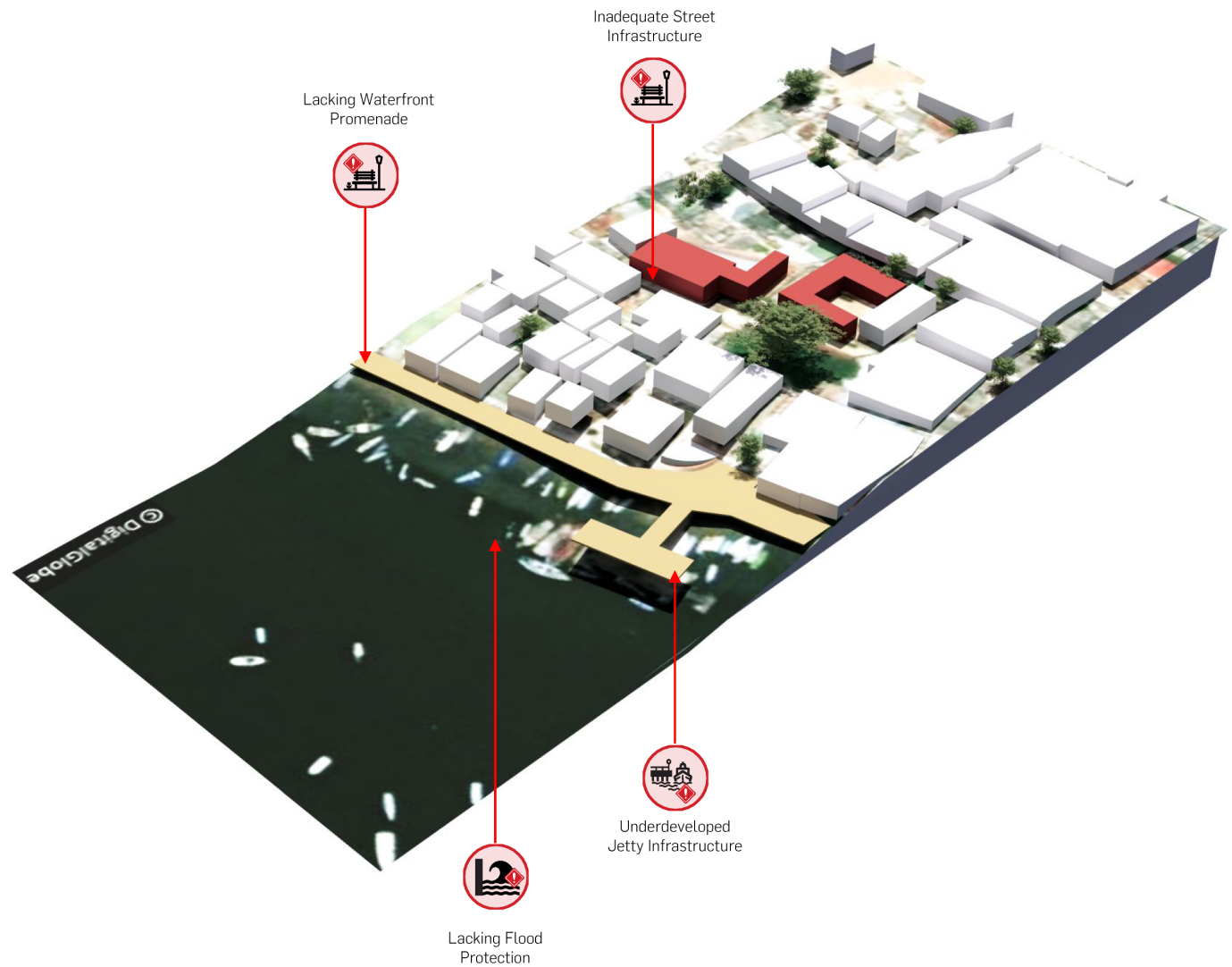
Finally, in consideration of additional exposure to more extreme weather, further quay walls and break waters are being built. These however follow a traditional technology approach (reinforced concrete structures) and of traditional wall profiles.

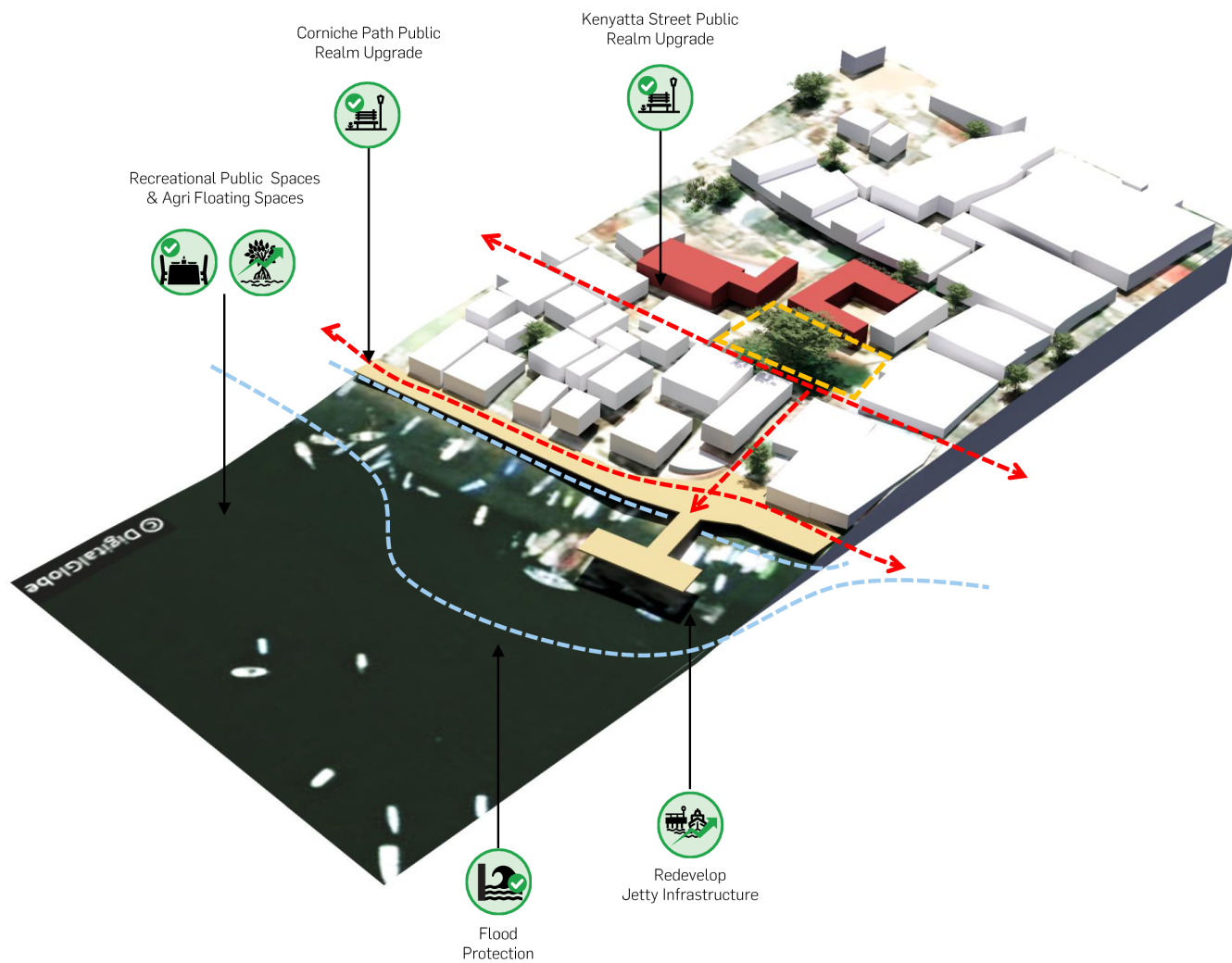
Opportunities and Proposals

Key opportunities lie within the following areas:

- > The creation of additional public space along the Corniche Path to ease congestion and accommodate more functions;
- > The adopt innovative quay wall technologies and solutions that both help protect the World Heritage Site from more frequent floods, that are sympathetic with the heritage designation of the Old Town and that can mitigate intense stormwater impacts;
- > Given consideration to coastal solutions that could help to protect and enhance the local marine ecosystem;
- > Build a better quality waterfront pathway with good pedestrian links, public amenities and facilities;
- > Provide a direct and continuous connection between Lamu town and Shela along Corniche Path to improve access and movement between the settlements and surrounding activity nodes.

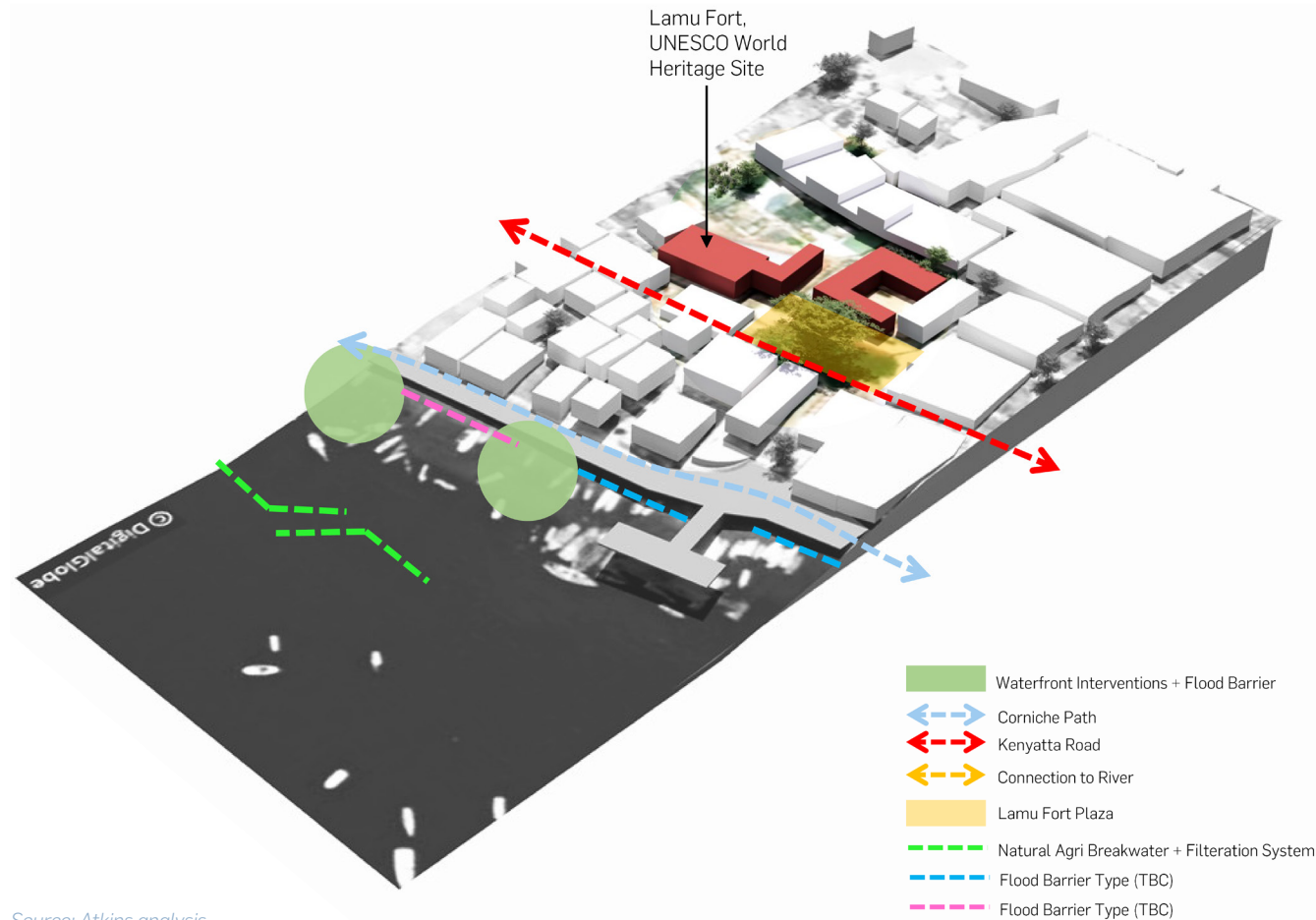
Figure 4.37 Lamu Old Town waterfront issues and opportunities





Source: Atkins analysis

Figure 4.38 Lamu Old Town waterfront initial zoning



Source: Atkins analysis

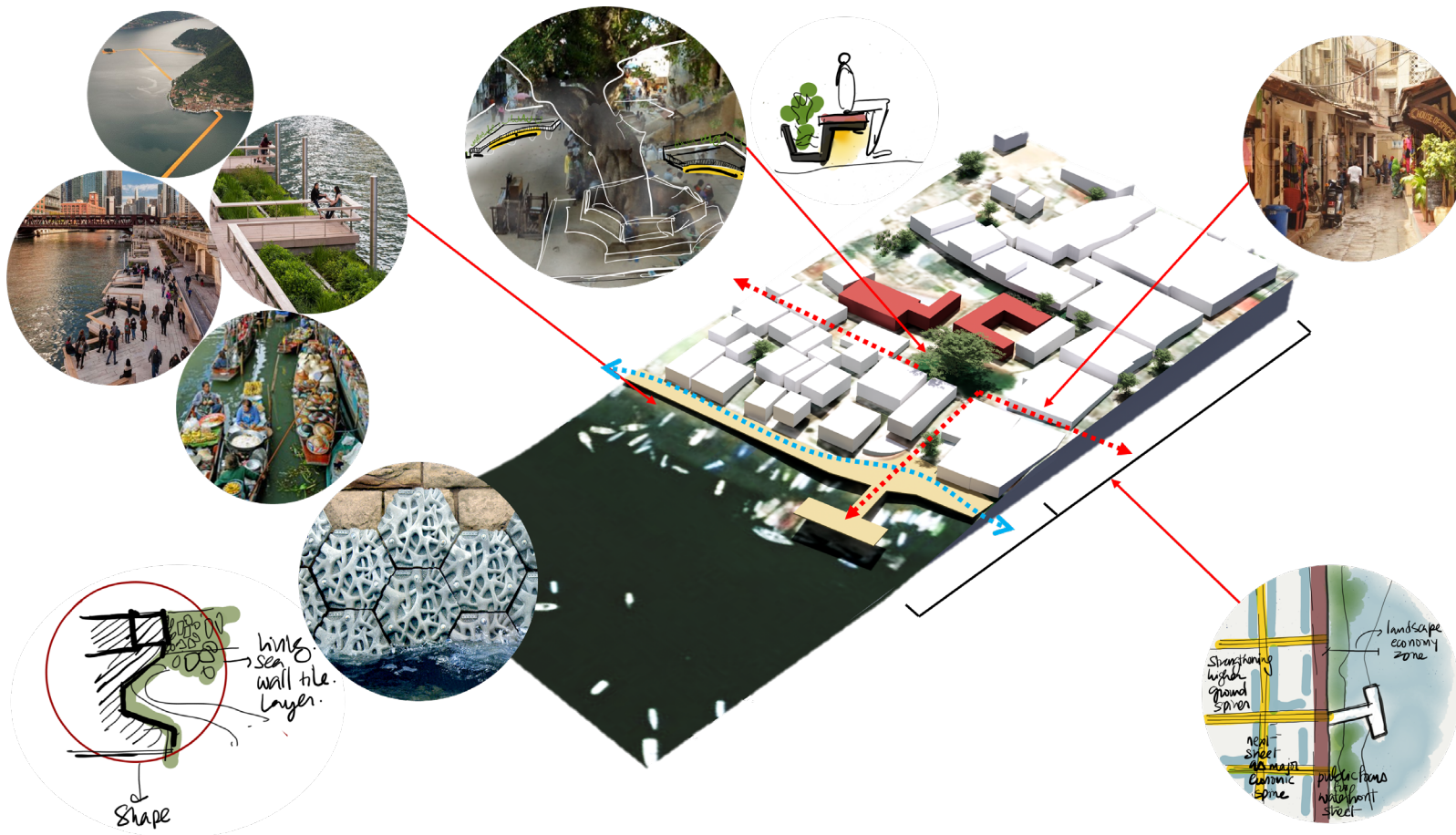
The illustrations below capture the essence of the proposals and holistically integrate a combination of solutions into an innovative Corniche Walk.

- 1. Making space** – to address the limited space on the Corniche Path, a series of either permanent or temporary (pop-up) pods extending from the promenade toward the sea, are aimed at creating additional public realm that could both be used as a sitting area or as an informal pier by day and additional event space by night (ie. temporary al fresco dinning, mini-stages for street artists, etc.). With such additions, there will be more room on the pathway to accommodate more pedestrian flow and establish areas suitable for temporary stalls and other uses. These simple solutions should allow for ample and flexible use of the space.
- 2. Protect the town** – quay walls are currently being built or restored along the waterfront and increased capacity piers are planned to be introduced. Currently, the quay walls are flush with the paving and are not designed to include parapets. Recent high tide events indicated that the sea level has increased (or might more often increase), current height of quay walls is insufficient to contain the tides. Therefore, a new type of parapet that can double as sitting area and protect the walkway from floods (based on current forecast and projections) is introduced in the most vulnerable areas. The quay wall adopts a convex profile, this it has been demonstrated, it will help manage better both intense and higher waves by absorbing and deflecting the kinetic energy of the waves themselves. Finally, more permeable paving coordinated with sub-surface drainage is introduced on the waterfront, this can accelerate storm water drainage and help mitigate temporary flash floods on the promenade.

3. Supporting the marine ecosystem - quay walls are a fundamental tool in protecting coastal towns from floods, however traditional smooth concrete walls, are not conducive and aren't a good platform for natural marine ecosystems colonisation. A recent innovation and experimental solution introduced in a series of costal projects, suggest the adoption of more organic cladding of to the quay walls. These are meant to mimic organic

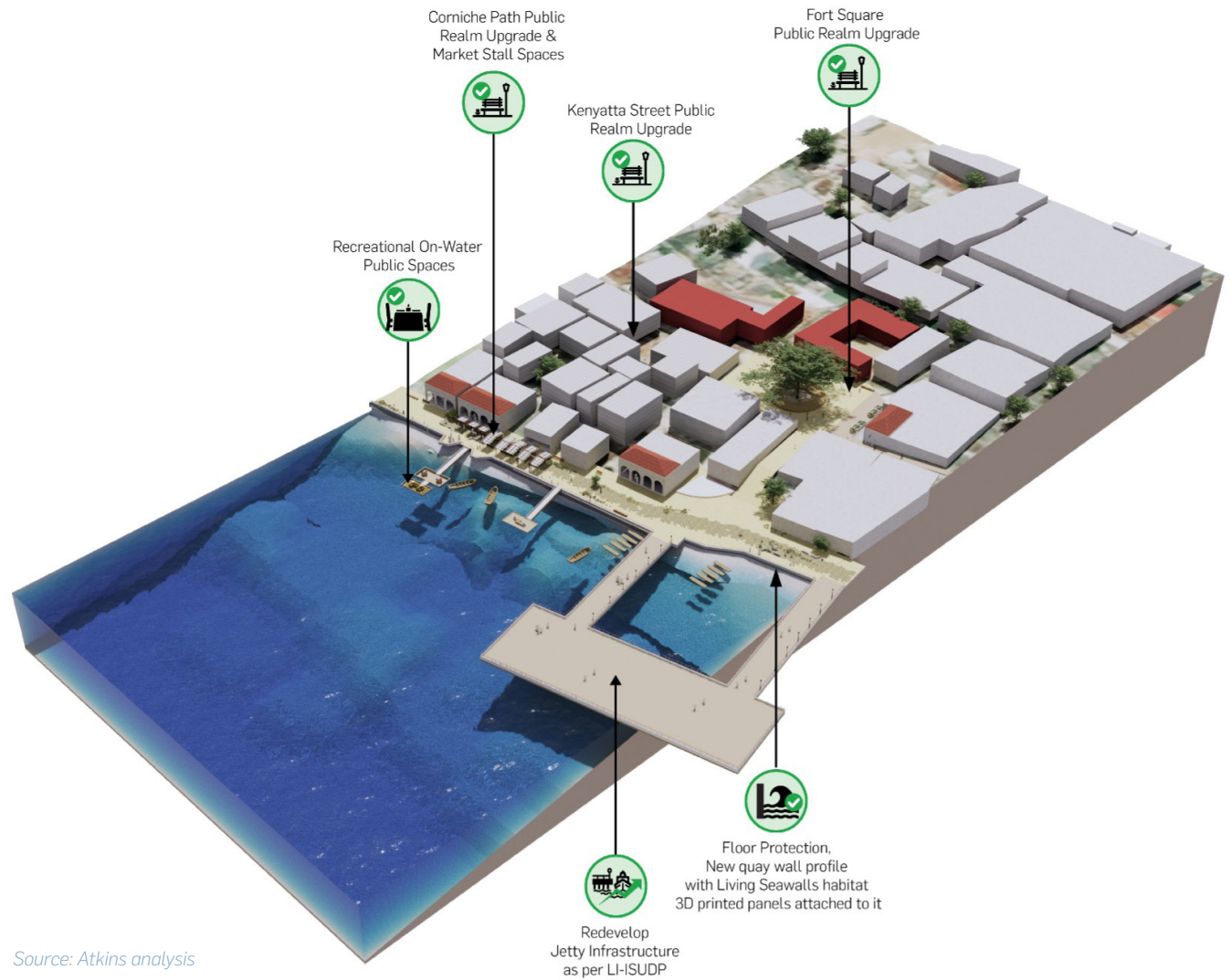
natural systems (i.e. Mangroves) and create an environment where microorganism and algae are more likely to settle and thrive. This is a low key, relatively cost-effective solution that can be retrofit on most structures. Beside their ecological value, these 3D printed tiles have also an attractive aesthetic which can, when exposed because of low tide, naturally blend with the articulated waterfront's Swahili aesthetic.

Figure 4.39 Lamu Old Town waterfront – proposal ideas



Source: Atkins analysis

Figure 4.40 Lamu Old Town waterfront - proposed interventions



Source: Atkins analysis

Figure 4.41 Lamu Old Town waterfront – typical seafront scene (market day and other days)



Source: Atkins analysis

Cargo handling

Lamu's waterfront is the focal point for trade and possesses a legacy maritime facade from its historical origins as a trading town. The bays and jetties that used to serve the trading towns port activity are problematic element of urban waterfront; particularly because of the inappropriate mixing of cargo-handling and passenger-handling activities.

The traffic from these activities has grown significantly, and is beginning to detract from the attractiveness of the waterfront and the overall urban quality which holds enormous cultural and tourism value.

Separating incompatible urban and cargo functions on the waterfront is required. The LIUUDP identifies dedicated areas for cargo-handling at Wiyoni and Langoni and the repurposing of jetties along the waterfront to serve passenger traffic only. Separating the two frees-up the prime shared waterfront space to undergo much-needed renewal and revitalisation. Rationalising the operation of the new cargo jetties is a critical factor in realising the waterfront's renewal aspirations and preventing a clash between the two. A combination of measures can be considered to support the operation of the cargo bays while protecting the character of the waterfront area. These should include:

- > Waterfront access being restricted to certain times of the day, preferably off-peak hours. This, can be deployed together with the redistribution of cargo traffic to other parts of the transport network. The ring roads proposed in section 4.4.2.3 provide alternative routes that connect the two cargo bays and allow cargo traffic to bypass the waterfront area. A cargo route by law would be required to restrict and enforce cargo movement to specific parts of the network;
- > The provision of clear road signage and traffic signs to help cargo navigate the network and adhere to permitted routes and times for cargo movement;

- > Better management of the loading and unloading of goods originating from, or destined for, the heritage area by providing dedicated loading zones - preferably behind buildings to minimise transport disruption; and
- > Encouraging the delivery of light-weight, time-critical shipments that are destined for the heritage area by non-motorised transport.

Location

- > Lamu Town

Linkages

- > Urban development

Table 4.31 Project 9 Summary Information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
Corniche path upgrade 5 km	Total cost = KES 1.354 billion	Regeneration of seafront, creation of quality public spaces, better facilities for existing businesses and attraction of new business	Pods - Private investor: design build operate maintain (DBOM)	Local Authority, (International Financial Institutions) IFIs,
Wayfinding along sea front	KES 250 million			Central government
Quay walls with 0.6 m parapets	KES 227 million	Improved local resident mobility and tourism>	Quay walls and paving	Pods might be delivered in a PPP framework with Private businesses implementing and managing the spaces
Permeable paving (concrete blocks and public realm drainage)	KES 276 million	Better access between Shella and Lamu surrounding attraction points	Public Authority or a mix of Public/Private such as Business Improvement District (BID)	Some revenue can be generated through leasing or selling of advertising rights that would contribute towards maintenance
Multi- purpose pods (25/30 sqm) wooden decks with steel structure	KES 585 million	Mitigation of floods and increased sitting areas		
3D printed concrete tiles bolted on quay walls		Wider public space		
		More rational use space planning		
		Opportunity to manage the pods as rented space by local businesses		
		Enhanced marine ecosystem		

Source: Atkins analysis

Table 4.32 Project 9 Basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
May require some land acquisition	Detailed flood survey along the waterfront	Short to medium term
Sea level rise in coastal locations is a key issue, particularly during storm surges	Site surveys and technical studies	Multi-phase
Intrusion of motor vehicle traffic	Pre-feasibility study	Old Town World Heritage Site committee approval
Poor solid waste management		Public zones operations and maintenance by Municipality
Funding		
Relieving waterfront from boda boda traffic – this partly relies on implementation of by pass road		
Funding		
Sea level rise uncertainty		
Requires careful management and respect of enforcement of policies		

Source: Atkins analysis

SUED principles for implementation

Climate resilience recommendations

This proposal is designed to increase the resilience of the Old Town to coastal flooding, and explicitly considers the potential for increases in sea-level of up to 1m by the end of the century. Specifically:

- > Increasing the height of sea walls will offer greater protection against rising sea levels, coastal erosion and flooding;
- > Construction of living sea walls and retrofitting older walls offer biodiversity benefits for invertebrates in addition to flood resilience benefits, while seaweeds and fish can improve water quality; and
- > The proposed permanent or temporary pods for increasing the space available on the Corniche Path will include green spaces, and planting, which will reduce the impact of increasing temperature extremes.

Social inclusion recommendations

The regeneration of the seafront will create accessible, quality public spaces that will encourage sustainable modes

of transportation and enhance the wellbeing and public health of local communities. The improvement of the area will also contribute to its economic development and further development of the tourism sector.

- > Ensure there is a meaningful consultation process with local communities and relevant stakeholders, particularly including SIGs and disadvantaged groups; this will contribute to an increased sense of ownership and will help to understand the particular needs that these groups may have. It will also be important to integrate informal vendors that might rely on those spaces and whose livelihoods will be affected, and support their integration in other UEP interventions;
- > Adopt principles of universal design that allow easy access and use for everyone
 - > Avoid graded routes and when changes in level are unavoidable, include ramps. Include tactile pavings at crosswalks;
 - > Install benches at regular intervals for people with mobility impairments to rest. Consider benches that are appropriate for elderly people, and people with

reduced mobility. Leave space alongside benches for wheelchair users to sit next to their companions;

- > Footways should consider materials that are firm and non-slippery, particularly during wet weather;
- > Provide good lighting and implement signage that is appropriate to people with hearing and visual impairments or learning disabilities. It is recommended to utilise easy-to-read text or simple symbols; and
- > Avoid reflective material that could cause confusing glare. Develop a clear wayfinding systems to local hospitality venues that is accessible to PWD both physically and digitally.
- > Liaise with local cooperatives, local SMEs and NGOs for construction works and the maintenance of the waterfront;
- > A Resettlement Action Plan (RAP) should be developed if any phase of the project requiring land acquisition involves the displacement of populations or economic activities. This plan includes:
 - > Identifying affected populations and potential negative impacts associated with the displacement through a census survey;
 - > Determining and communicating the cut-off date to receive compensation/assistance and the implementation schedule in an accessible and timely manner;
 - > Consulting affected populations about the relocation site/alternatives, the implementation schedule and compensation and assistance measures;
 - > Developing specific measures for PWD, elderly people, women, and other groups who might be disproportionately disadvantaged by the displacement;
 - > Implementing a grievance mechanism for disputes that might emerge during the resettlement process; and
 - > Monitoring and evaluating the resettlement process and the adequate implementation of compensation/assistance measures.

Case Study 4.19 - Marine urbanisation and eco-engineering¹²⁸

Oysters, seaweed, fish, algae and many more organisms have a new home at North Sydney Harbour. At one of the world's largest living seawalls in Bradfield Park, an ocean conservation project brought together Swedish carmaker Volvo, Reef Design Lab, the Sydney Institute of Marine Science (SIMS) and the North Sydney Council to create an ecosystem for some of the most vibrant marine life using 3D printing.

For decades marine life had to look for other places to inhabit because more than 50% of the Sydney Harbour shoreline is armoured with seawalls, a form of coastal defence that protects against waves and tides. In tune with its sustainable vocation, the Swedish car giant Volvo sought an opportunity that seeks to restore the balance of the ecosystem. Using 3D printing technology, experts have developed 50 tiles that have been installed along an existing seawall structure last October and were designed to mimic the root structure of native mangrove trees, becoming the home to thousands of living organisms.

Sydney scientists have been leading the world in the study of the greening of seawalls for more than a decade, and we are really pleased that this research has arrived at the stage where we are now working at a real-world scale, in one of the most extensive seawall retrofits worldwide.

Facilitated through the vision of North Sydney Council this living seawall installation is the result of a significant collaboration of financial partners: the Harding Miller Foundation, the James N Kirby Foundation, and the NSW Government, with in-kind support from GHD Engineering, and Reef Design Lab. North Sydney Council has also commissioned a fabulous sculpture for the site allowing the public to better-understand the science behind the research.



¹²⁸ Macquarie University, Marine urbanisation and eco-engineering (2014), Available at: Marine urbanisation and eco-engineering — Macquarie University (mq.edu.au), (Accessed: 10/11/2021).

Case Study 4.20 - Mama Ngina waterfront¹²⁹

Mama Ngina waterfront is a 26-acre waterfront space recently renovated into a modern public realm along the Mombasa coastline. The waterfront development included landscaping and paving of the waterfront, construction of a natural amphitheatre, the Kilindini Cultural Centre, ablution blocks and gateways into the waterfront. Before the renovation, the waterfront was unkempt, degraded, and lacked safety barriers along cliffs exposing users to safety concerns. With the new upgrades, residents and tourists can enjoy leisurely walks, entertainment, and sports, and they can watch ships sail through into the port while enjoying the cool breeze at the waterfront.



¹²⁹ Staging nomad Africa, Mama Ngina waterfront park (2021), Available at: <https://staging.nomad.africa/mama-ngina-waterfront-park/>, (Accessed: 03/12/2021).

4.4.2.2 Project 10: Wiyoni Bay clean-up

Project overview

Building on the existing proposals in the LIIUSDP and connected to the Town's central zone by the Corniche Path, the Wiyoni Bay inlet area not only presents a unique opportunity to upgrade the otherwise neglected waterfront but also to make use of the location to improve the water quality that drains into the sea.

The LIIUDP has already identified a new node to create ocean front opportunities for new trade and integrated transport. Multi-modal transport such as boat, donkey, motorbikes, and bicycles as well as pedestrian use is integrated into the design. The area is envisioned to provide a high-density mix of commercial activities through the development of a business complex. It is designed to accommodate various commercial uses that will spur economic development within the island.

There is an ongoing issue across the island for stormwater drainage and sewerage treatment. This location has been a trouble spot for a while due to raw sewerage, untreated waste from the adjoining abattoir and a hotspot for waste dumping. Supplementing the LM's plan to transform it into an attractive node, there is a proposal to connect this business complex to Lamu Old Town via an enhanced waterfront pedestrian path. To mitigate some of the untreated water a reedbed filtration system is proposed in the bay. This will be done while maintaining marine activity and access to the repair workshop.

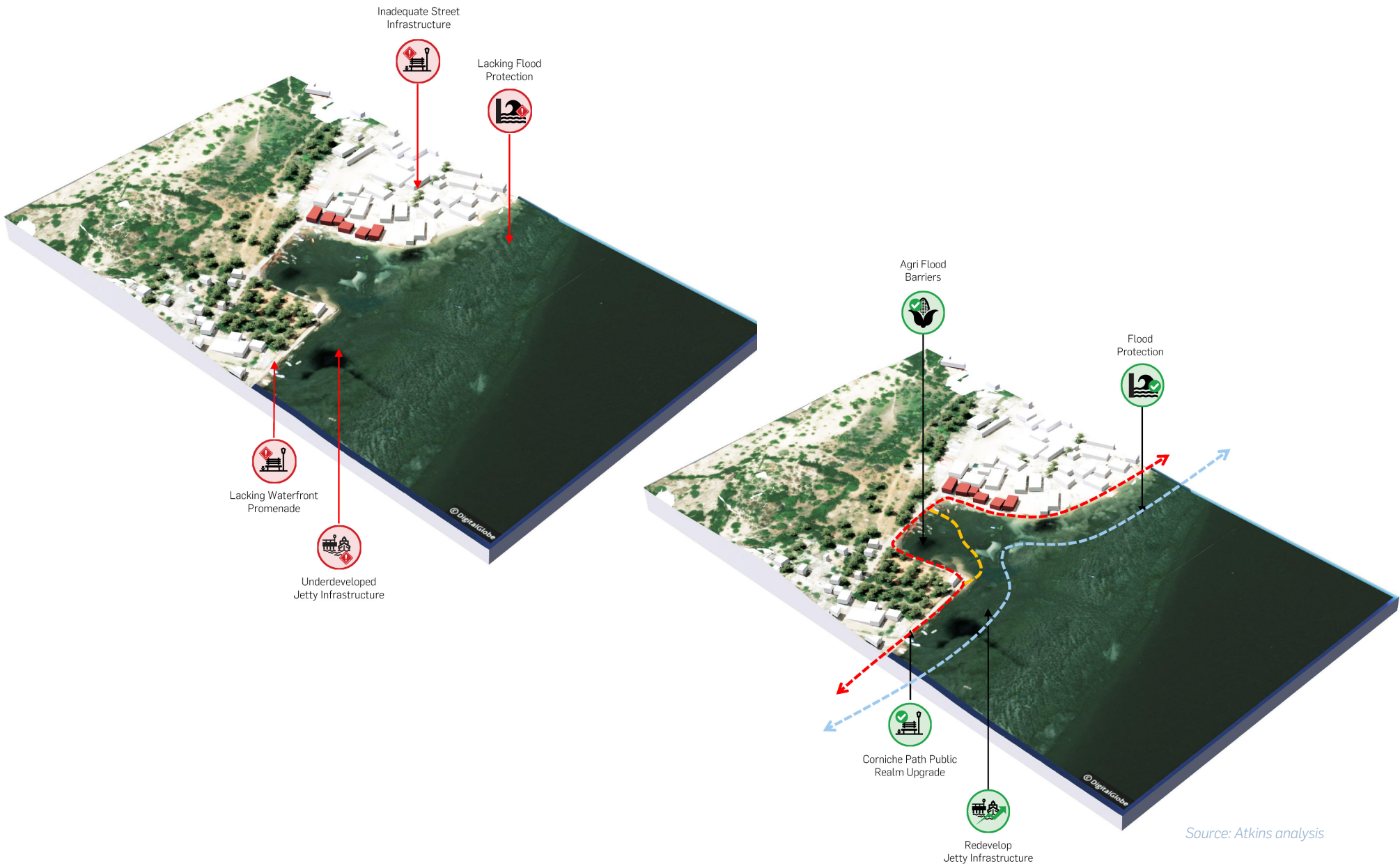
Proposals

- 1. Upgrade of waterfront path** - this will further enhance the oceanfront node as proposed in the LIIUDP and add value to the proposal;
- 2. Reedbed filtration system** - these are low-cost, low-maintenance, environmentally-friendly and use only natural, sustainable, and ecological processes and gravity driven systems that don't require any energy input. They are highly effective when properly designed and can be used to produce near river quality water. Vertical flow reed-beds are more effective at nitrifying effluents, converting ammonia into nitrates and nitrites, than most package sewerage treatment plants. This system will be very beneficial to treat some of the untreated stormwater¹³⁰;
- 3. Quay wall upgrade** - in line with the waterfront upgrade project, a section of quay wall upgrade can improve the quality of the space (subject to feasibility); and
- 4. A visitor jetty**, some food and beverage, and public realm upgrades, are also proposed along the waterfront path.

¹³⁰ The abattoir operation requires its own dedicated waste water treatment facility before any discharge is allowed.

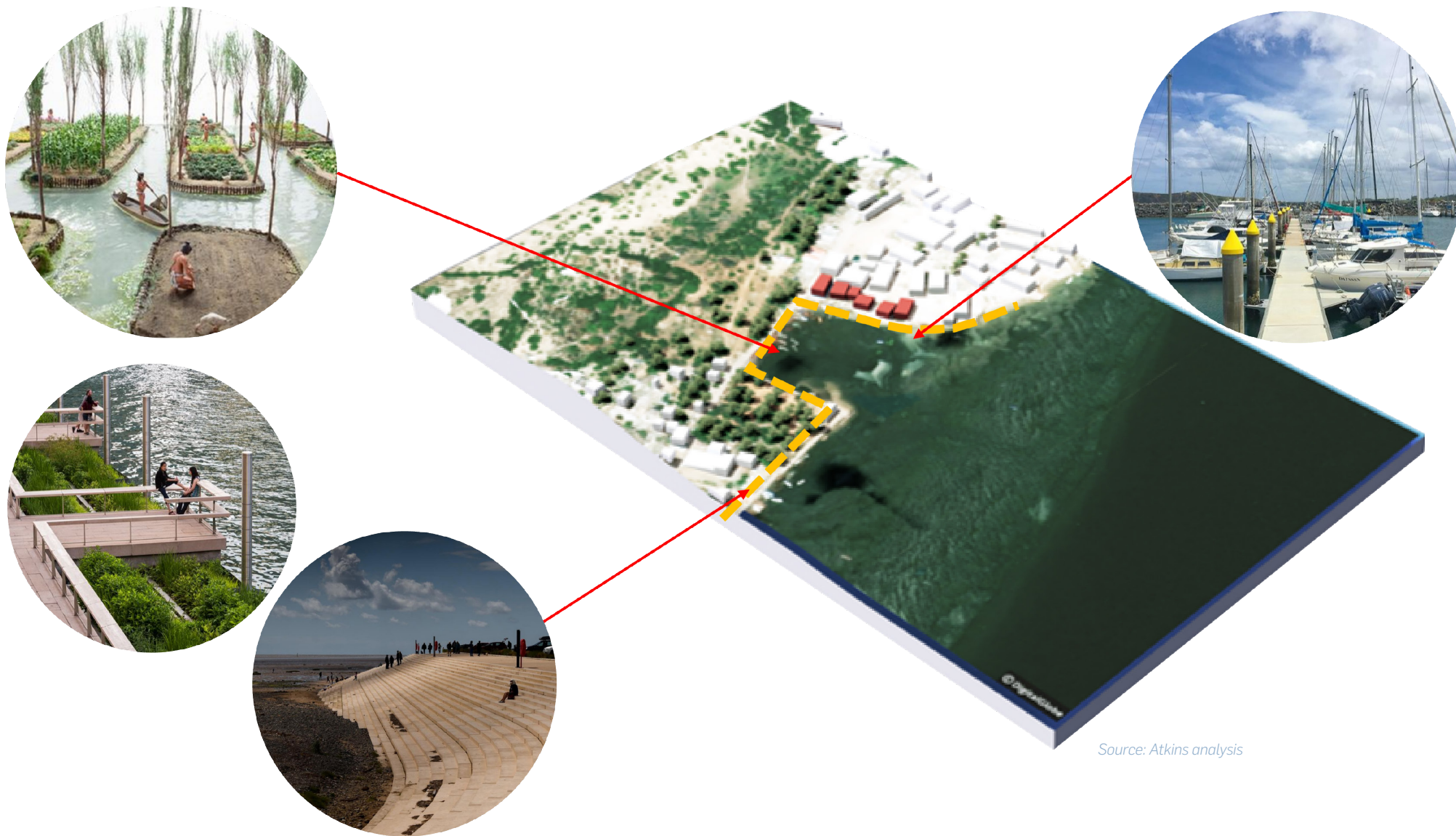


Figure 4.42 Wiyoni Bay issues and opportunities



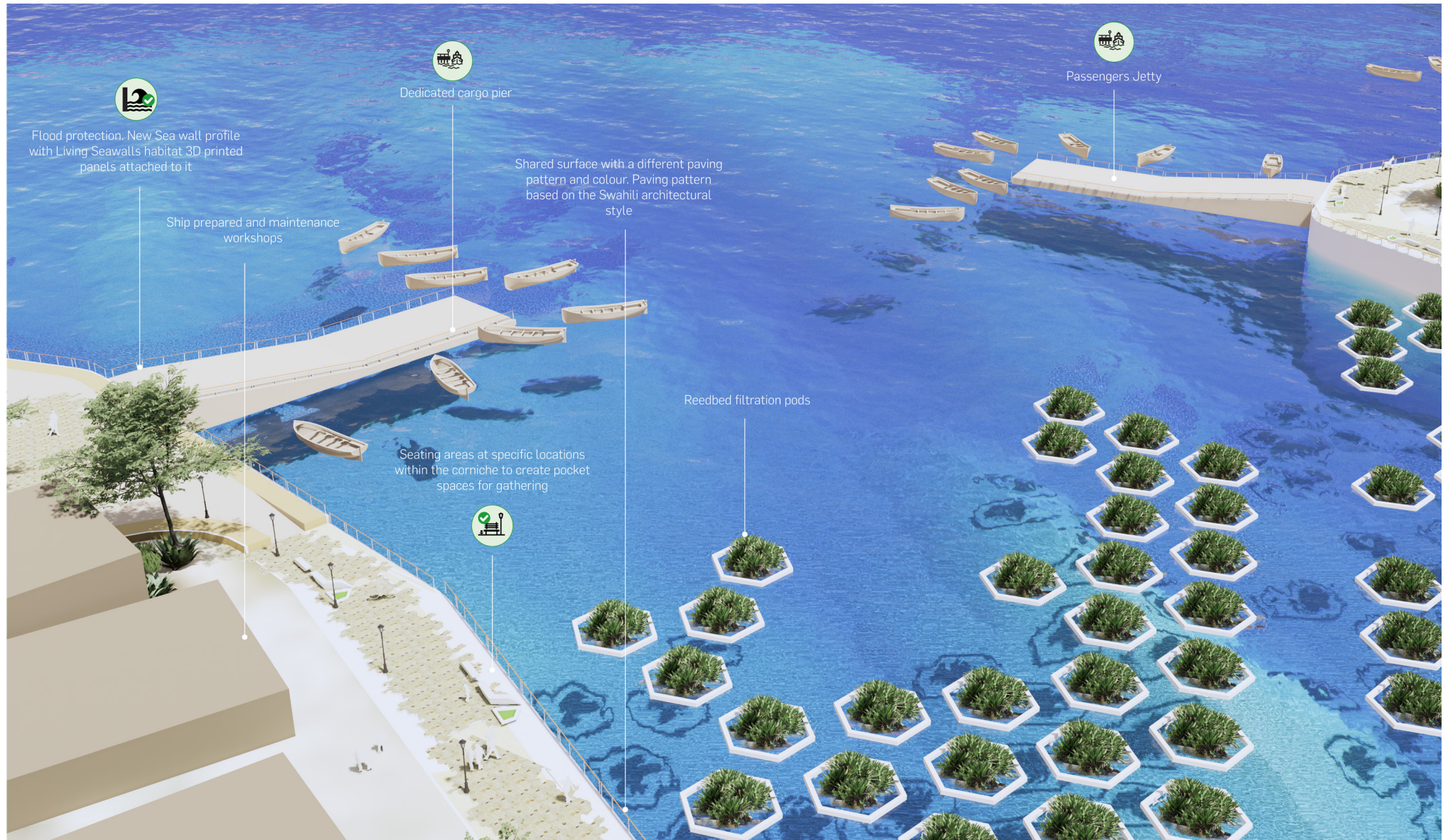
Source: Atkins analysis

Figure 4.43 Wiyoni Bay initial Ideas



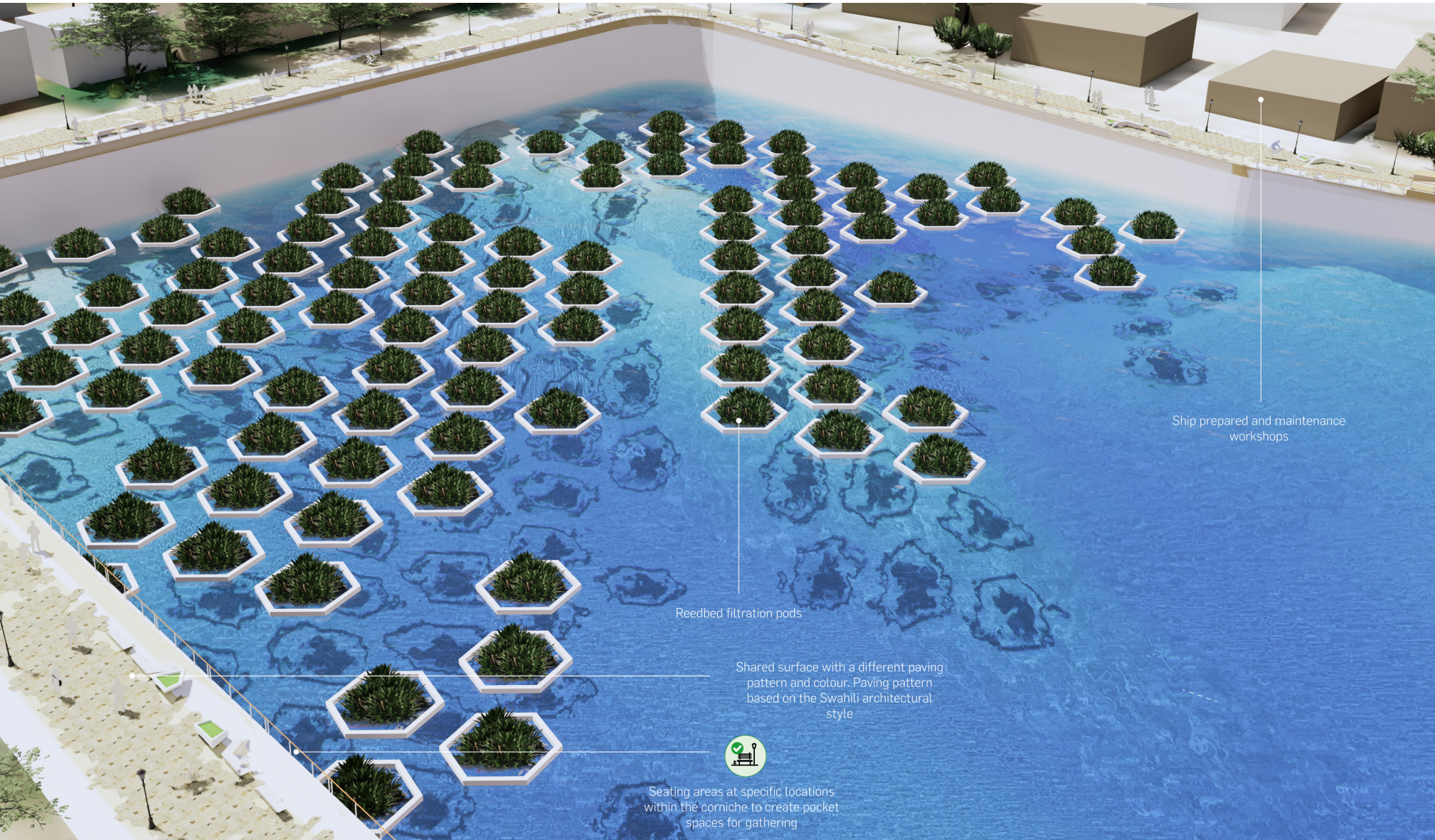
Source: Atkins analysis

Figure 4.43 Wiyoni Bay initial Ideas (continued)



Source: Atkins analysis

Figure 4.43 Wiyoni Bay initial Ideas (continued)



Source: Atkins analysis

Table 4.33 Project 10 Wiyoni Bay summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
Waterfront path/ boardwalk	Total cost = KES 631 million	Supporting the water filtration system	Private investor: design build operate maintain (DBOM)	Local Authority, (International Financial Institutions) IFIs,
Reedbed filtration system (subject to feasibility)	KES 39 million	Reduced dumping of waste and improved water quality		Central government
Quay wall upgrade (4-6m)	KES 173 million		Public Authority or a mix Public Private such as Business Improvement District (BID)	Value capture following completion: levies, leases on temporary events and local businesses
Visitor jetty with 6m wide walkway	KES 273 million	Attract local residents as well as local and international tourists		
Public realm - market plaza, visitors entrance	KES 76 million			
	KES 5 million			
Hospitality and food and beverage	KES 65 million			

Source: Atkins analysis

Table 4.34 Project 10 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Concept and detailed masterplan to be developed for the wider site before progressing	Pre-feasibility study	Short to medium-term to facilitate early stages of VC projects and enable further development
Funding	Site surveys and technical studies	
Land ownership	Detailed market study	
Extensive mangrove habitat in the vicinity		

Source: Atkins analysis

Linkages

- > Project 9: Waterfront Upgrade, Quay wall upgrade
- > Project 12: Lamu Old Town drainage and wastewater conveyance and disposal
- > VC waste collection and processing

SUED principles for implementation

Climate resilience recommendations

The proposed upgrade to the quay wall will increase protection against coastal flooding, and will be designed based on the same principles outlined in the waterfront upgrade project. There are also plans for additional, softer flood protection measures at various points to protect the coastal path. The design of the walkway should make use of shade where possible to provide protection against temperature extremes.

Social inclusion recommendations

Upgrading the quay will represent employment opportunities and will enhance the socio-economic development of the area. Facilitating links with different means of transport will enable the economic inclusion of local communities and particularly SIGs.

- > As with the two proposals above, it would be important to apply principles of universal design to make these interventions (i.e.: plaza, jetty, footways, etc.) accessible and safe, particularly for elderly people, PWD and women.
- > Liaise with local cooperatives, local SMEs and NGOs for construction works and the maintenance of the quay



4.4.2.3 Project 11: Ring Road

Project overview

Lamu Town has a very limited road network to support existing travel demand, and this puts pressure on the current road infrastructure. At present, the town has only one road suitable for motor vehicles along the seafront, Corniche Path, which runs from Wiyoni Village to Lamu Town, and which acts as an open channel for commercial and movement activities.

Besides this, the rest of the town is supported by narrow streets that allow for non-motorised and animal transport, particularly donkeys. The constrained transport network forces most of the traffic onto the Corniche Path, which is a focal point for socialization and unloading boats. This exacerbates the conflict between the different uses and users such as humans, animals, carts and boda bodas.

To address this, alternative connections are needed to divert traffic, particularly, cargo traffic, away from the Corniche Path, main street, and centre of the town and improve accessibility within the town. These ring roads within Lamu island can offer the required accessibility to various key activities particularly, commercial, farmlands, and touristic locations.

This proposal looks at upgrading two ring roads, an inner circumferential road of the heritage site and another circumferential road linking the proposed Wiyoni cargo jetty to Langoni cargo jetty and extending further to Shella Village.

The redevelopment would provide for a wider right of way (RoW) to allow boda bodas, tuk-tuks, carts and lightweight freight vehicles to operate with minimal conflicts, improve accessibility and reduce the cost of transport on the island. Improvements to adjoining links would need to be considered with dedicated unloading and loading points at strategic locations along the roads to serve businesses and residents within the town.

This redevelopment will be critical in supporting the County's plans to manage the movement of cargo between the two jetties, Wiyoni and Langoni, and prevent intrusion into the regenerated waterfront areas.

The project will be structured in to five 5 components:

- > A feasibility study to determine the road alignment, current and future transport demand and user requirements, environmental and resettlement requirements;
- > A preliminary design to determine the required RoW and land acquisition;
- > A detailed road design with bill of quantities (BoQ), project costing, and construction tendering plan;
- > The actual construction and supervision for works; and
- > The development of road maintenance plan.

The project will also incorporate other components such as NMT provisions and landscaping features, such as planting of trees to ensure accessibility for all modes of transport.

Around 6 km of road has been identified for upgrading, however, the final size of the road would need to be determined by the feasibility study.

Location

The location of the ring roads is as shown in the Figure 4.44 right.

Linkages

This proposal supports the SUED principles of urbanization, sustainability, economic viability, and social inclusion.

Figure 4.44 Proposed ring roads



Source: Atkins analysis

Table 4.35 Project 11 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
A feasibility study to determine the road alignment, current and future transport demand and user requirements, environmental and resettlement requirements	Total cost = KES 683 million	Reduced transport cost	KURA road agency LC Government	Implementing agency will be the Municipality
A preliminary design to determine the required RoW and land acquisition requirements	Feasibility study - KES 8 million	Improved accessibility of Lamu island	Development partners i.e., FCDO, WB etc	They will complete the pre-feasibility study and provide the land to the developer
Detailed road design with bill of quantities (BoQ), project costing, and construction tendering plan	Preliminary and detailed design (including BoQ and tendering) - KES 60 million	Improved land value		
Actual construction and supervision for works	Construction - KES 600 million			
Assessment of defects/ liability (12 months after completion of construction)	Tree planting - KES 15 million			
Development of road maintenance plan	Annual OPEX (Maintenance) - KES 30 million per year (5% of the total construction cost per annum)			
Tree planting to provide walkable environment				
NMT provisions (inclusive in the road costs)				

Source: Atkins analysis

Table 4.36 Project 11 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Land acquisition	Cost benefit analysis needed for the road infrastructure Limited financing/ no available funds to commit to the road improvements/ land acquisition	Medium-term Alternative transport modes are needed to address the high cost of transport. In addition, road infrastructures are known to open areas for development and improving accessibility. Lamu Island need this critical link and it is important for the county to commit to undertaking a feasibility study in the short-term

Source: Atkins analysis

4.4.3 Climate resilient infrastructure projects

A series of climate resilient infrastructure projects are proposed to support the sector development in a resilient and sustainable way.

4.4.3.1 Project 12: Lamu Old Town drainage, wastewater conveyance and disposal

Lamu Town has a network of open drains and buried culverts along the town's paved streets draining into the Indian Ocean. The open drainage system was created to collect rainwater from roof gutters and drain it to the ocean and was not adequately designed to cope with the increased surface water runoff during storm events seen today¹³¹. Furthermore, as Lamu Town has grown, the number of piped water connections, pit latrines and shallow septic tanks have equally grown. Due to the lack of a separate sewerage system, grey water from homes has been connected to the open drains; and misconnections, that are a result of the lack of a sewerage system, reduce the open channels' capacity to drain surface water effectively.

Black water discharge to the open drains is another major issue that not only adds pressure on the open drains and causes a foul smell in the town but also poses a serious health risk to residents and street users and can cause harm to marine life. High rates of waterborne diseases such as typhoid and dysentery are common¹³². This has mainly been found in poorer areas in the upper city and the lower quarters of the suburbs, where septic tanks are not affordable, and space is not available¹³³. Stagnant water in the drains also acts as a breeding ground for disease-causing parasites such as malaria-carrying mosquitoes.

During rainy season, water puddles form on roads, streets and footpaths, despite the gradient sloping towards the ocean¹³⁴, see Figure 4.45. To compound the issue, poor solid waste management means open drains often become blocked with solid waste and silt. This further reduces their capacity. Furthermore, solid waste often forms further obstacles along the roads that leads water mixed with donkey dung, this water remains stagnant for days posing further health risks.

Figure 4.45 Rainwater flowing in the streets during a rain shower (below and right) and roof downpipes and sewer pipe draining to the open channel (last image)



Source: Atkins site visit



Furthermore, storm surges often cause flooding along the sea front road as ocean water overtops the quay wall and encroaches onto the road and into Lamu Town. This further exacerbates the local drainage network as water from the streets and open drains mixes with the ocean water and cannot drain out to the ocean until waters recede.

131 UNESCO, Final Mission Report, Water and Sanitation Assessment Mission to Lamu (2005).

132 Coast Water Services Board, Final Master Plan Report – LAMU Island (2012).

133 UNESCO, Final Mission Report, Water and Sanitation Assessment Mission to Lamu (2005).

134 UNESCO, Final Mission Report, Water and Sanitation Assessment Mission to Lamu (2005).

Figure 4 46 - High tides cause floods in residential areas in Lamu



Source: Nation YouTube channel. Available at:
https://www.youtube.com/watch?v=RV6N4_RCKfw

There is no municipal sewerage system on Lamu Island or within the Municipality, therefore households, businesses, hotels and institutions use septic tanks. Due to space constraints, most household septic tanks are small and are mainly used for blackwater discharge. The emptying of septic tanks is a significant challenge due to the narrow nature of roads and streets within the town. During rain events the black water from these septic tanks can overflow into the open drains. When sludge from these tanks is extracted, there is no safe discharge site so waste is transported to Wiyoni bay where it is dumped into the ocean causing further pollution and risks to human health.

In the past the issues with regards to poor drainage and sanitation have been a major cause for censure for the status of the Lamu Old Town UNESCO World Heritage Site. The lack of liquid waste management within the town was noted as a threat to the site during missions in the late 2000's and early 2010s. The County was asked to consider improvements in sanitation, water supply and waste management in order to tackle the issues which posed a threat to its heritage and UNESCO World Heritage Site status.

Figure 4.47 Domestic septic tank constructed on the street



Source: Atkins site visit

A wastewater masterplan was developed for Lamu Town by the Coast Water Services Board in 2018. The masterplan proposed the construction of a sewer network through the Old Town, Shela village and the informal settlements found to the north and west of Lamu Town. The proposal also included the construction of a sewerage treatment works (STW) located to the west of Lamu Town. This is an expensive and ambitious project as it will develop a sewer network across Lamu Town and its informal settlements, furthermore, the project is not expected to be complete until 2040.

Project overview

As Lamu Old Town is a UNESCO World Heritage Site and conservation area, there are certain limitations as to what can be done to improve the drainage and sanitation situation. All buildings, streets, frontages, open spaces, streetscape elements and environmental features in the conservation area are preserved as historical and architectural features. Any amendments, alterations or repairs need to satisfy UNESCO specifications.

Scenario 1: Separate system

Due to the above-mentioned site constraints, it is deemed that the best way to tackle the existing issue is by providing the means to separate the surface water from the wastewater, if possible, as well as provide source control as part of the Sustainable urban Drainage System (SuDS) solution, to intercept water and reduce surface water runoff. This will improve the capacity of the existing open drains which in turn would help reduce flooding caused by surface water runoff during rainfall events, provide interception storage and treat pollutants from small rainfall events along with reducing the health risks caused by mixing blackwater with storm water.

In this scenario:

1. The open drains should be covered and enlarged when possible, for example outside of the UNESCO World Heritage site boundaries. Inlet chambers are to be constructed at intervals along the roadsides to allow the entry of storm water. This will separate the surface water from black water which is currently discharged directly into the open drains;
2. Small-scale rainwater harvesting, such as stone or wooden water butts, are to be located to collect water from rooftops and to be collected by water butts for domestic use. These can be made using local materials that are used within the Old Town such as quick lime, coral rag, squared hard wood beams of local species of hardwood¹³⁵, and form a local business opportunity. These can also be made of recycled plastic and could provide a growing business area for the Flipflop Foundation. See Figure 4.48;
3. Provision of pervious surfaces using natural stone. This can be laid on existing surfaces. It will improve uneven surfaces found on streets throughout the town. Additionally, it will reduce surface water runoff by providing surface water interception for small rainfall events;
4. At the back of the existing quayside seawall, a main surface water sewer interceptor, with gullies at frequent intervals can be tunnelled to intercept storm water within the drains. The flow will then be pumped into a treatment feature, such as floating reedbeds/mangrove beds found at Wiyoni Bay and along the sea wall before it discharges to the sea. These can be integrated during the Corniche Path and quay wall upgrading project; and
5. In this scenario, all wastewater is to be collected separately and treated in the proposed STW as part of the wastewater masterplan.

Figure 4.48 Water butts made from different materials: natural stone, wood, recycled plastic



Source: Available at: 1) <https://www.owlshall.co.uk/rainwater-harvesting/tanks/water-butts/stone-effect-300l/>. 2) Norway, wood effect, Water Butt – 230 Litres – Freeflush Water Management Ltd. 3) Buy Cloudburst 200 litre Water Butt Kit | Evengreener.

Scenario 2: Combined system

If a separate system cannot be achieved in the short term, a combined conveyance system can be provided instead. The open drains would be covered and enlarged, when possible, to provide the hydraulic capacity needed to convey the combined flow. Inlet chambers are to be constructed at intervals along the roadsides to allow the entry of stormwater. A collection sewer connecting all existing outfalls can be installed under the sea front road or Corniche Path, which can then be reinstated to retain its current functions and importance to the local heritage. Archimedes screw pumps will be installed along the pipeline where required to improve

flow transmission. Alternatively, a collection sewer could be built, attached to the sea wall and designed to incorporate existing jetties and other sea front activities. This can be explored as part of enhancement to the Corniche Path. This collector sewer fits into the future installation proposals of the existing wastewater masterplan.

The combined surface, grey and black water would be collected via sewer interceptor that takes the flow to a pre-treatment facility, such as septic tank/settling tank to collect the sludge, then the liquor can discharge to floating reedbed/mangrove beds for further treatment. This will prevent sedimentation and blockages from occurring and reduce maintenance required. In the long term, the sewer can be linked to the wastewater STW as proposed by the wastewater masterplan in order to eliminate the need for pre-treatment.

Location

The project is located within Lamu Town, specifically along the sea front road as due to the topography of the town all the water from the open drainage network flows west to east towards the Indian Ocean. The main collector pipe for wastewater will be sized to cater for a larger area to take into account future development and build capacity into the system.

> Lamu Town

Linkages

- > There is a link with the existing wastewater masterplan from 2018; and
- > Links to project 9: Lamu Old Town waterfront improvement and town centre improvement and project 10: Wioni Bay clean-up.

¹³⁵ UNESCO, Lamu Old Town Management Plan 2013-2017 (2013).

Table 4.37 Project 12 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
Feasibility study	Total cost = KES 264 million¹³⁶	Covering of the open street drains will help to separate the surface and grey/black water so that it can be redirected for further treatment	Donors/IFI	Implemented through the County/Municipality or LAWASCO as part of the wastewater masterplan
Covering of open drains.	KES 60 million	This will result in reduced risk of water borne diseases and improve the sanitation across the town as well as reduce the amount of waste water which is discharged into the Indian Ocean	Potentially climate funds	Maintenance of the system should be undertaken by LAWASCO
Small scale rainwater harvesting	The feasibility study will determine the cost for covering the open drains, harvesting rainwater and	Increased capacity in the drainage channels from the implementation of rainwater harvesting and separation of the surface and grey/black water will aid in building climate resilience into the drainage system		
Storm water interception drain along sea wall.	Construction of the storm water interception drain along the sea wall			
Wastewater pipeline to treatment facility	KES 60 million			
Floating reed/mangrove beds at Wiyoni Bay and along the sea wall.	KES 100 million	The project will help improve drainage in Lamu Town helping to maintain its UNESCO World Heritage Site status and preserving its heritage		

Source: Atkins analysis

Table 4.38 Project 12 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Lack of space along sea front road	Detailed location and drawings of the drainage network within Lamu Town	Medium to long-term
Design of roofs which could prevent implementation or efficient rainwater harvesting		The drainage masterplan needs to be developed and feasibility study to be completed, depending on scenario chosen work on the Lamu Town STW would need to be complete

Source: Atkins analysis

SUED principles for implementation

Climate resilience recommendations

Flooding in Lamu Old Town is a significant problem, in particular when high tides combine with poor drainage as outlined above. Sea level rise and increases in heavy rainfall events will exacerbate the problem and are likely to lead to increases in flooding. The proposals for improved sewerage and drainage, including the potential use of SuDS and rainwater harvesting to reduce runoff, could significantly reduce flood risk, in particular, when implemented in combination with upgrades to coastal protection. The reduction in flooding would also improve public health and reduce the prevalence of diarrheal disease, with associated health care cost reduction which is often a significant burden on low-income groups.

Social inclusion recommendations

This project has several socio-economic benefits. The improvement of drainage in Lamu Town will support the preservation of Lamu's buildings and cultural heritage. The project will also increase water for domestic use, enhancing local water supply for household and ease the responsibility of fetching water for women by providing readily available collected rainwater. It also creates a business opportunity for youth engaging in waste recycling and organisations such as Flipflop and Taka Taka.

Covering the open water drain will also reduce the risk of water borne diseases and hence improve the health of the community thereby minimising healthcare costs.

To maximise the benefits of this project, it is recommended to sensitise local communities on proper ways of water harvesting and storage, and liaise with existing NGOs to provide training.

¹³⁶ A 20% buffer has been added to the total cost in order to account for the sensitivity of the UNESCO world heritage site and use of appropriate materials.

Case Study 4.21 - Stabilisation pond and reed bed¹³⁷

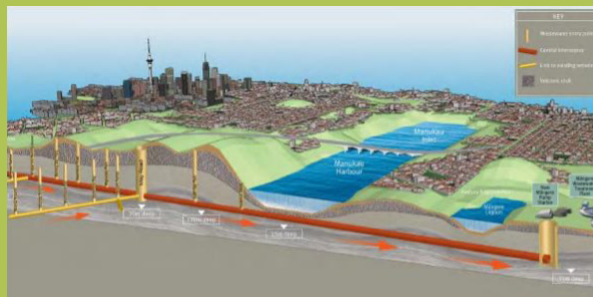
At the Welcome Break Motorway Services in Oxford, UK a modified stabilisation pond and reed-bed system is used, in conjunction with a basic submerged aerated filter STW to treat the wastewater from the whole site. The plant produces high-quality effluent that meets the required discharge standards. The site has also become a wildlife haven and sanctuary, attracting birds, ducks, deer, butterflies and dragonflies.



¹³⁷ Cress Water, Oxford motorway services (2021), Available at: <https://cresswater.co.uk/case-studies/oxford-motorway-services/> (Accessed: 03/12/2021).

Case Study 4.22 - Central interceptor tunnel, tunnelling for a cleaner city - Auckland, New Zealand¹³⁸

The older parts of central Auckland, New Zealand, are mainly served by old combined sewers, which drain wastewater from homes and business as well as stormwater collected from yards, rooftops and roads. Under storm conditions, this combined system exceeds its capacity and, as a result, overflows into waterways, polluting beaches and estuaries. With population growth and climate change increasing pressure on the combined sewer system, the situation had to be rectified. As part of a ten-year sewer and stormwater separation project to improve water quality, in 2019 a new wastewater interceptor was designed with planned construction completion in 2025. It will reduce overflows into waterways by 80%¹³⁹, providing environmental, social and water quality improvements. At 14.7 km long, with an internal diameter of 4.5 m, the central interceptor will be tunnelled using boring machines to divert combined sewerage flows from Lynn in Auckland to the Māngere Wastewater Treatment Plant.



¹³⁸ Arup, Central Interceptor Tunnel (2021), Available at: <https://www.arup.com/-/media/arup/files/publications/t/the-arup-journal-2021-issue-1.pdf> (Accessed: 03/12/2021).

¹³⁹ NZherald, Central interceptor Auckland's new 12 billion sewer tunnel to clean up z beaches (2019), Available at: <https://www.nzherald.co.nz/nz/central-interceptor-aucklands-new-12-billion-sewer-tunnel-to-clean-up-z-beaches/YMFKALHG2KI5WYSX24ZKFCF4XI/> (Accessed: 03/12/2021).

Case Study 4.23 - Constructed Wetland with Mixed Mangrove and non-mangrove plants for municipal sewage treatment¹⁴⁰

A constructed wetland wastewater treatment facility, with mixed mangrove and reed species, was successfully established in Shenzhen, China. The mixture of different plants was a key success factor as different species vary in terms of their respective pollutant removal efficiency. The effluent analysis indicated that the system was effective in removing pollutants including nitrogen, phosphorus, heavy metals and toxic organic pollutants. The removal efficiencies of nutrients and metals from the wastewater ranged from 75% to 98% and 88% to 96% respectively¹⁴¹.



¹⁴⁰ Nora F T, Yuk-shan W (2014), Constructed Wetland with Mixed Mangrove and Non-mangrove Plants for Municipal Sewage Treatment, International Conference on Future Environment and Energy.

¹⁴¹ Prof. Nora, F T, Constructed Mangrove Wetlands for Wastewater Treatment (2016), Available at: <https://www.dsd.gov.hk/rdforum/2016/files/en/presentation/D1T2.pdf>, (Accessed: 06/12/2021).

4.4.3.2 Project 13: Streetlighting

Project overview

This infrastructure project aims to provide a solution to the streetlighting issues facing Lamu Old Town.

The current situation has evolved from several failed solutions. The main issues have been the high cost of traditional grid-powered lights provided by KPLC and the fact that they failed during a power cut, which led the Municipality to explore solar powered lighting options. In 2014, LC government partnered with a number of corporate banks and the Ports Authority to install solar lighting¹⁴². Solar streetlighting is typically vulnerable to theft and vandalism, but in Lamu it was also affected by the corrosive coastal conditions (i.e. salt spray) which has led to the failure of the fittings. In 2019 Lamu Town reverted to KPLC streetlights. Along the waterfront now is a mix of solar fittings, old KPLC high-pressure sodium lamps and new KPLC LED lamps.

In the narrow alleyways there isn't enough room for traditional pole-mounted fittings, so the solution has been to install building-mounted fittings that have been manufactured to fit in with their surroundings.

Figure 4.49 Streetlighting solution



Source: Atkins site visit

The purpose of this project is to optimise the technology solution, particularly with respect to finding a robust solar-powered solution (although solar may not be suitable in alleyways), and implementation model for LM to ensure climate resilience, and financial and operational sustainability.

This project has several components:

- > Review of the technology choices for streetlighting to find suitable products for the i.e. use of solar and robust construction;
- > Review of current streetlighting plans to ensure coordination with proposed urban development plans and augment the plans to ensure coverage of all main streets in Lamu Town, markets and areas of public congregation;
- > Review and update Lamu's current financial arrangements for streetlighting, with the aspiration to improve the economic situation for the Municipality and ensure long-term maintenance of installed streetlights; and
- > Deploy new lighting solutions and remove redundant fittings from key areas, primarily the waterfront.

Location

This project will target key areas such as the waterfront, Old Town and Fort Plaza on Lamu Island and Mokowe jetty.

Linkages

- > Solar streetlighting installation identified in the Lamu Municipality Integrated Development Plan with a budget in the Public Works Sector of KES 25 m; and
- > Links to project 9: Lamu Old Town waterfront improvements and town centre improvement and A20: developing a Swahili Heritage Guide.

¹⁴² All Africa, Kenya: Lamu residents protest over removal of solar street lighting (2019), Available at: <https://allafrica.com/stories/201907040227.html>, (Accessed: 02/12/2021).

Table 4.39 Project 13 Summary Information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
Review current implementation plan	Total cost = KES 50 million	Improved finances for municipalities	Donor/IFI	Site selection - LM
Review current commercial and technical arrangements	Benchmark: KES 150,000 per pole ¹⁴³ , KES 4-5 million per km depending on spacing	Improved safety and security	Financing can be sourced from a number of options, including World Bank funded Kenya Urban Support Programme, which has funded streetlighting in Thika, Ruiru and Limuru ¹⁴⁴	Equipment selection - street lighting design specialist
Design study to ensure suitable coverage of target area	Estimated total based on part coverage to new areas, part reworking of existing areas	Longer operational hours at commercial centres	The World Bank also offers advice, sample legal documents and further reading on using a Public Private Partnership route for streetlighting, detailing projects completed in Brazil, Mexico and India ¹⁴⁵	Construction and implementation - LM
Equipment review and selection				Operation and maintenance - responsibility of LM
Development of new commercial plan (procurement, deployment, implementation, maintenance)	Actual total: KES 40-50 million based on 10km of road covered			

Source: Atkins analysis

Table 4.40 Project 13 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Finding robust solar streetlighting technology suitable for a marine environment	Detailed maps showing current street lit areas;	Short to medium-term
	Detailed implementation schedule for new streetlighting;	Short-term to complete coordination, mid-term to complete implementation
Achieving buy-in from Lamu Municipality, KPLC	Currently selected technology	
	Current commercial arrangements between Lamu Municipality, KPLC	

Source: Atkins analysis

SUED principles for implementation

Climate resilience recommendations

The potential to use solar-powered light fittings will reduce the use of grid electricity and therefore reduce greenhouse gas emissions.

Exposure to salt spray, increases in extreme temperatures, and potential increases in solar radiation may cause the streetlight assets to decay more rapidly, requiring more regular maintenance. This should be considered when planning operational maintenance for the project.

Social inclusion recommendations

Street lighting reduces street harassment, crime, and fear of crime, contributing to the safety of women, PWD, elderly people, and other vulnerable groups. Better lighting allows markets and businesses to operate for longer hours, improving the economic outlook of vendors and market traders. This is particularly relevant for many women in Lamu Municipality, who operate their business at night (e.g small food kiosks), by reducing the risk of gender-based violence (GBV).

¹⁴³ EnGo planet, Africa and solar powered street lights (2021), Available at: <https://www.engoplanet.com/single-post/2019/07/22/Africa-and-Solar-powered-Street-lights>, (Accessed: 29/07/2019).

¹⁴⁴ Kiambu, Municipality street lighting projects (2021), Available at: <https://kiambu.go.ke/2020/06/municipality-street-lighting-projects/>, (Accessed: 17/06/2021).

¹⁴⁵ The World Bank, Energy-efficient street lighting PPPs (2021), Available at: <https://ppp.worldbank.org/public-private-partnership/energy-and-power/energy-efficient-street-lighting-ppps>, (Accessed: 17/06/2021).

Case Study 4.24 - Quezon City, public lighting delivery models, Philippines¹⁴⁶

Quezon City (QC) had been actively exploring and implementing upgrades to its street lighting system. Many streets and roads were not lit at night, so public safety was an ongoing concern. The Mayor created a Task Force to look at installation, repair and maintenance of streetlighting. This body was charged with overseeing an initiative to expand night-time lighting coverage across the city. QC subsequently embarked on a city-wide street lighting programme to illuminate 80% of the public road network. It involved installing 3,000 new streetlights, with an additional 1,000 streetlights retrofitted by Meralco, a private electricity utility.

In the past, QC had relied on traditional lighting technologies. However, the emergence of the first generation of LED streetlights prompted a rethinking, since any improvements in energy efficiency would translate into desirable budget savings.

The city funded a study to determine the feasibility of upgrading their streetlighting to more efficient technology. The study compared the potential costs and benefits of three technologies: ceramic metal-halide lamps, induction lamps, and LEDs. It concluded that ceramic induction lamps would be a suitable replacement for existing street lighting, while LED luminaires, which were quite expensive at the time of the study, would only be suitable for new installations.

A constraint arising from the conversion of QC's streetlights to LEDs was the split ownership of the assets and the flat rate charged by Meralco on a portion of the assets, as identified in the study. To solve this, the Mayor signed a Memorandum of Agreement with Meralco that turned over the nearly 3,000 ornamental streetlights owned by the utility to the QC government for a price of PHP 5.7 million (KES 12.6 million).

Meanwhile, the city installed meters on all of the ornamental streetlights so that savings from the retrofit of LEDs would yield energy cost savings. For the remaining pole-mounted streetlights that are owned by Meralco, the utility on its own authority has undertaken a project to convert the streetlights in its ownership to LEDs. Since QC continues to pay Meralco a flat rate per pole, the LED retrofit undertaken by Meralco increases their profit, and the city benefits from better lighting.

4.4.3.3 Project 14: Solar-powered abstraction for water to increase supply

Project overview

Currently the water treatment capacity at Shela and Matondoni water treatment plants, on Lamu Island, is 2,500 m³/day. This meets the current water demands of 1,290 m³/day on the island¹⁴⁷. There are approximately 60 shallow wells and ten boreholes on Lamu Island which supply Lamu Town, Shela Village and Manda Island with fresh water. Water is pumped and chlorinated in a treatment plant in Shela and later distributed to the network. Many people revert to collecting water from local wells and water pans. Currently there are around 4,683 registered connections and 60% of these are active. There is also high NRW of 45% due to loss of water from an ageing pipe network and faulty water meters. Within Lamu Town, pipes are often located running along the open drains. In the event of a leak or fracture these pose a risk to human health.

The project seeks to increase the reliability and efficiency of the existing piped water network as well as increasing the number of piped connections to limit the time spent collecting water. One of the initial steps of the project would be to survey and replace pipes within the piped water network in order to remove aged pipes which may be prone to fractures causing leaks from the network. This will help to reduce the level of NRW as well as reduce the risk of water borne diseases entering the piped water network from the open drainage system.

Solar pumping should be implemented at the shallow wells and boreholes present on the island in order to improve their efficiency at extracting ground water. This will also eliminate the costs associated with electricity needed for pumping water to the treatment plant located in Shela.

¹⁴⁶ ESmap, Proven delivery models for LED public lighting: Municipal financing delivery model, Quezon City Case Study (2016), Available at: https://www.esmap.org/sites/esmap.org/files/DocumentLibrary/Quezon%20City%20-%20Proven%20LED%20Delivery%20Models8_Optimized_Final.pdf, (Accessed: 14/06/2021).

¹⁴⁷ Lamu Municipality, draft LIUUDP (2021), based on population figures from the 2019 KNBS census and assumption of average water use of 49L/day.

The number of household connections to the piped water network should be increased both in Lamu Town and within the informal settlements around the town. These should be targeted at low-income households. A loan scheme for the implementation of piped water connections can be explored to lower the costs associated with establishing a connection to the network.

Location

The project will be focused on Lamu Island and aimed at improving the water supply network connecting Lamu Town and the efficiency of ground water extraction in the Lamu Island sand dunes.

Linkages

> Linkage to project 17: solar desalination.

Table 4.41 Project 14 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
LAWASCO piped network renewal feasibility study	Total cost = KES 66 million	The improvements in the piped network will reduce the level of NRW and reduce maintenance cost of aging pipes	Donor/IFI or Water Sector Trust Fund	The main implementation agent would be LAWASCO
Solar pumps for the 60 shallow wells and ten boreholes on the island	KES 30 million	Increased number of piped connections to low-income residences will help to promote sanitation within the Municipality		
Last mile connections for 500 households	KES 16 million ¹⁴⁸			
Rolling loan fund to support the connections of 500 low-income households	KES 10 million			

Source: Atkins analysis

Table 4.42 Project 14 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Access to LAWASCO pipes found within drains and underground in Lamu town	The status of the Lamu port water supply project; once complete this will relieve pressure on the current network by reducing the ports reliance on the LAWASCO network	<p>Short to medium-term</p> <p>Solar pumping should be implemented in the short term to increase the efficiency of the water distribution system on Lamu Island</p> <p>Piped network rehabilitation can occur in the short to medium-term to improve the water distribution network on the Island and mainland as demand grows due to increased population levels</p>

Source: Atkins analysis

¹⁴⁸ Based on average low cost pumps for shallow wells. KES 15,000, and borehole solar water pumps, Kes 1.5 million. Source: Grekko Limited, Solar water pump prices (2019), Available at: Solar Water Pump Price | Grekko Limited | +254715157132, (Accessed: 14/12/2021)

SUED principles for implementation

Climate resilience recommendations

The proposal will reduce NRW by replacing damaged and old pipes, and as such increase the sustainability and reliability of water supply. This will increase resilience to drought and rainfall variability. Groundwater assessments should be carried out to ensure that the amount of water being extracted by the solar-powered boreholes is sustainable and does not deplete the water table. This is particularly important as maintaining a good groundwater level will reduce the likelihood of saline intrusion, and saltwater contamination of the aquifer as sea levels rise.

Social inclusion recommendations

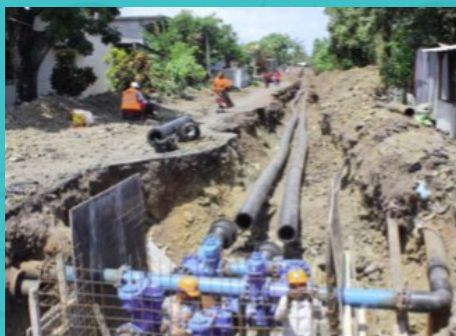
Access to water is critical for socio-economic development and the improvement of public health. Provision of clean water will reduce incidences of water borne diseases within the community and consequently reduce money spent on healthcare and time away from productive activities.

Household connections improve accessibility to water for PWD and other consumers. This will also reduce time spent by women fetching water for the household, contributing to their wellbeing, and freeing-up time for income generation and other activities.

- > Small-scale desalination plants have the potential to generate employment within the local community, particularly for PWD, youth, and women;
- > It is recommended to ensure there are strategies such as instalments, subsidies, or loans support low-income populations with the connection to the water system; and
- > To ensure there are employment opportunities for SIGs and local NGOs during implementation of the project on available casual labour.

Case Study 4.25 - Société Nationale d'Exploitation et de Distribution des Eaux (SONEDE)¹⁴⁹

In Tunisia the water company, SONEDE, has managed to expand by around 70,000 connections a year through the use of a connection loan scheme. Customers can pay the cost of the connection on a quarterly basis over five years. New customers, who opt for a credit connection, receive a bill each quarter that includes the tariff for consumption during the previous quarter, and a loan repayment instalment.



¹⁴⁹ Center Blog, Creation of the new water company (Sonede) (2019), Available at: Creation of the new water company (Sonede) (centerblog.net), (Accessed: 03/12/2021).

4.4.3.4 Project 15: Desludging business and sludge-handling facility

Project overview

Septic tanks and pit latrines need to be periodically emptied to prevent excess build-up and the risk of overflow into the drainage system during storm events. The narrow streets within Lamu Town pose a significant challenge to this, as traditional desludging equipment is too large to access them. Furthermore, sludge that is currently removed from septic tanks is often dumped into the ocean at Wiyoni Bay as there is no sludge treatment facility in the Municipality, this leads to increased levels of pollution and poses a risk to human health due to water borne diseases.

Therefore, the project proposes the incubation of a local desludging business on Lamu Island. Small desludging machines, such as Vacutug carts or Gulper pumps would allow for the extraction of sludge material along narrow streets in Lamu Town due to their small scale and ease of manoeuvrability. The Vacutug carts could utilise the local donkey population to pull them along the streets. Whereas the Gulper pumps could be manufactured in the town by the Flipflop foundation out of locally sourced materials and recycled plastics.

Once collected, it is proposed that the sludge is transported to a sludge handling facility which would be best placed near the proposed STW to the west of Lamu Town. A black soldier fly larvae (BSFL) sludge-handling system is proposed to handle the sludge and use the biowaste to produce poultry and fish feed. This would eliminate the dumping of sludge into the Indian Ocean resulting in both environmental and sanitation benefits. Furthermore, the feed produced from the BSFL sludge-handling facility would be sold to local fisherfolk and local fish farms, contributing to the fishing and maritime sector as well as the fish processing VC. This is a great example of the circular economy in action.

It is proposed that the business is set up as a PPP in partnership with LAWASCO and a local SME whereby revenue is generated by selling the service of desludging residential, commercial and institutional septic tanks and pit latrines within the town. Donor or IFI funding would help to secure the BSFL sludge handling facility which could be managed by the same PPP. The sale of poultry and fish feed would generate another strand of income for the business.

Location

The initial desludging business activities would be located in Lamu Town, as this is where the major issues manifest due to the narrow streets and shallow septic tanks. The BSFL sludge-handling facility would be located on the island, ideally outside of the town, to prevent foul smell reaching residents and along a road where it can be easily accessed by the donkey-pulled Vacutug carts. The ideal location for this facility would be next to the proposed STW in the wastewater masterplan as this would build future capacity for the system to handle sludge from the STW once it is constructed.

In the medium to long-term the desludging business could be expanded to include the remainder of the Municipality with satellite BSFL desludging facilities located in Mokowe.

- > Lamu Island; and
- > Municipality wide

Linkages

- > Linkage with the currently-proposed wastewater masterplan and STW from 2018;
- > Linkage with the fish processing VC (black soldier fly larvae feed from sludge-handling facilities), fishing sector (black soldier fly larvae feed from sludge-handling facilities); and
- > Also linkage with with VC waste collection and processing to support tourism.

Table 4.43 Project 15 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
Feasibility study	Total cost = KES 280.5 million	Extraction of sludge from shallow septic tanks and pit latrines would help limit black water entering the drainage system	PPP and Donors/IFI	The project could be implemented by LAWASCO in partnership with a SME from the local community
Donkey drawn Vacutug (one for initial investment)	KES 30 million		The desludging business could be run by a PPP in partnership with LAWASCO and a local SME	
Handheld Gulper pump (one for initial investment)	Per Vacutug KES 580,000	Furthermore, it would also limit the amount of sludge that is dumped into the Indian Ocean at Wiyoni bay decreasing environmental pollution and risk to human health		The operation and maintenance of the sludge handling facility could be undertaken by LAWASCO or be part of the desludging business
Black soldier fly larvae sludge handling facility	Per Gulper pump KES 4,500-18,000 KES 250 million ¹⁵⁰	The sludge transported to the BSFL handling facility would produce feed for the fishing and maritime sector as well as the fish processing VC	The BSFL sludge handling facility could be delivered through Donors/IFI funding	Local community groups such as the Flipflop foundation could help to deliver Gulper pumps by manufacturing them from recycled materials

Source: Atkins analysis

Table 4.44 Project 15 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Initial seed funding to purchase the necessary equipment for the desludging business	Total number of septic tanks and pit latrines found within Lamu Town to aid in feasibility study	Short to medium-term
Acquisition of land for the BSFL sludge-handling facility (if located on the same land as proposed STW this may not be an issue as land would be owned by LAWASCO)	Total volumes of sludge to aid in feasibility study	The desludging business can be established in the short-term
		Whereas the sludge-handling facility would need to be established in the short to medium-term as the suitability of the site would need to be assessed and a feasibility study would need to be completed

Source: Atkins analysis

¹⁵⁰ Cost estimate for BSFL sludge handling facility based on assumptions of dry sludge production, around 50g/day, for the predicted population equivalent of Lamu Island in 2035, around 45,000 inhabitants (based on draft LIUDP). Cost of plant based on 7 tonne plant costing US \$ 7 million, source: SNV, black soldier fly waste tech in practice Kenya (2020), Available at: 6-black-soldier-fly-waste-treatment-tech-in-practice-kenya.pdf (snv.org), (Accessed: 10/12/2021).



SUED principles for implementation

Climate resilience recommendations

The proposal means that there is a reduced risk of sludge being released into the drainage system during storm events. This would improve public health and reduce the prevalence of diarrheal disease, with associated health care cost reduction, which is often a significant burden on low-income groups. Flood risk assessments should be carried out for the sludge-handling facility to ensure it is not located in an area at risk of flooding.

Social inclusion recommendations

The project will enhance public health by reducing waterborne diseases and pollution. Moreover, the project proposes the incubation of a local desludging business on Lamu and represents employment opportunities for local communities and SIGs (e.g.: with the operation of small desludging machines). As specified above, the Gulper pumps could be manufactured in the town by the Flipflop foundation out of locally sourced materials and recycled plastics.

The sludge handling facility will also provide opportunities for income generation. Women, youths, and PWD could be involved in the operation of the sludge facility where they keep the larva.

Recommendations to maximise benefits include to:

- > Ensure there is training on how to manufacture gulper pumps using recycled waste. This training could be developed by Flipflop or Taka Taka.
- > Youth are already involved in transport services, i.e donkeys or pull carts. The project could contribute to their professionalisation. Provide trainings on health and safety and on the adequate transportation of the sludge to avoid waste dropping on the streets.
- > Facilitate access to information about funds or seed capital for start-ups that particularly targets SIGs.
- > Since there is usually community distrust and preconceptions about the use of treated waste as fertiliser or compost, it is recommended to liaise with existent environmental organisations to develop sensitisation workshops at the community level. Involve local organisations and NGOs to develop these workshops.



Case Study 4.26 - Small-scale desludging equipment

Compact **Vacutug carts** were introduced into multiple low-income communities around Africa and South East Asia in the early 2000's by UN Habitat¹⁵¹. The Vacutug technology can be implemented in high-density communities and informal settlements where roads are narrow; the carts are highly manoeuvrable and can be used to access hard-to-reach septic tanks and pit latrines which can often be inaccessible to large desludging machines¹⁵².

Vacutugs implemented in Dar es Salaam, Tanzania, emptied 877 pits with an average of four per day during the first 12 months of operation; this generated a profit of USD \$700 during the same period. Prior to their implementation a field survey found that residents were willing to pay up to KES 250 per extraction.

Gulper pumps are simple handheld pumps which operate similarly to borehole pumps¹⁵³. They are used to empty existing pit latrines of their semi-solid sludge. Standard Gulpers can reach 1-1.5 metres into a pit latrine. These can be made from locally-available materials, for example recycled plastic, and their design is open source and can be tailored to specific scenarios.



151 UN Habitat, Sanitation – Vacutug (2021), Available at : <https://mirror.unhabitat.org/categories.asp?catid=548>, (Accessed: 02/12/2021).

152 Engineering for change, The Vacutug (2021), Available at: <https://www.engineeringforchange.org/solutions/product/the-vacutug/>, (Accessed: 02/12/2021).

153 Engineering for change, The Gulper (2021), Available at <https://www.engineeringforchange.org/solutions/product/the-gulper/>, (Accessed: 02/12/2021).

Case Study 4.27 - Black soldier fly larvae sludge handling facility¹⁵⁴

Sanergy Inc. is a Kenya-based company that has developed a process of using biowaste, in the form of sludge, as a growth substrate for BSFL. The larvae feed on the biowaste and assimilate it to 40% protein and 25% fat by storing it up in its body¹⁵⁵. The BSFL are later processed and dried to produce high quality poultry or fish feed. A study into the utilisation of BSFL as feed for the commercial poultry sector in Kenya concluded that an adoption rate of 5% to 50% had the potential to generate US\$ 16 to 159 million annually, equivalent to 0.02% – 0.24% of Kenya's GDP¹⁵⁶.

The remaining biowaste is processed into an organic crop fertiliser or charcoal briquettes which can be used for industrial building or other household uses. In October 2021 the Japan International Cooperation Agency invested USD \$2.5 million to set up a facility in Nairobi.



154 Kyodo News, JICA invest \$2.5 million in fly-based sanitation startup in Nairobi (2021), Available at: <https://english.kyodonews.net/news/2021/10/1f7ce061210b-jica-invests-25-mil-in-fly-based-sanitation-startup-in-nairobi.html>, (Accessed:01/12/2021).

155 Kyodo News, JICA invest \$2.5 million in fly-based sanitation startup in Nairobi (2021), Available at: <https://english.kyodonews.net/news/2021/10/1f7ce061210b-jica-invests-25-mil-in-fly-based-sanitation-startup-in-nairobi.html>, (Accessed:01/12/2021).

156 Abro, Z., Kassie, M., Tanga, C., Beesigamukama, D. and Diiro, G. (2020), Socio-economic and environmental implications of replacing conventional poultry feed with insect-based feed in Kenya. *Journal of Cleaner Production*, 265.

4.4.4 VC waste collection and processing to support tourism

This VC draws together three essential parts of waste management: collection, material recovery and organics processing. A properly-developed waste management system will improve the appearance of Lamu Town, and the entire Municipality.

Actors in the area like Takataka, the Youth Alliance and Weka Lamu Safi (WELASA) already collect waste and Flipflop already process some plastic waste into lumber to produce dhows with the hope of producing other products in the future. This VC would further secure the relations between the current actors and encourage others to join, so that all waste is collected and processed for the benefit of local people and visiting tourists, as well as benefiting the environment.

It is hoped that this VC would enable the local actors to collect a wider range of wastes, with:

- > Non-plastic waste bulked and transferred to Mombasa or elsewhere;
- > Plastic waste processed on Lamu Island, within the Municipality to produce lumber and other plastic components, including Vacutugs, using 3-D printing or taken to Nairobi (specifically for PET bottles to be recycled by PETCO); and
- > Organic waste processed either by black soldier fly or in modular anaerobic digestors, to produce biogas and fertiliser.

Summaries of the three parts of the waste management system are shown below. Further work will be needed to establish the number of workers needed, land take, water and energy demands and transport requirements.

Waste collection

It has been identified in the UNESCO water and sanitation assessment mission to Lamu Town that door-to-door waste collection is needed to improve waste management practices. This VC would aim to create a better system for the collection of waste, discouraging informal dumping and open-burning, as well as significantly reducing the health and environmental impacts of open waste deposits. This would offset the effects of improper waste management on the environment, water resources, and subsequent climate effects in line with the SUED principles.

A door-to-door waste collection system would include procurement of new waste receptacles for residents and businesses, which encourage source segregation for organic, recyclable and residual waste.

The VC would also include the procurement of systems to collect the waste; ranging from split body hand carts and bicycles with trailers to larger collection vehicles and/or tractors and trailers dedicated to collecting solid waste. The size of collection system/vehicle would be dictated by the specific requirements of the area having its solid waste collected, e.g. hand carts and bicycles for the narrow streets of Lamu Old Town and larger vehicles for less congested and/or rural areas.

As well as the procurement of new solid waste receptacles and new collection systems/vehicles, the VC would also fund procuring storage space for the collected recyclables – organic waste would go directly to the AD plants (see below) and residual waste to the landfills (see project 19) – and staff and offices to manage collection operations. The VC would include public awareness and education campaigns to encourage reuse and recycling, and proper waste disposal. The actors already known to be collecting solid waste; Takataka, the Youth Alliance and Weka Lamu Safi (WELASA), would all be involved in this process.

Location

The door-to-door waste collection would be Municipality / County wide with storage space for recyclables and offices needed in or near Lamu Town for waste collected on Lamu Island and Mokowe for waste collected on the mainland.

Linkages

- > Multiple Municipality documents highlight the need for upgrading the solid waste management collection system in the Municipality. The VC would support urbanisation and community health by reducing or eliminating open dumping and burning of waste, as well as reducing the volume of waste going to the landfills, which could lead to a reduction in the size and number of landfills required. This would free-up space for housing and other land use; and
- > The waste collection system relies on a good transportation network including roads, vehicles, and traffic routes, therefore there are links between this VC and the transportation infrastructure proposals.

SUED principles for implementation

Climate resilience recommendations

There are no direct climate resilience considerations for the VC. There is, however, a clear benefit that the reduction in solid waste and wild dumping will reduce the amount of waste which is swept into drainage systems, and which can cause blockages and localised flooding. As such, a solid waste collection system should help to increase resilience to flooding.

As mentioned above, the collection system is dependent on a strong road network, and ideally the roads used should undergo upgrades in both road surface and drainage to ensure that they remain passable, and that collection can continue, even during heavy rainfall events.

Social inclusion recommendations

Improved solid waste management practices and the discouragement of informal dumping will bring significant benefits to public health. Source segregation reduces costs in solid waste handling and recycling represents potential revenue. A cleaner environment contributes to the commercial and tourism development of the area.

The project also represents employment opportunities for SIGs. Many young men already work in transportation, and they could be engaged in solid waste collection. There are also employment opportunities for PWD and women, for example in back-office activities to manage collection operation and logistics.

Recommendations:

- > Waste collectors should receive training in safe working methods and road safety and receive the adequate PPE. They should also be trained on how to segregate the solid waste, and on how to handle solid waste properly to avoid dropping it on the way from households to the collection point, which negatively affects local communities; and
- > To engage local communities and NGOs in education campaigns to generate awareness about the importance of source segregation and appropriate solid waste disposal.

Materials recovery facility

The second part of the VC would be for the construction of two materials recovery facilities (MRF), for the collected waste, which aims to maximise the extraction of valuable and recyclable waste such as paper, metal, glass and plastic. Once segregated, these can be sent for processing on Lamu Island or within the Municipality itself for onward sale to recycling facilities in Mombasa and Nairobi. The MRFs will be small/modular and simplistic at first, with basic sorting tables for the segregation of different recyclables (recyclables will already be segregated from general waste and organics through the collection process).

The MRFs can then be built up with sorting equipment, plastic shredders, metal shredders and paper/cardboard balers over time. This can be funded in part from the fees paid under voluntary extended producer responsibility schemes like that run by PETCO for PET bottles.

Location

The MRFs should be constructed on Lamu Island and at Mokowe.

Linkages

- > The CIDP acknowledges the impact of poor waste management services to the health and safety of the town's population;
- > The VC would support communities by reducing the volume of waste going to the landfills;
- > The VC supports SUED principles of sustainable urbanisation, environmental resilience and climate change resilience;
- > The MRFs rely on a good transportation network therefore there are links between this part of the VC and the transport projects; and
- > The VC would support the NGOs Takataka, WELASA and Flipflop, who already collect solid waste and process some plastic waste to build dhows.

SUED principles for implementation

Climate resilience recommendations

Capital assets such as MRFs have a long-life span, as they are expected to be operational for decades. Climate change is already affecting waste management processes and operations that are subject to weather related impacts are expected to increase over the coming decades. The MRFs could be sensitive to changes in temperature, fluctuations in precipitation and storms and high winds. Higher temperatures could reduce worker's productivity and in extreme cases adversely affect workers at risk from heat stress.

Higher temperatures may require changes to equipment due to an increased potential of dust, odour, bioaerosol release and combustion risk, in solid waste processing areas. Precipitation decrease may reduce water availability for site management (e.g. dust suppression). On the other hand, flash flood occurrences on-site can adversely affect operations in cases of inundation of site facilities (e.g. weighbridge, roads and offices depending on site location). Site location and design should account for potential surface water flooding. As good transport links are an important part of the project, upgrades to roads to improve their surface and increase storm drainage would ensure better access all-year round and could be considered as part of the development of a more resilient transport system.

Social inclusion recommendations

Solid waste recovery at the MRFs represent formal employment opportunities, providing salary, equipment, and training.

- > Ensure informal waste pickers' livelihoods are not disrupted by integrating them in the new solid waste management system and consulting their preferences and needs; and
- > As recommended above, engage local communities and NGOs and develop education campaigns to generate awareness about the importance of source segregation and appropriate solid waste disposal.

Organic waste processing

The LIUUDP Situational Analysis Report identified that 65% of waste generated on Lamu Island was organic, including the large amount of donkey dung that is generated. This part of the VC would provide a sustainable solution to manage organic solid waste and reduce the volume of waste in the environment and being sent to the landfills. This in turn leads to lesser impact on the environment through degradation of land and pollution in line with SUED principles. This solution can also be used for the collected liquid waste, as described in project 15.

This project relies on organic waste being segregated at source and collected separately from other waste streams. Once the organic waste is collected, from homes, markets, abattoirs, hotels and restaurants etc, it would be processed through anaerobic digestion (AD), which can produce fertiliser and biogas.

In 2019 it was estimated that Lamu Island alone generated 12,110 tonnes of waste, with further quantities generated across the rest of the Municipality. Based on the assumption that 65% is organic waste, this could mean that nearly 8,000 tonnes per year could be processed, with this amount likely to go up as the other VC's and other businesses develop in the area.

It is important to consider future space requirements for organic waste processing to support potential future growth in the other VC's and other businesses, including those focused on tourism. Future space requirements could be for either additional AD units or a single larger unit.

Location

An AD facility should be developed on Lamu Island, as well as on the outskirts of Mokowe. They could be co-located with facilities for dealing with sludge, as set out in the project 15.

Linkages

- > This VC would support the other VC's, environmental resilience, and climate change, as it would reduce or eliminate the volume of organic waste going to landfills, which generates methane (a greenhouse gas) and provide fuel which would reduce the use of wood from forests;
- > There are potential links between this VC and desludging businesses and sludge handling project 15 (desludging if black soldier flies are not utilised straight away or at all) and energy infrastructure proposals as this would provide biogas;
- > There are also links with transportation infrastructure proposals to upgrade roads as vehicles will bring in organic waste and take out fertiliser; and

SUED principles for implementation

Climate resilience recommendations

The site of the AD plants would need to be chosen to reduce the risk of flooding and ensure good access. Indirect resilience benefits of this project are an increased supply of fertiliser for farmers, which could help enhance yields, while mitigation benefits are clear in the reduction of methane.

The collection system is dependent on a strong road network, and ideally the roads used should undergo upgrades in both road surface and drainage to ensure that they remain passable, and that collection can continue, even during high temperature and heavy rainfall events.

Social inclusion recommendations

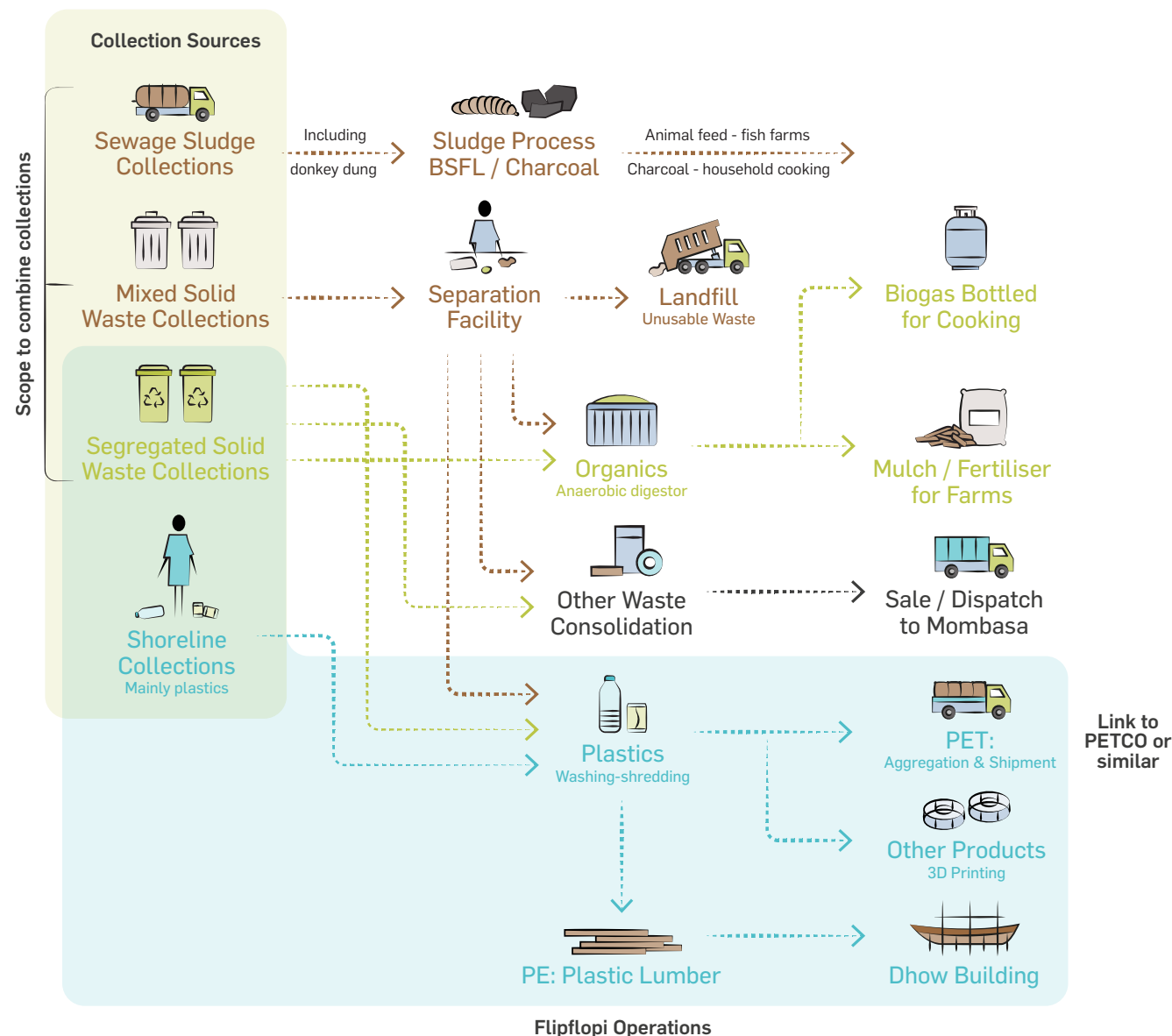
Both processes, organic waste collection and its processing, represent employment opportunities, providing salary, equipment, and training.

- > This project presents employment opportunities for SIGs. Many young men already work in transportation, and they could be engaged in organic waste collection. There are also other employment opportunities for example in back-office activities to manage collection operation and logistics.

The potential of producing biogas also represents several socio-economic benefits and opportunities for women's economic empowerment. For example, women can generate new livelihood opportunities, reduce risks and time spent collecting fuel, and lower their expenditures on fuel. This is particularly relevant for women who are often in charge of these tasks. It could also contribute to reducing health risks and smoke-related illnesses, while mitigating climate change¹⁵⁷.

Right is the flow chart for the VC to illustrate how the different parts come together and interact.

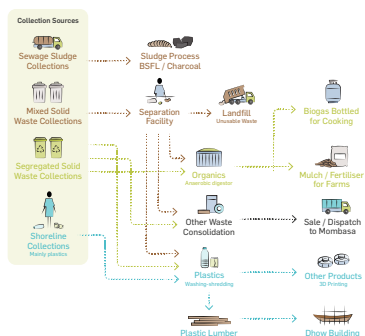
Figure 4.50 VC waste collection and processing flow chart Lamu Island



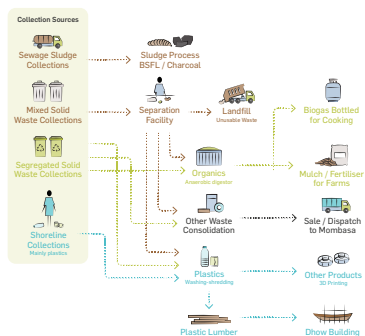
157 J Libaisi, M Njenga, (2018), Biogas as a Smart Investment for Women's Empowerment and Livelihood Enhancement, Recovering bioenergy in Sub-Saharan Africa: gender dimensions, lessons and challenges, pp.33-38,

Figure 4.51 VC waste collection and processing flow chart Lamu County

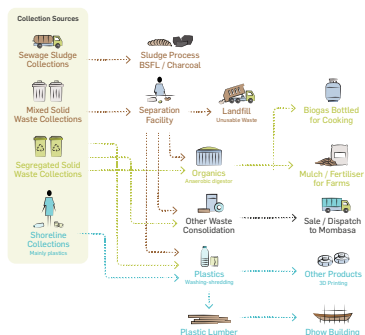
Local Waste Network - Lamu Island



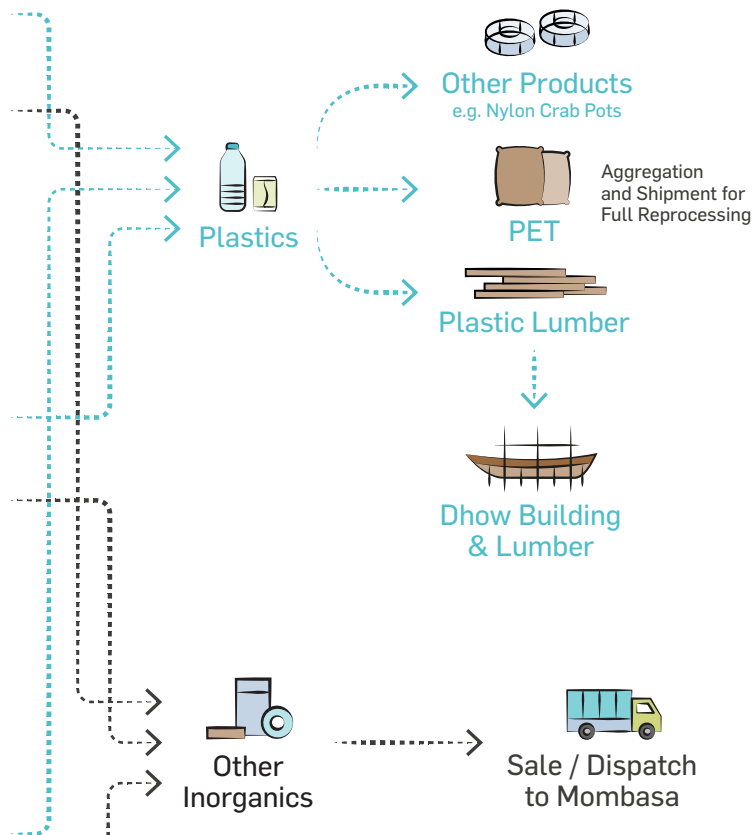
Local Waste Network - Mpeketoni



Local Waste Network - Pate



Linking of Local Waste Networks and Expansion in Flipflop's Plastics Operations



Case Study 4.28 - Waste collection Kenya¹⁵⁸

A UK Aid-funded project, delivered by WasteAid and local partner organisation Kwa Muhia Environmental Group (KMEG), will set up a waste and recycling centre that will create green jobs and contribute towards a cleaner environment. The community of Kwa Muhia has no formal sanitation or waste management provision and is on the southern shores of Lake Naivasha. This is threatening the conservation status of Lake Naivasha, an internationally important wetland site, due to plastic pollution from the community, and agricultural runoff from the nearby flower farms.

As part of the project the local team will organise a waste collection service with waste taken to a new community waste management and recycling centre. There waste will be processed into useful products that can be sold in local markets. In addition, KMEG will be running an awareness raising campaign to encourage waste-wise behaviour in the community. The project is seen as an opportunity to improve public health by reducing diseases spread by uncollected rubbish and convert waste into wealth. It will introduce simple and affordable waste management and recycling skills for disadvantaged women, youths and PWD, creating jobs and cleaning the environment for current and future generations.



¹⁵⁸ Water Aid, Water Aid awards UK aid funding for community recycling in Kenya (2021), Available at: <https://wasteaid.org/wasteaid-awarded-ukaid-funding-for-community-recycling-in-kenya/>, (Accessed: 03/12/2021).

Source: Atkins analysis

Case Study 4.29 - The Gorge Farm Energy Park, Kenya¹⁵⁹

Since 2016 the Gorge Farm Energy Park in Naivasha has been producing two megawatts of electricity, which is used at Gorge Farm itself, owned by the Vegpro Group, and has sufficient surplus to meet the power needs of 5,000 to 6,000 rural homes.

The Energy Park also generates heat for the farm's greenhouses, and fertiliser which can be used by local farms, displacing the need for synthetic fertiliser. The Energy Park processes 50,000 tonnes of Gorge Farm's organic residue to produce biogas, through anaerobic digestion, and 35,000 tonnes of fertiliser. The biogas is burned in two engines to produce the electricity and heat. It is estimated that producing the same amount of electricity and heat using diesel would require five million litres of fuel annually, plus the extra fuel required to transport the diesel from Mombasa. The use of biogas to produce the electricity is also estimated to save 7,000 tonnes of carbon dioxide emissions annually.

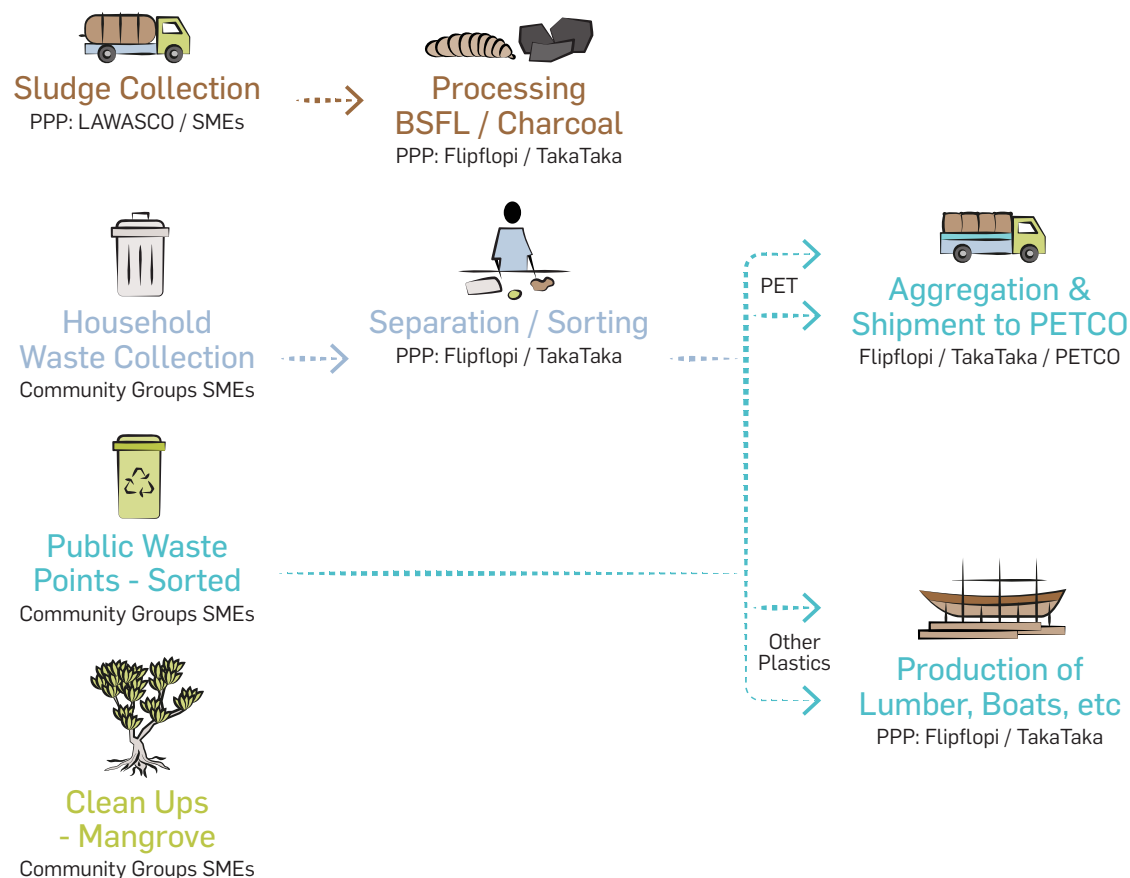
Biojoule Kenya, the independent power producer that operates the Gorge Farm plant, sells the power to Gorge Farm and to Kenya Power and Lighting Company for US\$0.10 per kilowatt hour. Diesel-generated power, by contrast, costs US\$ 0.38 per kilowatt hour to produce. Tropical Power supplied engines for the Energy Park, in conjunction with Clarke Energy, a UK-based engine service provider and by locating the plant very close to the grid interconnection point, engineering challenges were minimised. The project is seen as an example of how locally-produced feedstock can be used to generate clean and cost-effective power for Kenya. A policy analyst at the Kenya Institute of Public Policy Research and Analysis believes biogas could generate between 29 to 131 MW of power in the country.



¹⁵⁹ Reuters, Kenya energy biogas (2021), Available at: <https://www.reuters.com/article/kenya-energy-biogas-idUSL5N1EZ1KL> (Accessed:03/12/2021).

¹⁶⁰ Bio mass magazine, Bringing AD to Africa (2021), Available at: [Bringing AD to Africa | Biomassmagazine.com](https://biomassmagazine.com/bringing-ad-to-africa/), (Accessed: 03/12/2021)

Figure 4.52 VC waste collection and processing possible actors



Source: Atkins analysis

4.5 Maritime Trade, Transport and Future Industries

4.5.1 LAPSET aspirations in Lamu

LAPSET presents a significant opportunity for economic development for Lamu not only to develop as a gateway and transport hub to Kenya and East Africa but also as a strong incentive to establish export-orientated manufacturing and agri-processing industries within the Municipality. The development of the port in Manda Bay and the Special Economic Zone (SEZ), along with the other components of the LAPSET corridor (such as the railway, airports, resort city) is highlighted as a flagship project under Vision 2030 and identified in the National Spatial Plan as crucial to spurring growth in northern parts of the Country which will help with the re-distribution of urbanisation and economic opportunities.

The development of a port at Lamu will allow for relief of the congested Port of Mombasa and provide the opportunity to develop export-orientated manufacturing and industries, a deep-sea fishing port, as well as those that make use of global value chains, in Lamu. The development of the Port was also meant to support the export of oil following its transport to Lamu along the LAPSET corridor.

The Port Industrial Area and SEZ will provide the employment land and infrastructure required to support industrial and agri-processing activity. These activities will add value to agricultural and livestock produce by communities along the LAPSET corridor and to fishing activities based around Lamu. Manufacturing activities in other sectors, for example construction materials, will also provide employment opportunities. The Port will allow for the export of products, particularly heavy goods, as well as access to imported goods and other manufacturing inputs where these are required. The Special Economic Zone can provide an environment that attracts investment in manufacturing and other industries including logistics and services-related activity.

The proposed development of a Resort City can further help to develop Lamu's already strong tourist offer. Current assets include the natural environment and cultural heritage, particularly the UNESCO World Heritage Site of Lamu Old Town. In addition, development of the Port, SEZ and Lamu Metropolis will increase demand from business tourism. As demand for travel to the area increases, either for business or tourism purposes, the current airport infrastructure may prove inadequate, requiring investment in the upgrading of facilities to allow further air connections and routes to serve Manda.

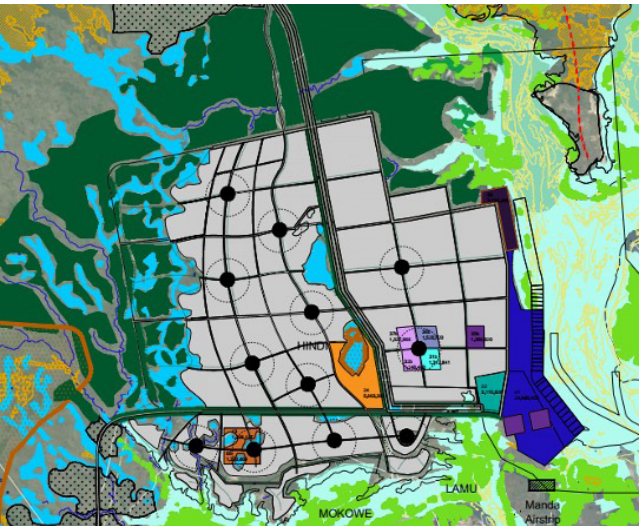
Current Activity

Currently only the first berth at LAPSET port is operational in the new port, while the second and third berths are 95% complete and should be operational by mid-2022. Data from Kenya Ports Authority (KPA) shows ten ships have docked at the new port since 20th May 2021 when the first berth was launched. The port is intended to complement Mombasa Port for transshipment purposes with immediate target markets being the Middle East and Pakistan, while smaller feeder ships will service the East Africa region and potentially other Indian Ocean Island nations such as Madagascar. There is also a site set aside for a livestock holding zone for exports to the Middle East, while there has been some initial interest from potential investment in food processing, wood and lumber, automotive imports and distribution, and warehousing and logistics to service East African landlocked countries.

Phase 1 of the project in Lamu (c. 460 ha of employment land) consists of an initial three berths and accompanying logistics area (64 ha) and some 85-ha developed in close proximity to the port as shown in Table 4-45. The oil storage and loading facility will be developed within the port zone. The initial phase of the Resort City (28 ha) was also expected to be built out and the first phase of the residential township would be established around a neighbourhood centre.

Table 4.45 Initial Development Phase

Development strategy



Key development statistics

- > Total labour demand: 21,900
- > Total population: 56,800
- > Total households: 19,300
- > Capacity to house 64,900 people, or 22,100 units.
- > Power demand: 75 MW
- > Water demand: 14,900 m³/day

Source: LAPSET investment framework

4.5.2 Potential future activity in Lamu

The Lamu Investment Framework¹⁶¹ sets out potential economic activities that could be accommodated within the SEZ. However, these are not based on a detailed demand assessment to determine viability and scale but rather, consideration is given to similar examples of Special Economic Zones globally and an assessment of demand drivers regionally. It is worth noting that the Investment Framework was completed pre-CVOID-19. In light of current global economic conditions and emerging priorities post COP26, the mix of potential industries located within the SEZ could considerably change and/or be delayed. For example, heavy industrial uses might prove unsustainable both environmentally and also financially. However, key identified industrial activities such as food processing remain relevant and align with priorities coming out of the Lamu UEP.

As noted above and in section 3.5, the spatial strategy of the UEP, to bolster and promote balanced economic development across the Municipality, is to leverage off activities and infrastructure investments associated with the LAPSSET Port and SEZ activities, as well as the future Port City Metropolis development. For example, the urban centre of Mokowe has been identified as a key location for initial UEP VCs that can benefit from the future opening-up of access to supply chains and markets (local, regional and global) enabled by the LAPSSET node development.

Key activities from the Investment Framework are presented below and considered relevant domestic demand drivers including GDP and population growth, inward investment and investment in infrastructure. Production activities oriented towards export opportunities, whether making use of local inputs or integrating into global supply chains, have also been considered. The assessment of potential activities presented within the Investment Framework draws on examples of the development of industrial zones in East Africa and internationally and an assessment of Kenya's competitive advantages and contextual factors.

Table 4.46 Potential activities within Lamu SEZ

Sector	Main products	Specific activities	Market drivers
Metals processing	Steel	Long and flat steel products service centres Stamping/pressing of steel/aluminium sheet Welded steel tubes Hot-dip galvanising facilities General machine shop facilities Fabrication workshops	Focus on domestic demand. Drivers: GDP and population growth; Urbanisation; Investment (infrastructure); Growth of industrial activity; Consumer disposable income; Substitution by other materials.
	Copper	Copper tube manufacture Brass castings	
	Aluminium	Aluminium extrusion facilities Aluminium foil mills Aluminium casting facilities	
Building materialst	Aggregates	Sand, gravel and crushed stone	Focus on domestic demand. Drivers include: GDP and population growth; Urbanisation; Investment (infrastructure); Growth of industrial activity; Consumer disposable income; Substitution by other materials.
	Cement	Cement plant Clinker grinding plant	
	Light manufacture building products	Pre-stressed and pre-cast concrete products Ready mix concrete factories uPVC windows and doors Float glass and glass panels (IGU) Plasterboard, cement board	
Light manufacturing	Apparel	Apparel and textiles. Facilities often specialise in a particular operation or component, e.g. patterns, cutting, embroidery, trims, etc.; or assembly.	Globalised supply chains; Competition in clothes retailing; Shift in manufacture away from East Asia; Abundance of low skilled labour force in East Africa; Established export-oriented industry in Kenya; Market access (e.g. AGOA).
	Furniture and wood products		

161 Atkins Acuity, Lamu Port City Agreed Investment Framework (2017).

Sector	Main products	Specific activities	Market drivers
Food and beverage sector	Storage facilities Flour production Frozen fruit and vegetables Fruit and vegetables preserved in containers Beverage production Food packaging facilities Meat processing Fish processing Edible oils Pasta/noodles/couscous Vegetables/potato crisps and snacks		Similar drivers apply domestically and internationally. These include: population and economic growth; disposable income; shifts in consumer choices (e.g. increasing meat and soft drinks consumption, demand for packaged or processed foods); Kenya as a major agricultural producer.
Heavy industrial facilities	Metallurgical facilities Basic chemicals Petrochemicals		Significant capital investments. Require large, accessible markets due to large production capacity of plants. Other key investment criteria: raw material availability (ores, gas, oil); energy costs.
Tourism	Leisure tourism MICE/Business tourism	Coastal resorts Ecotourism Cultural heritage Cruise tourism	Economic growth and disposable incomes (domestic and international); Consumer choices (e.g. ecotourism); Perception and marketing of Kenya/Lamu (e.g. security concerns). Industrial development of area to drive business tourism.

Source: LAPPSET investment framework

The Investment Framework also details the potential physical requirements by sector.

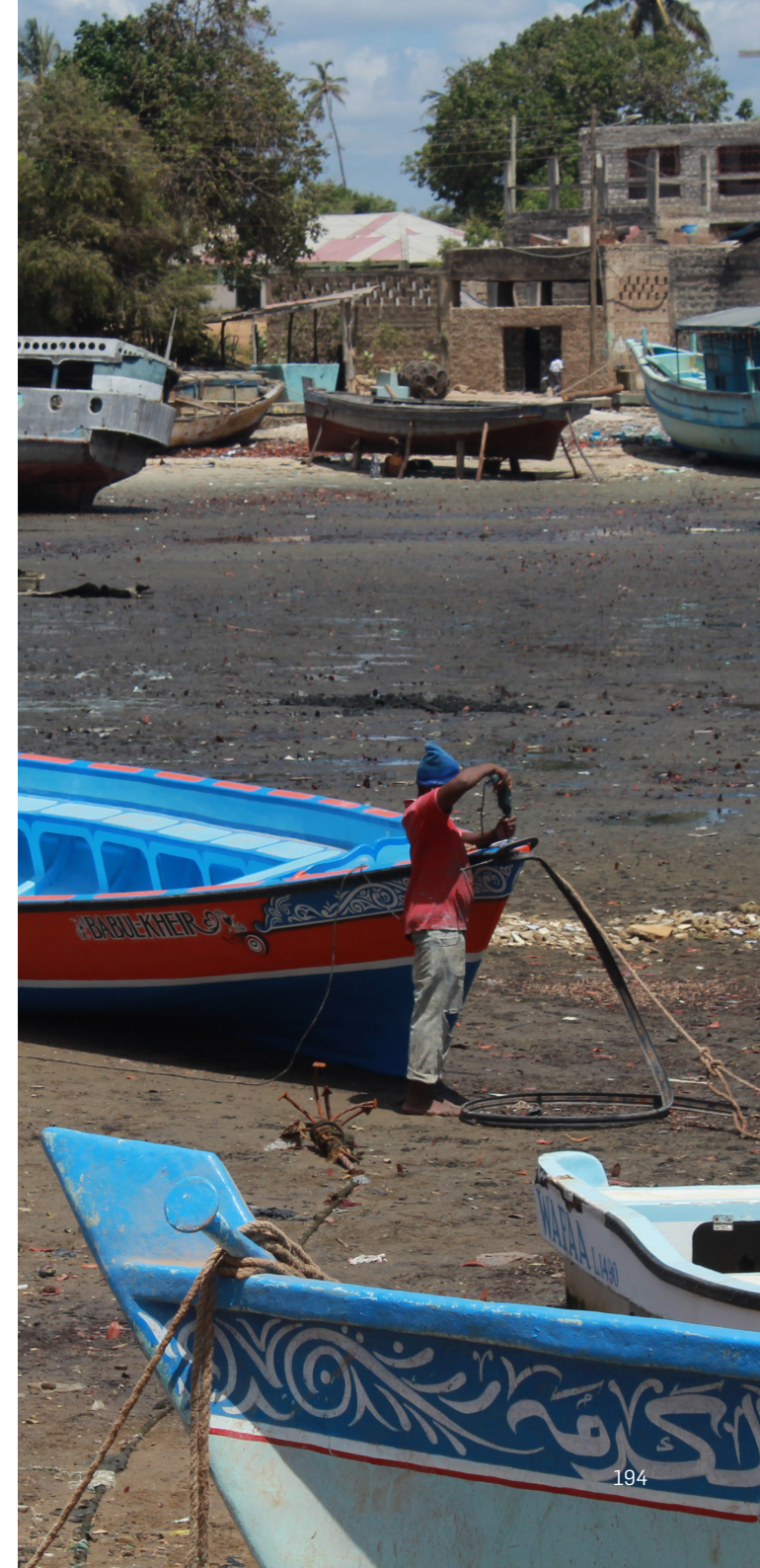
Table 4.47 Sector requirements

Sector	Locational requirements	Infrastructure requirements	Environmental concerns	Typical lot/plot size
Metal processing sector	Good access to road/railway network	Reliable supply of low-cost electricity or gas	Air pollutants Water pollutants	1-2 ha for smaller workshops to 10-20 ha for larger facilities
Building materials: heavy industrial sector	Depends on facility: if clinker grinding plant, then next to port, or close to raw materials source	Energy intensive	Noise, dust and air pollution.	10 ha
Light industry	Close to road/rail network	Medium-low energy intensity	More limited	2ha -6 ha
Apparel manufacture	Access to power and workforce	Less energy intensive - reliable power supply	More limited	< 1Ha
Food and beverage sector	Close to water source	Significant quantities of water, energy intensive	Wastewater and emissions to air (flue gases, dust and odour)	various
Heavy industrial facilities	Safeguarding site close to the port	Energy intensive, fresh/sea water for cooling purposes	Air pollutants; odour; water pollutants; safeguarding areas for hazardous facilities.	300 ha per industry sector

Source: LAPPSET investment framework

It is important to note that whilst the central Government has financed much of the initial port construction, including the access roads from the regional road network, any future ongoing developments are to be driven by private investors and operators and this will include the roll-out of further infrastructure to enable the commercial and industrial port areas, along with the SEZ to be developed.

Given this reality, along with the many global uncertainties with regards the COVID-19 pandemic as well as geo-political events and outcomes, it is difficult to project a future development trajectory or phasing for LAPPSET, despite the current 20 to 30 year development horizon. This means that the projects and interventions identified within the UEP have been determined and anchored on the local needs and economic opportunities within the Municipality whilst having the potential to engage with, and leverage, from future industrial and commercial investments, and import/export activities undertaken in the LAPPSET node.



4.5.3 Required infrastructure, including housing

Lamu County, especially Mokowe and Hindi areas, are directly affected from the influx of population which is putting a lot of pressure on existing infrastructure. Among the population migrating to Lamu are skilled/unskilled job seekers, investors, service providers and tourists.

Development of Lamu Port has no doubt put pressure on existing social and physical infrastructure that was largely unprepared for the population influx. The construction of the first three berths have so far seen LAPSET Port having an average workforce of about 1500. Consequently, housing is one of the sectors that have been significantly impacted due to a mismatch in demand and supply.

The available housing units are mainly in two forms- high end houses for the skilled workers from Kenya Ports Authority, LAPSET Corridor Development Authority (LCDA), and consultants which totals 20, while the unskilled workers have been provided with 600 semi-contained housing units all within LAPSET campus. This leaves a housing deficit of about 800, on average. To meet this demand LCDA set aside land to build 400 units through a public private partnership (PPP) and the units are expected to be completed and ready for occupation by end of 2022.

In the meantime, the excess demand is absorbed by neighbouring towns. About 400 workers are accommodated in Hindi town which is approximately 12.5 km from the port, about 250 workers reside in Mokowe which is 17km from the port, and about 150 workers commute from Lamu Island daily. To facilitate commuting workers, KPA provides a bus that drops-off and picks-up port workers from Mokowe jetty every day.

The danger of this burgeoning residential housing without guidance of a spatial plan is that it grows in an informal housing settlement and suffers spill-overs of informal economic activities. Consequently, it results into an unattractive environment for business investors. This pattern is very evident in Hindi and Mokowe towns.

Other developments that have appeared in the area include petrol stations, retail shops, supermarkets, and office buildings which are responding to the latent demand created by the population influx.

Affordable housing

A range of housing options targeting low, middle and high-income families should be considered within the proposed residential mixed-use clusters. These should be supported by a range of community facilities located within the various neighbourhoods and linked to the wider parts of the development core, such as the commercial and administrative/ civic zones, as well as public open spaces.

Compact walkable cities with integrated neighbourhoods providing the full range of civic and cultural services, access to education and health facilities, open space and recreation, and commercial / retail opportunities are all engendered in the eco-city principles.

In order to kickstart this process it is proposed that the Municipality pursues the development of affordable housing through the current Government of Kenya Affordable Housing Programme being driven by the State Department for Housing and Urban Development (SDHUD). The current Affordable Housing Programme provides an opportunity to engage in the development of housing and supporting infrastructure which can be the catalyst to accommodating the in-migration of people in order to facilitate population growth and boost economic activity.

The introduction of supporting infrastructure through roads, water, power and sanitation will provide further baseline infrastructure provision for additional development and economic opportunities to be leveraged.

At this time, the Municipality should focus on potential development of a range of housing within the Mokowe urban node in order to ensure this particular growth node is developed and managed in a sustainable and resilient manner. In this regard, the UEP encourages the Municipality to pursue an agenda of enabling local landowners within the town to enter into the affordable housing programme through partnerships in coordinating and assisting them with the affordable housing application and permitting procedures.

Risks

Some of the risks that have been documented and were highlighted during stakeholder consultations included:

- > Planning and construction of the port have yielded a wide range of concerns and contestations, particularly on land rights, the environment, local livelihoods, and security;
- > Development of LAPSET Port has disrupted the livelihoods of about 5000 fishermen. The fishermen claim that dredging of the port area caused fish to migrated to more sheltered areas and into deeper sea which is a challenge to navigate due to the low capacity of the fishing boats that they use;
- > The completion and operationalization of the port is increasingly attracting people of all types from various parts of the country and beyond. This is likely to be a threat to the socio-economic fabric of the indigenous communities who are known to be conservative Muslims; and

- > Potential dredging of Lamu Faza sea way route if maritime traffic increased. The Lamu Faza sea way route is a critical corridor for local passenger transportation and other water borne commerce. The Mkanda channel is a critical section along this waterway and is located between Kililana and Manda Island. This 1.5 km long channel is the main route between Lamu Island, Pate Island and other locations north of the island and it is primarily used by fisherfolk, traders, shippers and boat passengers. Users reported to having difficulty navigating the channel due to its shallowness. The channel was dredged in 1997 to increase its width and depth but currently large vessels are only able to navigate the channel when tides are high. Alternative routes require boats to circumnavigate Manda Island at greater transport costs i.e fuel. The channel's proximity to Lamu Port and the spoil from dredging works undertaken during the port's construction are anecdotally blamed for increasing the amount of sedimentation in the channel.

Increased population and economic activity will add to the traffic along the channel intensifying the pressure for deeper and wider channels for navigation. Good local inter-connectivity and logistics between the islands around Lamu will be dependent on enhanced accessibility across the channels. Thus, an exploration of options that respect the sensitive environments around the channel and mitigate the ecological impacts of its continued use as a critical section of seaway route will be required.

This could form part of the Marine Spatial Plan assessments (Project 5) that look to enhance the maritime transport and trade activity in a manner that fosters inclusive development and secures the long-term sustainable development of the region.

Figure 4.53 Mkanda channel



Source: Atkins analysis

4.5.4 Recommendations for standards and regulations aligning to eco-industrial development, green ports and SEZ

This section outlines high-level recommendations to strengthen standards and regulations to adopt eco-industrial development, green ports and sustainable SEZ by LAPSET Authority.

Strengthen environmental and social impact regulation

The ongoing and proposed LAPSET infrastructure development projects need to be carried out in a phased and sustainable manner to avoid potential issues of environmental degradation, encroachment on natural habitats and negative socio-economic implications for the local population. There is a clear need for environmental and social management to protect the local livelihoods of Lamu communities, and crucially its fragile marine and terrestrial ecosystems. Enforcement of EIA regulations including Environmental Management Plans, Sustainable Management Plans and a Resettlement Action Plan should be applied to ensure mitigation measures are implemented and affected communities compensated. Requirements to properly manage environmental and social impacts include:

- > Feasibility studies for infrastructure projects;
- > Development of a detailed master plan to guide the development of the site;
- > Development of an Environmental and Social Impact Assessment and Environmental and Social Management Plan;
- > A Resettlement Action Plan also needs to be developed in order to relocate individuals who are currently settled at the site and farming activities within the site to allow room for the industrial park; and

- > Provision of enabling infrastructure i.e. access roads, utilities services, housing.

This should involve the conception of considered and targeted policies and guidelines to drive inclusive and environmentally sound port development and operation.

Sustainable Construction Guidelines for Lamu Port and SEZ

Lamu Port has already started operation, with three berths out of 24 now constructed. However, it is recommended that sustainable construction guidelines are introduced for the development of the remaining berths and the Port Industrial/Special Economic Zone. Accounting for the intrinsic value of Lamu's marine resources in future design and planning is not only crucial for long-term sustainable development but it can also benefit the Port and its stakeholders. The introduction of guidelines that place ecosystems centrally in the design and construction of marine infrastructure have the potential to¹⁶²:

- > Prevent the 'green handbrake' on developments, where projects are called off due to legislative environmental constraints, and evade costs and delays in planning and implementation as a result of fines, lawsuits or clean-up expenses;
- > Improve branding of LAPSET and the Port, as increasing public pressure is placed on maritime developments to actively prevent harm to the environment;
- > Limit the potential for negative ecosystem impacts to backfire on the Port itself, for instance through coastal erosion and sedimentation induced by the Port; and
- > Create added value with regards to ecosystem services like flood protection, food production and recreation.

To maximise the potential for such benefits, sustainable construction guidelines should be embedded in the development of the Port and SEZ going forward, including (but not limited to):

Construction techniques

With the exception of 'natural' ports, physical interventions are typically necessary in facilitating the effective functioning of ports. This can include dredging to deepen the port basin and access channels, land reclamations, and civil engineering works such as breakwaters, berths and quay walls¹⁶³. To conserve the fragile marine ecosystems of Lamu, these interventions should be avoided if possible, and minimised if not.

Traditionally, ports utilise breakwaters to offer shelter from ambient wave and current conditions. However, open or unsheltered berths have increasingly been recommended as an alternate option in mild coastal environments. Such techniques can limit the required level of civil works and therefore reduce the accompanying destruction of habitats and interruption of natural flows. Advances in shipping technology and mooring methods that stabilise ships under more energetic conditions may enable the construction of similar berths at locations that were not considered feasible previously¹⁶⁴.

Selection of structures and materials

In general, port structures replace natural habitats with disadvantageous conditions for biodiversity, including steep slopes, low structural complexity and high homogeneity. However, recent innovations in the field of ecological engineering have provided pioneering concepts for multifunctional, ecosystem-based marine infrastructural design¹⁶⁵.

¹⁶² De Boer, W.P. et al. (2019), Identifying Ecosystem-Based Alternatives for the Design of a Seaport's Marine Infrastructure: The Case of Tema Port Expansion in Ghana, *Sustainability*, 11, pp.66-85.

¹⁶³ Schipper, C.A., Vreugdenhil, H. and de Jong, M.P.C. (2017), A sustainability assessment of ports and port-city plans: Comparing ambitions with achievements, *Transportation Research Part D*, 57, pp.84-111.

¹⁶⁴ De Jong, M.P.C., Weiler, O.M. and Schouten, J. (2012) Open water ports—a sustainable design approach, *Proceedings of the Third International Engineering Systems Symposium*, Netherlands, 18th-20th June 2012

¹⁶⁵ De Boer, W.P. et al. (2019) Identifying Ecosystem-Based Alternatives for the Design of a Seaport's Marine Infrastructure: The Case of Tema Port Expansion in Ghana, *Sustainability*, 11, pp.66-85.

Integration of such solutions should be considered in the development of the port and SEZ going forward to create alternative habitats or enhance existing ones. Some examples from literature include:

- > Breakwaters that act as artificial reefs;
- > ECOcrete®, a biological concrete that can improve the ecological value of quay walls¹⁶⁶;
- > Artificial habitat creation to improve the nursery function for juvenile fish;
- > Novel resurfacing materials to enhance surface complexity; and
- > Hanging ropes from poles and pontoons so marine organisms can attach, thus increasing biological productivity and biodiversity¹⁶⁷.

Sustainability is increasingly being regarded as an integral part of value creation and a source of competitive advantage for industries and businesses. Incorporation of sustainable practice guidelines can contribute to the strategic goals of Lamu Port and the SEZ through increased revenue and market share; reduced cost of operations; decreased environmental and financial risk; enhanced brand image; improved relationships with key stakeholders and a greater ability to maintain 'license to operate'¹⁶⁸.

Corporate social responsibility policies

Corporate social responsibility is a self-regulating business model that encourages a company to be socially accountable – to itself, its stakeholders and the public. By developing corporate social responsibility policies,

companies are encouraged to be conscious of their impact on all aspects of society – including economically, socially and environmentally¹⁶⁹. As a result of the potential negative implications of the development for the environment of Lamu and its communities, it is recommended that the Government of Kenya, as the main shareholder of the LAPSSET Corridor Development Authority, establish a core corporate social responsibility to provide significant financial and practical support for the conservation and maintenance of Lamu's marine resources.

This would fall under the LCDA's mandate to build the capacity of the LAPSSET Corridor towns to manage the urban growth resulting from the aforementioned infrastructure investments¹⁷⁰. The corporate social responsibility policy should ensure that the LCDA develops significant funding mechanisms for conservation and maintenance work to address potential physical conservation issues, as well as to support social and cultural issues that could result from LAPSSET's likely implications for migration into Lamu in future.

It is also recommended that core corporate social responsibility works towards preventing and mitigating potential social impacts related to the project. Mega-development projects that do not consider social safeguarding measures could negatively impact local communities. There are examples in the past¹⁷¹ that have shown that a large influx of temporary foreign workers and contractors could generate harmful social dynamics in local communities, with particular negative consequences on sexual and reproductive health, and gender-based violence.

Case Study 4.30 - Addressing gender-based violence and harassment in the construction sector

Major infrastructure projects can become a high-risk environment in terms of gender-based violence (GBV) and harassment affecting local communities and workers. This situation is further complicated when there is a large influx of outside workers, particularly when they live close to or within host communities. Some project components, for example those provoking displacement and resettlement or those requiring transportation, can often represent significant GBV risks. Poorly designed or maintained working spaces or project sites (e.g.: with bad lighting, shared latrines) can also contribute to increasing risks.

A recent CDC guide¹⁷² has explained the benefits that emerge from addressing GBV in the construction sector: (1) It strengthens occupational health and safety and improves workers' wellbeing, for example reducing the risk of contracting sexually-transmitted diseases such as HIV/AIDS; (2) It avoids reputational damage, legal liabilities and financial risks for companies, investors and construction contractors; (3) It contributes to building social relationships and links with local communities, for example, by working with communities and local governments to prevent and respond to GBV; and (4) It broadens the workers' pool by generating incentives for women workers from local communities (due to lower perceived risks). Some recommendations include: (1) Putting in place monitoring mechanisms, codes of conduct and protocols for contractors, including sensitisation training; (2) Establishing accessible grievance mechanisms for local communities; (3) Considering engaging expertise from local women's rights NGOs working on GBV to conduct awareness campaigns; (4) Conducting audits to identify places and situations that could lead to GBV.

166 Perkol-Finkel, S. et al. (2018), Seascape architecture – incorporating ecological considerations in design of coastal and marine infrastructure, *Ecological Engineering*, 120, pp.645–654.

167 Paalvast, P. et al (2012), Pole and pontoon hulases: An effective way of ecological engineering to increase productivity and biodiversity in the hard-substrate environment of the port of Rotterdam, *Ecological Engineering*, 44, pp.199–209.

168 Slinger, J., Taneja, P., Vellinga, T. and van Dorsser, C. (2017), Stakeholder inclusive design for Sustainable Port Development, *Proceedings of MTEC2017*, Singapore.

169 Fernando, J., Corporate Social Responsibility (2021), Available at: <https://www.investopedia.com/terms/c/corp-social-responsibility.asp>, (Accessed: 29/11/2021).

170 UN World Heritage Centre, ICOMOS and ICCROM, Report on the Joint Reactive Monitoring Mission to Lamu Old Town (2019).

171 For example, the WB funded project in Uganda that ended in the inspection panel due to sexual assaults claims Available from <https://www.theguardian.com/global-development/2016/jan/12/world-bank-cancels-uganda-road-sexual-assault-claims> and <https://documents1.worldbank.org/curated/en/482251502095751999/pdf/117972-WP-PUBLIC-recommendations.pdf>

172 CDC. Addressing Gender-Based Violence and Harassment (GBVH) in the Construction Sector (2020). Available at: <https://assets.cdcgroup.com/wp-content/uploads/2020/07/14193353/Addressing-GBVH-in-the-construction-sector.pdf>

Green port certifications

Green port certificates are awarded to ports which uphold the highest standards of environmental management, environmental reporting, sustainable development and implementation of appropriate mitigation strategies, as well as high quality and strong communication with stakeholders and local communities¹⁷³. Holding a green port certificate can enhance the ports competitiveness whilst improving business systems and management of port activities and facilities, as well as reduce the risk associated with poor environmental management and non-compliance with laws and regulations.

Green port certificates are built upon Environmental Management System standards, these should be integrated into the management system of the port and help to identify environmental impacts associated with port activities, operations and facilities. The three main standards include:

1. ISO 14001:2015 Environmental Management System;
22. EMAS III Regulation Environmental Management System; and
23. ECOPort (Port Environmental Review System) Environmental Management System.

A series of sustainable development and environmental management measures should be considered by the LCDA. These would allow Lamu Port to become a green certified port, these measures include, but are not limited to¹⁷⁴:

- > Implementing fines and fees for the handling of non-compliant Green Award Certified ships which could result in pollution events;

- > Monitoring of air quality, carbon emissions, noise emissions, seawater quality and soil quality in order to comply with environmental laws and standards as well as identify and mitigate against pollution events;
- > Implementing ISO 50001 Energy Management standards and reducing the consumption of electricity whilst developing and using clean energy solutions such as solar PV and other renewable energy sources;
- > Maintaining efficient use of fresh water, delivering an on-site waste water treatment plant and ensuring the segregation of water and oil systems;
- > Deploying sustainable and green port equipments such as electric vehicles and machinery;
- > Managing the storage and disposal of site waste whilst employing the principles of recycling and controlling hazardous materials and contaminants;
- > Providing high-quality safety, security and environmental management training to port staff;
- > Developing initiatives to manage land and marine based habitats through vegetation management, reforestation programmes and clean-up campaigns; and
- > Maintaining a high-level of communication with local stakeholders and communities in order to inform them of the ports activities and future developments whilst helping to support their sustainable growth.
- > Incorporating resource efficiency principles, thorough deploying energy efficiency processes, water resource management and waste management strategies, would help to reduce consumption and waste of natural resources and reducing operation and maintenance costs of port facilities and operations.
- > Applying circular economy principles through reducing material usage, eliminating waste and pollutions, redesigning processes to be less resource intensive; furthermore, using waste by-products can be highly efficient and would promote the local economy;
- > Becoming a certified green port can aid in strengthening relationships with stakeholders as well as bolstering the reputation of the port on the international market. Demonstrating efficient management of environmental impacts will boost confidence in the ports stakeholders and can lead to improved business relations; and
- > Improving the ports stakeholder and community relationship through the demonstration of full compliance with laws and legal requirements as well as the maintenance of high quality environmental reporting.

By acknowledging and actively promoting the identification of environmental impacts and applying mitigation and control strategies to the port activities as described above, as well as deploying sustainable development principles when expanding, upgrading and operating port facilities, green certified port would capitalise on a range of commercial, social and environmental benefits that include¹⁷⁵:

¹⁷³ Inter-America committee on Ports, Guide to environmental certification and sustainability reporting for ports of the Americas (2020), Available at: <https://portalcip.org/wp-content/uploads/2021/03/Green-Port-Guide-Translation-CIP01177E05-JD-PBM-MAR.pdf>, (Accessed: 21/12/2021)

¹⁷⁴ ESPO, ESPO Green Guide 2021 A manual for European ports towards a green future (2021), Available at: <https://www.espo.be/media/ESPO%20Green%20Guide%202021%20-%20FINAL.pdf>, (Accessed: 21/12/2021).

¹⁷⁵ Inter-America committee on Ports, Guide to environmental certification and sustainability reporting for ports of the Americas (2020), Available at: <https://portalcip.org/wp-content/uploads/2021/03/Green-Port-Guide-Translation-CIP01177E05-JD-PBM-MAR.pdf>, (Accessed: 21/12/2021)

Case Study 4.31 - Bolloré Ports' Green Terminal Certification¹⁷⁶

Bolloré Ports operates 21 ports worldwide with 13 of these being container terminals. In 2020 the company partnered with Bureau Veritas to develop a Green Terminal Certification for their ports. Each year Bolloré container terminals will be evaluated in line with the eight fundamental pillars identified in the diagram below.

The implementation of sustainable development methodologies when expanding existing ports, or developing new ones, and deploying innovative technologies, such as electric power gantries or electric handling vehicles, have allowed some ports to cut their carbon emissions. For example, the Freetown Terminal in Sierra Leone has had its carbon emissions cut by around 22% in 2018 after electric gantries were installed and the port was connected to the public electricity grid. The shift towards further digital innovations, such as e-payments, have allowed port functions to become more efficient.

Environmental protection and mitigations efforts, such as the protection of turtle eggs and facilitating their hatching process in safe environments, as well as community engagement to provide training and local employment, play a key part in awarding green terminal certificates to the ports woned by Bolloré Ports.



176 Bolloré Port, Green Terminal (2021), Available at: https://www.bolloré-ports.com/fileadmin/user_upload/BTLC_2104088_DP-Green_Terminal-A4_24P_ENGrev.pdf, (Accessed: 21/12/2021).

Case Study 4.32 - Tanger Med Port, Morocco^{177, 178}

The Tanger Med port, found 40km east of the city of Tanger, Morocco, was awarded the ECOPorts certification by the European Sea Ports Organisation for the third time in a row in 2020. The Tanger Med port is the first African port to have been awarded the certificate for its sustainable development approaches and compliance with environmental standards. In 2019 the port handled more than 65 million tonnes of goods including containers, cars and trucks, as well as more than 2.7 million passengers, whilst maintaining high standards of environmental monitoring and pollution mitigation.

The port authority have maintained a focus on sustainable development and environmental protection since its inception in the early 2000's. This has helped them secure the ECOPort certification whilst cutting their carbon emissions, reducing waste and consumption of energy and water.

Furthermore, in 2007 the Tanger Med Foundation was set up to work with the local communities surrounding the port in resolving problems and create solutions through the provision of professional training to young people in the community, hosting cultural and social events and workshops as well as funding medical equipment for PWDs. The foundation has also helped to finance various utilities projects and beach clean-up initiatives within the local communities.



177 Afrik21, Morocco: "EcoPorts 2020", Tanger Med port wins award for sustainable development (2020), Available at: <https://www.afrik21.africa/en/morocco-ecoports-2020-tangier-med-port-wins-award-for-sustainable-development/>, (Accessed: 21/12/2021).

178 Tanger Med, Annual Report (2019), Available at: <https://www.tangermed.ma/wp-content/uploads/2021/04/ACTIVITIES-REPORT-2019.pdf>, (Accessed: 21/12/2021).

4.6 Cross-sectoral / LM-wide infrastructure projects

This section outlines the proposed infrastructure projects that do benefit and support all key economic sectors described above as well as infrastructure improvements and upgrades that support the Municipality development beyond Lamu Island and Mokowe and to enable key urban nodes. These cross-sectoral and LM-wide infrastructure projects include:

- > Project 16 – Ferry service
- > Project 17 – Solar desalination
- > Project 18 – LM drainage masterplan
- > Project 19 – Landfills
- > Project 20 – Solar PV power generation

4.6.1.1 Project 16: Ferry Services

Project Overview

Water transport is the predominant means of passenger and cargo transport between the islands and the mainland across LC. These services are currently provided by infrequent small passenger boats, speed boats and dhows whose fares are unaffordable for most residents. Water transport is not safe, with high tides often endangering movement between the islands. The lack of an affordable dedicated sea transport service and the limited geographic size and economic size of LC's islands mean further constraints for economies of scale through expanded market access. This is having a negative impact on LM's economic potential, where leading sectors are forced to rely on the limited opportunities provided on each island as the transport cost of offering domestic products and services beyond their geography is prohibitive.

Better interconnectivity and logistics between the islands around Lamu will be pivotal in enhancing economic growth opportunities. Ferry services can also serve a lifeline role in connecting remote islands and rural communities, particularly in Lamu East to vital socio-economic opportunities.

Firstly, a feasibility study for addressing current inter-island bottlenecks and introducing ferry services is proposed. The study should aim to determine the viability of introducing new inter-island ferry services on a commercial basis as a way of boosting inclusive growth by supporting easier movement of people and goods across Lamu's islands. The ferry services would be geared towards strengthening the competitiveness of the leading sectors of the economy, including fishing, tourism and agri-business.

Secondly, an operational model to leverage from existing waterways, demand flows, surrounding infrastructure and encouraging initiatives that combine both public and private sector investment approaches will support the viability of the system. The two main jetties that experience significant traffic are Lamu KPA and Mokowe. These could form key terminal areas from where ferry services can depart from or arrive at. Based on existing waterways and travel patterns, the routes below to connecting Lamu Island should be considered:

- > Lamu Town to Mokowe with potential extension to Matondoni and Mkunumbi;
- > Lamu Town to Mtangawanga with potential extension to Kizingitini;
- > Lamu Town to Manda Island; and
- > Lamu Town to Shela

A successful ferry service will involve a phasing plan that introduces services in an incremental way and that builds upon its success. For instance, strategic ferry services should focus on routes that currently have a high frequency of trips while remote areas with low population levels will require lower frequencies of service at the onset or be considered for future route extensions. Therefore, the selection of appropriate ferry routes and the best transport technology should be based on demand and environmental consideration and precede the design of the infrastructure and technology.

The feasibility study should aim to set a realistic business and operational structure including the system capacity, the level of priority measures required, design elements such as jetties, landing steps, waterways, navigation aids, beacons, buoys and pillars, etc.

Location

The ferry services routes will connect

- > Lamu – Mokowe – Mkunumbi;
- > Lamu – Manda airport;
- > Lamu – Shela; and
- > Lamu – Mtngawanga - Kizingitini

Linkages

- > Improving connectivity with Pate and Manda islands, Mpeketoni and Witu are key to strengthening urban – rural linkages to foster economic development;
- > Support sea transport for aggregation network; and
- > Strengthening the agriculture and tourism sector.

Figure 4.54 Potential ferry routes



Source: Atkins analysis

Table 4.48 Project 16 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
<p>Feasibility study and operational model of introducing a ferry service on one route or a combination of routes. This should encompass</p> <ul style="list-style-type: none"> • Assessment of potential riders and service frequency • Options for funding and organising service • Assessment of vessels types and terminal needs • Management and operation models • Phasing plan • Costing • Economic benefits assessment 	<p>Total cost = KES 40 million</p>	<p>Reduce cost of water transport</p> <p>Improve accessibility for Lamu residents particularly those in remote islands and for PWD</p>	<p>A combination of public and private sector investment should be considered</p> <p>Ferry services are typically managed by the government while operations contracted to a private sector</p>	<p>Ferry and boat traffic is governed by Kenya Ports Authority and Kenya Maritime Authority. Coordination with these authorities will be required</p> <p>Boat operators and users are also key stakeholders</p>

Source: Atkins analysis

Table 4.49 Project 16 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Current improvement works along Mokowe need to be assessed to ensure they can cater for the docking of potential ferry serves	<p>Public transport demand analysis and service plan will be needed to inform the infrastructure and technology requirements</p> <p>A Strategic Environmental Assessment is needed</p>	Medium-term

Source: Atkins analysis

SUED principles for implementation

Climate resilience recommendations

This proposal is predominantly off-shore and so the transport routes are not at risk from climate impacts such as flooding or drought. Vulnerability assessments of land-based assets such as jetties and landings should be conducted to ensure resilience from extreme weather events such as storms and high tides. The use of services such as early warning systems to notify against hazards such as high tides and storms could further reduce vulnerability to climate-related impacts.

Social inclusion recommendations

The introduction of ferry services will improve connectivity and contribute to the socio-economic development of the region. In particular, a dedicated sea transport service will provide a safe and affordable option that will connect remote populations and facilitate access to markets, employment and social infrastructure. It will also contribute to the development of the touristic sector and subsequent job creation.

- > Ensure the ferries and associated transport infrastructure applies principles of universal design, to make these opportunities accessible for PWD and elderly people (e.g. ramps, handrails, step-free access, designated spaces for wheelchairs, etc.).
- > It is also recommended that maps are developed (both in terminals and digital options) to inform communities and tourists about available transport services. To facilitate their navigation, it is important to include accessibility considerations (i.e. tactile maps or narrated digital maps for visually-impaired people) and indicate the location of specific transport infrastructure that is accessible for PWD; and
- > Despite these services significantly decreasing transportation costs, it is recommended that subsidies or special fees for low-income communities and other vulnerable groups (i.e. elderly people, PWD) are incorporated.

Case Study 4.33 - Ferry services¹⁷⁹

Several large cities located by harbours, such as New York, Sydney, Auckland, Istanbul, and London, have historically had ferries that connect terminals at large, densely-populated urban areas with major employment hubs over short distances over waterways. Ferries also play a role where there are significant bodies of water to be crossed as a cost-effective alternative to developing bridges or tunnel infrastructure.

They can also play a significant role in waterfront rejuvenation. For example, in Toronto an expanded Jack Layton Ferry Terminal and adjacent Harbour Square Park as part of a waterfront transformation project has revitalised a previously inaccessible and derelict space into a thriving centre.



¹⁷⁹ Water front Toronto, Ferry terminal design competition (2021), Available at: <https://www.waterfronttoronto.ca/nbe/portal/waterfront/Home/waterfronthome/projects/ferry+terminal+design+competition>, (Accessed: 13/12/2021)

4.6.1.2 Project 17: Solar desalination

Project overview

Drought, saltwater intrusion and climate change are increasing the need to find low-cost resilient solutions to address water scarcity. This infrastructure project aims to provide a solution to the issues of lack of potable quality water faced by communities in Lamu County. Due to the continuing reductions in the costs of solar and battery storage technologies, solar-powered desalinations systems are becoming particularly well placed to offer solutions, particularly for remote rural communities.

Specifically, small-scale desalination (SSD) plants, which use reverse osmosis technology, should be utilised, in conjunction with solar power, in order to provide a sustainable source of water for the communities of LM. The viability of such plants has been explored by a EBRD funded project in Greece.

The purpose of this project is to provide a number of solar powered desalination facilities in underserved communities where water provision is poor as well as potentially provide portable water for the VC's and their associated processes.

Location

These projects will be located across Lamu County. One of the desalination plants will be located in Mokowe to support the fish and coconut processing VC's. The final locations and phasing will need to be determined at a later stage via a detailed feasibility assessment.

Linkages

- > Supports SUED principles of urbanization, environmental resilience and climate change resilience;
- > This project is linked to the solar ice-making facilities;
- > Efficient water extraction and increased supply; and
- > Fish processing and coconut VC's.

Table 4.50 Project 17 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
A pre-feasibility study to determine preferred potential locations, required size including phasing, technical arrangements including preferred technology, commercial arrangement options	Total cost = KES 250 million	Reliable, resilient and green potable water supply for underserved areas in the County	Commercial viability is not fully proven so this project may be dependent on some donor finance	The implementing agency will be the Municipality
Outline design of plant	Benchmark: KES 50 million per system		Solar-powered plants are typically financed using a Build, Own, Operate model	They will complete the pre-feasibility study and provide the land to the developer
Development of procurement and deployment plan This will include:	KES 250 million to complete five plants across Lamu County			
Procurement route – best options or engagement with solution providers/ contractors				
Deployment plan – upskilling of local marginalised groups to work as contractors				
Development of maintenance plan, focusing on upskilling of local marginalised groups to work as maintenance staff				

Source: Atkins analysis

Table 4.51 Project 17 Basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Developing a sound technical and commercial proposition that will ensure participation from suitable solar solution providers and funders	No knowledge of suitable solar providers willing to participate	Short-term
Securing necessary land		Improvement in provision of potable water urgently needed, solar desalination plants can take time to be built and become operational, initial stages including feasibility study should be addressed immediately

Source: Atkins analysis

SUED principles for implementation

Climate resilience recommendations

This project aims to build resilience to drought and increasingly erratic rainfall by developing an alternative source of water supply and an increased reliability of water supply. Reverse osmosis desalination is energy efficient and not reliant on fossil fuels so does not contribute to air pollution and provides a carbon-neutral water supply. The plant should be adequately protected against damage from storms, and coastal erosion. Harmful algal blooms, which are also known as red tides, are a risk to reverse osmosis plants as they pose a risk to human health if not managed appropriately and can block the filters used during treatment – leading to a reduction in water treatment. Monitoring for algal bloom is recommended as a precautionary method.

Social inclusion recommendations

As explained in the description above, this project will not only support the development of VCs and socio-economic livelihoods of surrounding communities, but it will also contribute to facilitating water access in underserved communities. The operation and maintenance of SSD plants represents employment opportunities for local communities and particularly SIGs.

Case Study 4.34 GivePower containerised solar powered desalination plant, Kiunga, Kenya¹⁸⁰

In 2018 GivePower installed its first solar powered desalination plant in Kiunga, near the Somali border. It provides clean water to 35,000 people every day, where previously they were forced to use brackish water.

The system consists of a solar canopy sized at 50kW that is coupled with 120kWh of battery storage. These run two reverse osmosis desalination pumps. The entire system cost just over US \$500,000 and has an expected 20-year lifespan.



180 PV magazine, A new solar desalination system to address water scarcity (2020), Available at: <https://www.pv-magazine.com/2020/02/06/a-new-solar-desalination-system-to-address-water-scarcity/>, (Accessed: 05/10/2021).

Case Study 4.35 - Viability of small-scale desalination solutions for small coastal communities, Greece¹⁸¹

A European Bank for Reconstruction and Development-funded study, undertaken by WS Atkins, into the use of SSD plants within coastal communities, conducting their research in Greece, found that construction of small-scale plants was more cost effective than piping water over relatively short distances; especially when taking into account energy costs associated with the transfer of water. It was estimated that the cost of potable water produced by an SSD plant can be as low as US \$15 per m³ compared with US \$18 per m³ for water produced by larger systems. The use of reverse osmosis plants, as opposed to traditional desalination plants, was favoured by small coastal communities. The SSDs should be powered by renewable energy, such as solar energy, in order to limit costs and maximise resource efficiency.



181 EBRD, Viability of small scale desalination solutions for small coastal communities (2020), Available at: <https://www.ebrd.com/cs/Satellite?c=Content&cid=1395291095259&pagename=EBRD%2FContent%2FContentLayout&rendermode=live%3Fsrch-pg>, (Accessed: 03/12/2021)

182 Water and Waste Digest, Desalination of saltwater and brackish water (2000), Available at: Desalination of Seawater & Brackish Water | WWD (wwdmag.com), (Accessed: 03/12/2021).

4.6.1.3 Project 18: Lamu Municipality drainage masterplan

Project overview

An integrated drainage masterplan should be prepared for Lamu Municipality with the intent of understanding natural drainage patterns influenced by topography and manmade structures, as well as flood-prone areas and problem hotspots. Analysis of the current drainage situation will help to identify grey-green-blue infrastructure solutions, such as new drains, green roofs and soak away ponds, and the location where these soft and hard interventions are best placed in order to provide safe water conveyance and alleviate surface water drainage problems. Moreover, the drainage masterplan would provide the Municipality with an effective planning tool to evaluate the effects of potential future development on drainage patterns in the Municipality.

Location

The drainage masterplan should cover the whole of the Municipality whilst focusing on the urban areas such as Lamu Town, Mokowe, Hindi and the Lamu Port area. By focusing on urban areas, the masterplan can provide a framework for the evaluation of anticipated future development on the island and mainland and their impacts on drainage.

> Municipality wide

Linkages

- > No linkages with existing projects
- > Link with the urban development and Tourism Framework for Lamu Island.

Table 4.52 Project 18 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
Drainage masterplan	Total cost = KES 60 million Benchmark: KES 50 million per system KES 250 million to complete five plants across Lamu County	A drainage masterplan would help to identify drainage problem hotspots within the municipality and aid the planning department in making decisions as to how drainage problems would best be solved Furthermore, the plan could be used to evaluate the impacts of potential future development within the urban areas of the Municipality	Public sector.	The drainage masterplan could be developed by the County government in partnership with LAWASCO and/or the Kenya National Highways Authority

Source: Atkins analysis

Table 4.53 Project 18 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Complicated drainage network along narrow roads in Lamu Town	Detailed digital elevation model of the Municipality	Short-term
Limited amount of space within Lamu Town for the implementation of infrastructure	Detailed historic flood data in the Municipality	The drainage masterplan should be completed in the short-term to provide a baseline diagnosis of the current problems associated with drainage across the Municipality
Differences in population density when comparing urban areas with rural hinterlands	Detail of individual drains within Lamu Town	The masterplan would be key in identifying hotspots and proposing future interventions as well as providing a framework for the evaluation of future potential development

Source: Atkins analysis



SUED principles for implementation

Climate resilience recommendations

Flooding is a major concern in Lamu Old Town, with both coastal flooding and surface water flooding causing significant disruption. The combination of sea-level rise, and increasingly heavy rainfall will only exacerbate the problem. Developing a drainage masterplan is a key step towards increasing the resilience of the town to climate change, and will allow further targeted interventions to reduce flood risk.

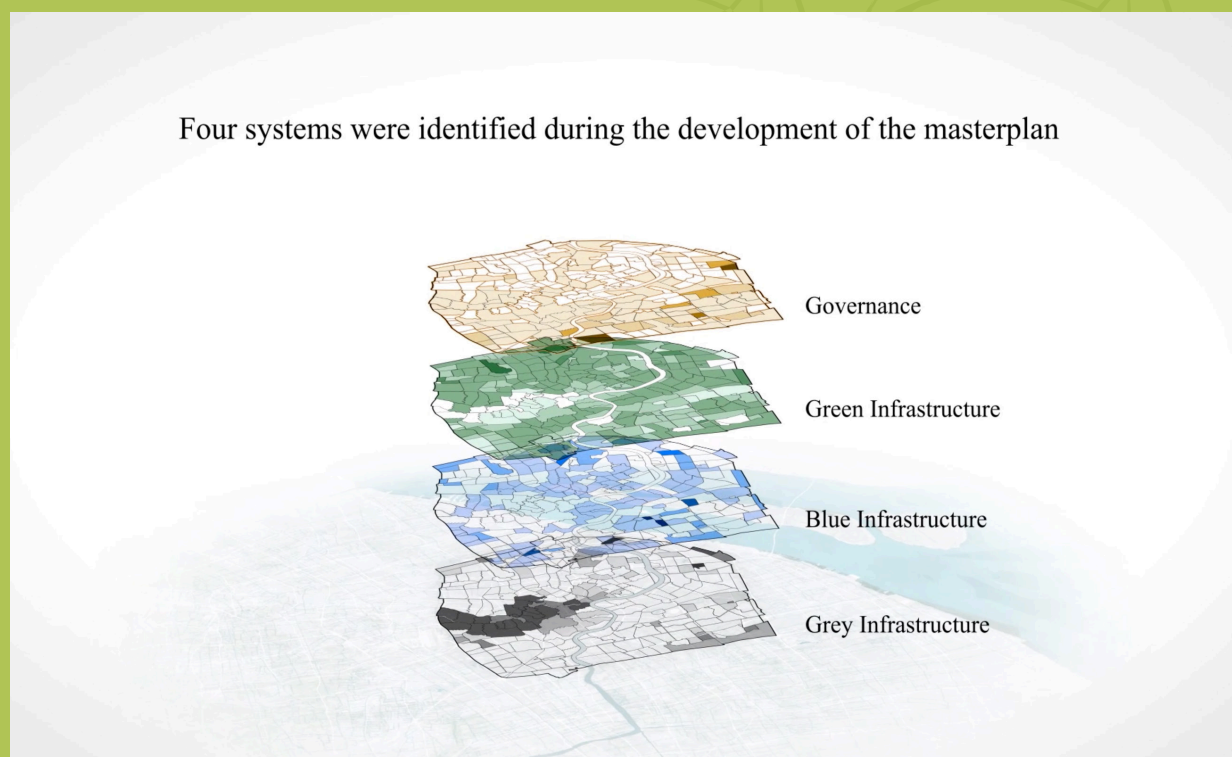
Social inclusion recommendations

The development of a drainage plan will improve public health, and reduce risks associated with extreme weather events. As explained above, these types of events have disproportionate negative effects on vulnerable communities, who see their lives and livelihoods severely affected, and do not have the same capacity to adapt as the rest of the population.

- > To maximise benefits, it is recommended to involve and consult local communities, local organisations, SIG groups and other relevant stakeholders in the development of the integrated drainage masterplan. This will also contribute to understanding and addressing particular needs that these groups may have.

Case Study 4.36 - Shanghai drainage masterplan¹⁸³

Rapid urbanisation and population growth has led to the increased level of impermeable surfaces across the city of Shanghai. In addition to this, the lack of green spaces and increased stormwater runoff across the city has led to severe flooding and river pollution in recent years. The existing ageing drainage system, as well as risk caused by increased rainfall due to climate change, pose additional challenges associated with decreased drainage capacity within the city. A study of the city's typology, topography, green spaces and existing drainage network led to the creation of a 'blue, green and grey' approach in order to support an integrated water cycle within the city. The masterplan used this approach to propose a combination of SuDS, increasing river channel capacity and improvements to the city's drainage infrastructure through the construction of new drains, in order to improve the city's drainage.



¹⁸³ Arup, Shanghai urban drainage masterplan (2021), Available at: <https://www.arup.com/projects/shanghai-drainage-masterplan>, (Accessed: 03/12/2021).

4.6.1.4 Project 19: Landfills

Project Overview

This project would cover the replacement of Lamu Town's two open dumpsites in Kashimiri-Kandahari (Shela) and Mkomani suburbs with a NEMA standard new engineered sanitary landfill, as well as creation of NEMA standard new engineered sanitary landfills at Mokowe (Hindi Ward), Mpeketoni (Bahari Ward), Witu (Witu Ward) and Faza (Faza Ward). The exact locations of the new engineered sanitary landfill sites will need to be away from sensitive places such as residential areas, schools and rivers, as well as taking into consideration future developments, so the landfill does not constrain development.

The existing dumpsites pose a health risk, degrade natural resources with the pollution of surface water bodies, groundwater aquifers and soils, and they are contributing to GHG emissions through the production of methane from the decomposition of waste. Rehabilitating existing dumpsites and commissioning new engineered sanitary landfills will reduce risks to human health and the environment – by installing appropriate liners for leachate containment and collection, as well as introducing a landfill gas capturing system, which can then be processed and used as biofuel.

Location

This project will be Municipality/County wide.

Linkages

- > Securing disposal sites is proposed in the Annual Development Plan;
- > The project supports the VCs as most will generate some waste, which will require safe management at a landfill. The project also supports urbanization, community health and environmental resilience through better management of waste;

- > There are links between this project and the transportation infrastructure proposals. This project is dependent on good road links, the location of the new landfills requires a well-managed feeder road for transportation of waste. Additionally, the collection of biogas links with energy infrastructure proposals; and
- > There are links between this project and the water infrastructure projects as rehabilitation of the dumpsite should improve groundwater quality in the area around the dumpsite.

Table 4.54 Project 19 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
Feasibility study	Total cost = KES 479 million	Improved ground and water quality around existing and new dumpsites	IFI/Donor Finance	Implementation and maintenance responsibility of Municipality
Construction of new engineered landfill cells	KES 3 million initial feasibility study KES 106 million to KES 426 million (dependent on the size and number of cells)	Reduces methane emissions from the dumpsites Provides employment	Revenue generating aspects: biofuel is a marketable product	Employment and training by Municipality or private entity/ CBOs
Construction of landfill gas collection and process system for biofuels	KES 25-50 million initial start-up costs for landfill gas collection and processing	Reduction in deforestation for fuel (instead biogas generation) Protects public health		Support from NGOs, community groups Use of local SMEs for waste services

Source: Atkins analysis

Table 4.55 Project 19 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
Waste being dumped, buried and burnt	Obtain funding for construction of new engineered landfill	Short to mid-term
Exact location of the new landfills will need to consider future developments	Designated size of the new landfill area (i.e. capacity) versus volume of waste that is produced in the Municipality and lifetime of the landfill	
Ensuring landfills do not become uncontrolled/unmanaged		
Undertake appropriate surveys and site investigations to ensure good quality of works		

Source: Atkins analysis

SUED principles for implementation

Climate resilience recommendations

Landfill sites need to be designed to minimise flood risk, and to ensure that heavy rainfall events do not lead to excess leaching, and contamination of water resources. Site investigations for the new landfill sites should take into account increases in the risk of both surface and river flooding due to climate change, as well as the potential destabilising effect of increases in heavy rainfall. The rehabilitation of existing landfill sites should, where possible, include stabilisation measures, and measures to reduce leaching.

Social inclusion recommendations

Well-engineered landfills contribute to the improvement of public health. They also have the potential to contribute to social inclusion and economic development through new employment opportunities and the involvement of local communities and NGOs.

Recommendations:

- > Develop training on occupational health and safety for all employees. Provide adequate PPE; and
- > Engage local communities and NGOs in sensitisation campaigns to generate awareness about the importance of source segregation and appropriate waste disposal.

Case Study 4.37 - Oum Azza landfill, Meghreb, Morocco ¹⁸⁴

After the Akreuch dumpsite near Rabat, Morocco became uncontrolled and over-capacity, polluting local groundwater and rivers, it was closed, and a new sanitary landfill was commissioned a few kilometres away.

Oum Azza landfill was developed with assistance from the World Bank but it is managed by private landfill operator Pizzorno. It receives waste that is collected from 13 communes in the region and has an annual capacity of 850,000 tonnes. Oum Azza is exemplary for this region, where waste is seen as a resource rather than trash, combining recycling with the generation of value chains, and jobs.

There is an organised system at the landfill, integrated with waste collection. Waste is shovelled onto a metal conveyor belt and spread evenly over a drum, where biomass is separated from the rest. Residual waste feeds into further conveyor belts where it is sorted manually. Valuable waste streams include cardboard, bottles, plastic, foil, and metals.

Informal sector waste collectors who were originally working at the Akreuch dumpsite were organised into a cooperative called Attawafouk, supported by the World Bank. This cooperative consists of 176 employees, 22 of whom are women. These employees are organised into teams that pick out different types of recyclables from the conveyor belt. Each employee is paid the same monthly salary of ~2,600 Dirhams per month, receives formal training, professional equipment, protective clothing, health insurance, access to a bank account and a low mortgage rate. Selected employees also receive vocational and career development via established diplomas in waste management.

The cooperative plays a strong role in the management of waste, governing whom the recyclables are sold to, and at what price.

The private operator funded the initial machines, and the landfill now turns over more than 460,000 Euros per year from recycling, from which the cooperative has been able to buy more equipment.

The Oum Azza landfill also derives value from the large organic waste stream (60%) by capturing the biogas from waste decomposition and converting it to electricity at a nearby cement factory furnace, for onward sale onto the national electricity grid.

¹⁸⁴ The World Bank, Morocco lets nothing go to waste (2016), Available at: <https://www.worldbank.org/en/news/feature/2016/02/16/morocco-lets-nothing-go-to-waste>, (Accessed:14/12/2021)

4.6.1.5 Project 20: Solar PV power generation

Project overview

Currently LC has very limited and unreliable energy infrastructure that does not support the County's current requirements or plans for future development. The mainland is connected to the national grid via a new main substation that was built primarily to serve the new port, but it also serves Mokowe and Mpeketoni. From Mokowe there is a cable bridge that crosses to Lamu Island, providing power to Lamu Old Town and Matondoni. Pate Island has a diesel-powered KPLC mini-grid and Manda Island also has a diesel mini-grid that serves the airport.

Each system has issues with reliability and high cost, and, particularly in the case of the mini-grids, high carbon emissions and local air pollution. The main grid is subject to both regulated and unregulated interruptions, and diesel engine plants are prone to failure in numerous ways, such as mechanical breakdown, lack of spare parts, and a delay in fuel deliveries.

Dependence on unreliable power limits residents' quality of life and the efficiency and capabilities of businesses across all sectors. If Lamu is to fulfil its vision of becoming an attractive centre for business, it needs a reliable supply of energy.

The purpose of this project is to introduce renewable energy systems to each island to augment the current systems. These systems, planned to be solar PV arrays, will improve resiliency, reduce running costs, carbon emissions, and local air pollution.

This project has four main proposed components:

- > A feasibility study to determine the current and future demand for power, required plant sizes including phasing, preferred potential locations, technical arrangements including preferred technology, local network connections and commercial arrangement options;
- > Design of solar arrays, including the design of the electricity distribution network to connect plants to their service areas;
- > Development of a procurement and deployment plan. This will include:
 - > Procurement route – best options for engagement with solar solution providers/ contractors
 - > Deployment plan - upskilling of local marginalised groups to work as contractors; and
 - > Development of a maintenance plan, focusing on the upskilling of local marginalised groups to work as maintenance staff.

This project will provide enough renewable energy to support the SUED projects and the Municipality's general development aspirations. The proposal is to develop a number of separate solar PV sites. This will improve the resiliency of the power system. Plants would be sized to suit, with consideration to both the current and future demands, and would incorporate energy storage.

The distribution network would be designed to interconnect each plant to ensure that the failure of one plant would not affect the provision of power to the town.

The key locations and estimated sizes of the PV systems are shown in Table 4.56.

Table 4.56 Project 20 location and estimated sizes of proposed PV plants

Location	Size	Cold Storage	Service area
Lamu Island	10 MW	Yes	General
Manda Island	1 MW	Yes	Airport
Pate Island	1 MW	Yes	General

Source: Atkins analysis

The final size, locations and phasing for the PV plants will need to be determined at a later stage via a detailed feasibility assessment.

Location

These projects will be located in the three sites identified in Table 4.56.

Linkages

Supports SUED principles of urbanization, environmental resilience and climate change resilience.

Table 4.57 Project 20 summary information

Sub-components	Estimated cost (KES range)	Benefits and impacts	Financing options and delivery mechanisms	Implementation agency and stakeholders
<p>A pre-feasibility study to determine preferred potential locations, required size including phasing, technical arrangements including preferred technology, and local network connections, commercial arrangement options</p> <p>Outline design of solar park</p> <p>Development of procurement and deployment plan.</p> <p>This will include:</p> <p>Procurement route – best options or engagement with solution providers/ contractors</p> <p>Deployment plan – upskilling of local marginalised groups to work as contractors</p> <p>Development of a maintenance plan, focusing on the upskilling of local marginalised groups to work as maintenance staff</p>	<p>Total cost = KES 1.6 to 1.8 billion</p> <p>KES 15 million to complete study/ design,</p> <p>KES 160 million to complete 1MW plant</p> <p>KES 1.3 billion to complete 10MW plant</p>	<p>A reliable, resilient and green energy supply for the town</p> <p>Reduced uncertainty and vulnerability around power cuts</p> <p>Make Lamu a more attractive place to do business</p> <p>A safer town less vulnerable to energy outages</p>	<p>Solar-powered plants are typically financed using a Build, Own Operate model</p> <p>Companies such as Globeleq provide finance and construct utility scale projects, whereas specialist impact investors such as Empower¹⁸⁵ can finance smaller scale projects</p>	<p>Implementing agency will be the Municipality</p> <p>They will complete the pre-feasibility study and provide the land to the developer</p>

Source: Atkins analysis

Table 4.58 Project 20 basic analysis and timeline

Challenges	Data gaps	Time frame, key dependencies
<p>Developing a sound technical and commercial proposition that will ensure participation from suitable solar solution providers and funders</p> <p>Securing necessary land</p>	<p>No knowledge of suitable solar providers willing to participate</p>	<p>Medium-term,</p> <p>Improvement in power situation urgently needed, solar power plants can take time to be built and become operational, initial stages including feasibility study should be addressed immediately</p>

Source: Atkins analysis

¹⁸⁵ Empower Impact Investment (2021), Available at: <https://www.empowernewenergy.com/>, (Accessed: 03/12/2021).

SUED principles for implementation

Climate resilience recommendations

Solar photovoltaics (PVO) have an operating lifetime of 20 or more years and their vulnerability to climate change includes wind and extreme temperatures. Lamu's diagnostics report has identified increasing temperatures and an increased intensity of rainfall in the coming decades.

Higher temperatures have a variety of impacts on solar PV systems. Lower cell efficiency and energy outputs are associated with increased temperatures, with some studies indicating that at a temperature of 50°C on the panel (which can be achieved at much lower air temperatures) solar PV outputs can be 12% below the rated output. The capacity of underground conductors may be lower, again due to higher ambient temperatures. The inverter on the other hand, which converts direct current power output into alternating current is not usually directly exposed and is not especially vulnerable to climate change.

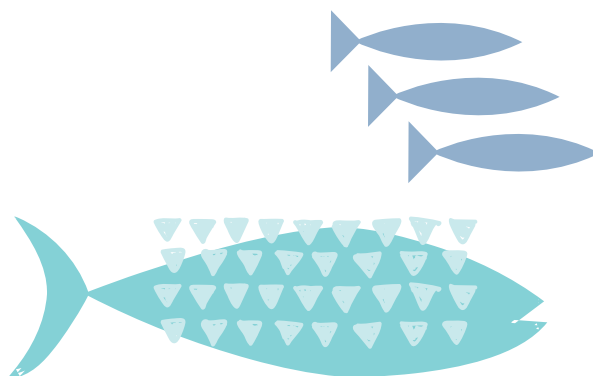
Lamu can consider the following adaptive measures in addressing the identified climate change impacts:

- > Use designs that improve passive airflow beneath photovoltaic mounting structures, reducing panel temperature and increasing power output; and
- > Choose modules with more heat-resistant photovoltaic cell and module materials designed to withstand short peaks of very high temperatures.

Social inclusion recommendations

This project will have an indirect effect on improving socio-economic conditions. By improving the provision, reliability, and resiliency of power in Lamu this will contribute to reducing power outages which will in turn contribute to improved commercial activity, and an improved ability to deliver services and education. There is also the potential for the creation of jobs, some of which could be targeted at employing youths through an upskilling programme.

- > To maximise benefits, it is recommended to ensure the new system is affordable and that there are financial mechanisms to support low-income households to connect to the new energy system.



Case Study 4.38 - Solar power deployed at Premium Poultry, Nigeria¹⁸⁶

Premium Poultry is Nigeria's largest egg producer, producing about 600,000 eggs daily. They decided to construct a solar PV plant at their Abuja factory to provide clean, reliable and cheaper energy and to reduce their carbon emissions. They partnered with impact investor Empower New Energy, who specialise in the investment of smaller-capacity systems in the utility and commercial/ industrial sectors and Rensource, a leading West African renewable energy services provider. The 700kW ground mounted PV installation will generate about 1,000MWh of electricity annually and offset 25,000 tonnes of CO₂ over its lifetime of 25 years. The plant created 40 jobs during its construction and operation phases.



¹⁸⁶ Tribune, Rensource, Premium Poultry Partner Empower to deploy solar to poultry farm (2020). Available at: <https://tribuneonline.ng.com/rensouce-premium-poultry-partner-empower-to-deploy-solar-to-poultry-farm/>. (Accessed: 03/12/2021).



5. Roadmap / Implementation Plan

5.1 Introduction

Effective urban and economic planning by strong, empowered municipal governments is critical to the success of cities in responding to current and future challenges. The municipal government's central role in the coordination of actors that shape urban development and economic growth is becoming even more important as governments are required to address increasingly complex challenges. Planning plays a critical role in directing and controlling land use, urban form, infrastructure and service delivery as well ensuring resilience of the urban system.

A number of other factors also have an impact on the ability of cities to respond to risks and development needs. These include the skills available in the workforce and within the municipal authorities, an effective and transparent governance structure, issues shaped by national and regional economic policies and dynamics, as well as access to global financial markets and the global governance of environmental issues.



It will be critical to identify potential risks to the implementation of the UEP, including risks and impacts from the current COVID-19 pandemic or other external shocks, as well as increasing stresses from the effects of climate change. This will need to be a continuous process of reviewing identified risks starting from planning and design to implementation stages. The proposed UEP and projects within the Development Framework have considered the existing and emerging economic and urban context including institutional and financial capacity of the County and Municipality.

The UEP complements the Municipality's development planning framework, with the IDeP and LIUDP alongside the CSP and CIDP. Such a planning strategy will also guide the Municipality in being resilient in the event of future socio-economic disruption. It will support the Municipality in responding effectively, and in a coordinated manner between departments, to adapt the transport network, land use, economic ecosystem and supply chain as required.

The following sections discuss relevant considerations across partnerships, funding and scheduling for the VCs and infrastructure projects and the wider economic development plan. Crucial aspects to the implementation of these are capacity-building, and recommendations for social inclusion, and climate change, which are provided further below.

The UEP is an advisory document aligned with the existing regulations and planning policy framework and is built upon the priorities of both the County and Municipality to boost development. The UEP will then support the realisation of benefits, including:

- > Value uplift of the agricultural and livestock sector and better income security for farmers and pastoralists, with training centres for additional skills and diversification of produce, access to shared resources and cooperatives with optimal machinery, best practice techniques that enhanced production, aggregation model, cold storage facilities and collection centres to increase shelf life of perishable products;

- > Added value to the agri-processing sector with deployment of the prioritised VCs of coconut processing at Mokowe. In addition, potential for the other identified agri-processing VCs that could be co-located in the preferred site at Mokowe;
- > Added value to the fishing and fishery-related activities to improve income security for fisherfolk and their livelihoods with the development of a sustainable fisheries management plan, mangrove restoration, access to fishing cooperatives and modern equipment and infrastructure, marketing of products, establishment of a Blue Economy innovation centre, sea-based collection centres and a fishing processing plan VC;
- > Value uplift of the tourism and heritage sector by enhancing the tourism offer and enhancing community involvement to benefit all, the beautification and decongestion of Lamu Island to attract more visitors, and improving connectivity across the Municipality;
- > An increase in formal employment in the sectors of industrial processing, tourism and potentially hospitality. Improve socio-economic opportunities across society, providing employment opportunities and accessibility to facilities to those from SIGs who currently face a lack of income security and marginalisation;
- > Lamu County to adopt a Blue Economy development approach to safeguard its sensitive marine and terrestrial ecosystems and ensure a healthy ocean while promoting economic growth and improving people's livelihoods;
- > Lamu to leverage from LAPSET development potential to re-positioning as a trading centre, gateway and transport hub in East Africa, to generate employment opportunities for the local population and undertake a sustainable economic development pathway; and
- > A community-driven plan to maximise from the strong and successful local initiatives and CBOs such as Lamu Youth Alliance, Shela Environmental Resident Group, mangrove restoration groups and the Flipflop Foundation, in order to influence and shape the economic development of Lamu.



5.2 Stakeholders, Partnerships and Institutional Structures

The strength of urban governance is one of the biggest issues affecting the ability of cities to respond to major economic and environmental challenges, which is also the case for Lamu Municipality. There are two different aspects of multi-level governance:

- > A community-driven plan to maximise from the strong and successful local initiatives and CBOs such as Lamu Youth Alliance, Shela Environmental Resident Group, mangrove restoration groups and the Flipflop Foundation, in order to influence and shape the economic development of Lamu; and
- > Horizontal governance referring to the coordination of activities across different sectors of society from local governments to the private sector, civil society, academia and grassroots organisations.

Vertical governance recommendations

Devolution is the backbone of Kenya's planning policy to transfer power, funds and resources to accountable, transparent and inclusive local governments. LC is one of the two-tier governance systems with granted powers in terms of overarching planning and development within the County territory and also in relation to management and governance of LM. The MB administers and manages the Municipality on behalf of the County government. The MM is the administrative head of LM who is responsible for the implementation of decisions made by the MB.

LM and its departments maintain good relations with the County Government and various communication channels exist vertically. Nonetheless, the Municipality should implement a plan of regular communication, e.g. periodic meetings and/or reporting to keep the County Government apprised of progress and developments on SUEP projects and to ensure that efforts are coordinated across the County. Failure to put such structures and processes in place will cause significant delays in project formulation and implementation, along

with direct impacts on the future roll-out of supporting climate-resilient and inclusive infrastructure and their associated costs.

One of the key initiatives to improve governance at different levels is to develop a **Marine Spatial Plan** (MSP): Project 5to specifically strengthen ocean governance and reduce conflict between the numerous Blue Economy activities and users of the sea, such as tourism, fisheries, marine transport, conservation, or mariculture. The MSP will provide the necessary framework for planning and regulatory efficiency, while safeguarding valuable marine habitats and ecosystem services. The MSP should be participatory and involve a wide range of community engagement, and should be developed in consultation with various national and local stakeholders involved in the Blue Economy and the management of Lamu's ecosystems, including the LCDA, Kenya Ports Authority, Lamu Government agencies, NGOs, CBOs and CSO

Horizontal governance recommendations

The following are likely to support the effective implementation of the UEP:

- > **Involvement of stakeholders** in steering committees and working groups: the MB and a continued PSG should involve a broad range of stakeholders throughout the lifecycle of any SUEP VC and infrastructure projects, sharing information and monitoring progress on intended outcomes for different stakeholders;
- > Creation and establishment of an inclusive **Lamu Tourism Board** involving various stakeholders and key players in delivering tourism services, to lead on the development of a tourism strategy including a management plan, skills and employment strategy, and marketing strategy;
- > The **Community-based cultural and skills exchange centre** in Lamu Town that could potentially operate as a cooperative group to host and organise cultural and sensitisation projects, art exhibitions focused on the Swahili

- culture, performance and seminars led by local NGOs, provision of space for rehearsals and meetings;
- > **Blue Economy Innovation and Training Centre** to offer upskilling of traditional learning curricula and which includes highly-relevant maritime topics such as vessel servicing, renewable energy, coastal risks and climate change, which could create sustainable jobs (with a focus on youth, and potentially on women), and support economic sectors across the County. This new learning centre would offer an environment that encourages and enables the development of new techniques and innovation, including the following areas of focus: ocean monitoring, integrated mariculture system, blue carbon valuation, sustainable fishing practice;
 - > Other **thematic working groups or project teams** could be established, drawn from representatives from the government and community stakeholders to develop particular actions and track its implementation. These groups could be formed around the key sectors and urban elements, such as: markets and trade, waste management, sustainable transport, land use and planning permissions, environmental protection. These working groups and project teams should report back to the Municipality; and
 - > A **mapping exercise** should also be undertaken to identify the existing relationships and partnerships that exist at both a Municipality and County level. Existing relationships with multilateral institutions, bilateral institutions, NGOs and think tanks can all be leveraged to support SUED projects. The mapping exercise will also be conducive to building greater coordination between the existing partnerships as well as identification of opportunities for partnerships with new and emerging entities.

Synergies with NGOs, CBOs and Grassroot Organisations

The 2010 Constitution of Kenya promoted community empowerment and the right for locals to exercise their sovereign powers in designing, managing and driving development within their counties and municipalities. In line with this, the implementation of the UEP should be

community-driven to benefit from the strong network of local NGOs and active grassroot initiatives in LC, which should play a central role in defining the future of Lamu for the benefit of its residents.

Community-driven development is increasingly being recognised as a valuable element of effective poverty-reduction and sustainable development strategies, based on the assumption that communities are the best judges of how their livelihoods can be improved and, if provided with adequate resources and information, they can organise themselves to provide for their immediate needs. This is already experience in Lamu, where the existing network of community NGOs and grassroot groups are assets and will be essential partners in the implementation of the UEP. Studies have shown that the development process is likely to be more responsive to local demands, inclusive and cost-effective than more centrally led programmes. Engaging local stakeholders will also be important in promoting participation in the proposed projects in the Development Framework, whilst simultaneously ensuring that Lamu maintains a sense of identity that reflects its communities and needs.

Based on discussions with NGOs and grassroot organisations during the UEP development process, there are clear opportunities for engagement of local stakeholders within its implementation, including formation of partnerships and community-led management of the proposed climate resilient projects and actions described in Chapter 4.. Community ownership is likely to promote inclusivity and participation, whilst focusing the projects on the most pressing local demands.

Table 5.1 presents an overview of the key NGOs, CBOs and grassroot initiatives within Lamu. These organisations should be actively included in the implementation of the UEP projects, due to their wealth of knowledge regarding the local environment, existing synergies and successful outcomes for the community of Lamu. It is important to note that these opportunities were identified during consultation with the stakeholders mentioned, however programme synergies should not be limited to these groups and could include any number of Lamu's community-led organisations if deemed suitable.

Table 5.1 Key NGOs and Grassroot Organisations in Lamu

Group/Programme	Overview of Aims/Activities
Lamu Women Alliance (LAWA)	Originally operating under the Save Lamu organisation, LAWA was formed to actively engage women in decision-making, promote sustainable development and preserve the environmental, social and cultural integrity of LC. The mission of the Alliance is to provide safe spaces and facilitate socio-economic well-being for vulnerable women and girls in Lamu County, through leveraging available resources and forging collaborations that enable them to enhance their resilience and thrive. This includes women empowerment programmes such as raining on advocacy, women rights, gender-based violence and political rights, supported by partners such as the Global Green Grants Fund and the Urgent Action-Fund Africa.
Shella Environmental Resident Group (SERG)	Developed by Lamu Marine Conservation Trust, SERG undertake a series of activities to maintain the environment of Shella and the wider area, including door-to-door rubbish collection in Shella Village, street cleaning and collection of marine litter along the 12km beach from Shella to Kipungani. SERG were also involved in the establishment of a community incinerator in August 2019, with the energy produced used to cook food for local residents. The group comprises two beach cleaners; four street sweepers who collect over 100kg of waste daily; and two door-to-door waste collectors covering 84 households and 112 guest houses, restaurants and shops.

Group/Programme	Overview of Aims/Activities
Lamu Youth Alliance (LYA)	<p>LYA is a consortium of 18 board members and 25 youth groups from LC, with a common objective of empowering the County's youth and advocating for a sustainable environment. LYA offers information, opportunities and linkages through activities such as:</p> <ul style="list-style-type: none"> • Youth Empowerment Forums: Monthly forums targeting youth grassroot groups with information on reforms and business opportunities. • Youth Parliament: Opportunity for the youth to express their opinions to government department heads, religious leaders and other stakeholders. • Traditional Cultural Activities: Community events to mobilise the community and encourage positive engagement in responsible leadership, e.g. through poetry, theatre and dhow races. <p>LYA could also play a central role in ensuring excluded groups are engaged in decision-making processes and development activities, for instance during the formation of cooperatives and provision of training programmes (see Sections 4.2.1, 4.3.1 and 4.4.1). To promote social inclusion, it was suggested that a cohort of young people from LYA could be trained as peer educators to deliver the aforementioned training, as young people will be more likely to engage in training if developed by peers. Action A12 (Section 4.3.1) similarly outlines the opportunity for the LYA to organise further expeditions to coastal towns to exchange ideas on marketing of fish products and to establish industry contacts.</p>
Flipflop Project / Takataka Heroes	<p>Takataka Heroes, for example Manda Taka project group, are the on-the-ground waste collection arm of the Flipflop Project – responsible for the collection, sorting and shredding of plastics on Lamu Island. They operate a waste management facility, including a full-time group of waste sorters and shredders, with partnerships established through local organisations to collect recyclable waste for processing at the workshop. Takataka Heroes also work closely with the local community to educate and raise awareness of the problem of plastic pollution. In February 2021, the group arranged the Okota Plastiki Competition that collected 24 tonnes of plastic in 4 weeks.</p> <p>This group could have significant potential to deliver the waste collection and processing projects outlined in the UEP, particularly the waste management VC (Section 4.4.4).</p> <p>There is also an opportunity for the involvement of Flipflop in the establishment of a desludging business on Lamu Island (Section 4.4.3.4), through the manufacturing of gulper pumps from recycled plastics.</p>
Lamu Organisation for Youth & People with Disability (LOYD)	<p>LOYD was formed to ensure the collective inclusion of PWDs and vulnerable young people in all matters social, political and economic, including decisions pertaining to the community of Lamu. In particular, this incorporates a focus on protecting the local environment for future generations and embedding an appreciation for the environment within the youth population. Recently this has included the 'Keep Lamu Plastic Free' initiative, including weekly collection of plastics by youths on Lamu Island to be recycled on the mainland. LOYD also operate mentorship programmes, which visit schools to discuss career options, discipline and issues like drugs and peer pressure.</p>
Lamu Arts and Theatre Alliance	<p>Lamu Arts and Theatre Alliance, a group of young performers focused on Swahili culture, should be involved in cultural exchange activities at the centre. This could incorporate provision of a rehearsal space for similar cultural groups. The former Al Mariwya Primary School property was proposed as a possible site for the centre, although this will require further investigation to gauge its suitability and availability.</p>

Group/Programme	Overview of Aims/Activities
Old Is Gold	<p>Old Is Gold Empowerment Forum is a registered CBO with the objective to legally, socially and economically empower the community of Lamu. This includes older members providing guidance and coaching on economic and legal matters, as well as tackling negative social perspectives within society.</p> <p>Members of Old is Gold also undertake beach cleaning exercises along Lamu seafront, and have a strong focus on raising awareness of the effects of plastic waste on the marine ecosystem and the importance of stewardship. This includes educating the youth of Lamu on their responsibility in fighting for a clean and healthy environment for future generations.</p>
Matondoni Youth Initiative (MYI)	<p>MYI is a registered CBO founded to support vulnerable youth in Lamu, particularly orphans and women. One of the core objectives of the group has been to support the creation of cottage industries for young women to support themselves independently in Matondoni, focused on traditional skills and products. MYI are currently looking to expand such industries to incorporate the use of waste products. This has been motivated by the group's campaign for the creation of a waste sorting site in Matondoni Village, as well as their regular beach clean-up activities. MYI also provide food donations for young people in need.</p>
Pate Marine Community Conservancy (PMCC) and Kiunga Marine Community Conservancy (KMCC)	<p>PMCC and KMCC bring together several fishing villages and key government institutions (particularly the State Department of Fisheries) to co-manage their fisheries with technical support from major NGOs such as NRT-Coast, Fauna and Flora International and WWF. PMCC oversees the coordination of conservation measures in four management units: Pethali, Rewa, Uvondo and Siyu, while KMCC are in charge of Mkokoni, Kiwayu, Rubu, Kiunga and Ishakani.</p> <p>The groups aim to increase income and employment for fishing communities by conserving key habitats such as mangroves and coral reefs, key fisheries and rare/threatened species like sea turtles, dolphins and sharks, therefore increasing social and ecosystem resilience to climate change. The groups also provide a forum to educate the community about conservation challenges and opportunities, as well as its cultural heritage.</p>
Mtangawanda Mangrove Restoration Women's Groups (MMRWG) in Pate, Faza, Mtangawanda, Siya, Ndau and Kizingitini	<p>MMRWG is a community-led project with groups in Pate, Faza, Mtangawanda and Siya. The group works with women and provides training on mangrove restoration – including education on mangrove species and how, where and when they should be planted, and how to monitor their degradation. In return, the women are offered loans of \$250 (£175) which are repayable in ten month periods and can be used to open small businesses. Following this, the women qualify for larger loans. The restoration has seen a recovery of marine breeding grounds with the return of fish and crabs. Controlled harvesting of mangroves provides construction materials for the group which can be sold.</p> <p>MMRWG is a community-led project with groups in Pate, Faza, Mtangawanda and Siya. The group works with women and provides training on mangrove restoration – including education on mangrove species and how, where and when they should be planted, and how to monitor their degradation.</p> <p>In return, the women are offered loans of \$250 (£175) which are repayable in ten month periods and can be used to open small businesses. Following this, the women qualify for larger loans. The restoration has seen a recovery of marine breeding grounds with the return of fish and crabs. Controlled harvesting of mangroves provides construction materials for the group which can be sold¹⁸⁷.</p>

Source: Atkins analysis

187 Kenya bulletin, Green growth: the save-the-mangrove scheme reaping rewards for women in Kenya (2021),

Available at: <https://kenyanbulletin.com/2021/05/24/green-growth-the-save-the-mangrove-scheme-reaping-rewards-for-women-in-kenya-global-development/>, (Accessed: 03/12/2021).



Other key private and government stakeholders

- > **Lamu Tourism Association (LTA)** – The LTA is an umbrella organisation incorporating various independent tourism businesses operating within Lamu. During stakeholder engagement, a representative for the LTA expressed a desire for the group to be involved in the establishment and management of a community-based cultural and skills exchange centre for Lamu, as outlined in Action A18. Activities proposed for the centre by the LTA included cultural appreciation and sensitisation events, tourism information and a shop selling local artisan products, as well as community services like counselling and after school programmes. Members of the LTA should also be considered as potential core members of an inclusive Lamu Tourism Board (Action A19).
- > **Lamu Beach Management Unit (BMU)** – BMUs are regarded as the backbone of fisheries co-management in Kenya, led by the Development of Fisheries, and were established initially to promote sustainable utilisation and management of local fisheries. As such, Lamu BMU should be considered as a key actor within the implementation of the initiatives and infrastructure projects detailed in the Fishing and Marine Sector Action Plan (Section 4.3), including the fish processing VC (Section 4.3.4). In particular, the BMU should be actively involved in the training of fishers to improve safety, catch quality and non-destructive fishing methods (Action A8), as well as enhancing the enforcement and monitoring of the sector (Action A9).
- > **Chamber of Commerce** – Engagement with representatives for the Chamber of Commerce indicated that members would be willing to be actively involved in the implementation of the UEP, including formation of partnerships with NGOs to drive development. As a key stakeholder for the Lamu business community, delegates from the Chamber of Commerce should be actively included in the potential formation of a Lamu Fishing Export Board to increase the marketing of fish to international markets, as proposed in Action A12,

as well as the aforementioned Lamu Tourism Board (Action A19). In addition, opportunities exist for the engagement of the Chamber of Commerce during the introduction of the priority VCs.

Synergies with other development programmes

FCDO, the World Bank, the AfDB, UNESCO funds and other multilateral institutions have ongoing programmes within the County which will provide synergy with the SUED programme and potential for partnerships. Examples include the World Bank's Kenya Urban Support Programme (KUSP), which could provide an important partnership, supporting proposed urban improvements. The KUSP has already supported Lamu Municipality and the implementation of improved infrastructure such as tarmacked roads.

Business Improvement Districts

A popular concept for the establishment of zonal organisation is the formation of Business Improvement Districts (BID). A BID is a business-led partnership (and a non-profit organisation) run by and for its members in a defined geographical area with a remit to invest collectively to improve their environment. These organisations are funded by a mandatory levy agreed between members, and they set priorities for local investment such as cleaning, safety, improvement of the local area and promotion, and building local networks that support local supply chains.

In the context of LM, the nature of partnership can be enhanced with public sector involvement and NGOs to help direct and attract additional funding for public realm and infrastructure improvements. The key benefits of this approach are an accountable, proactive and flexible approach, whilst bringing wider regeneration benefits. BIDs have often been implemented with regard to retail, hospitality and tourism-related areas, to ensure the area remains appealing to customers, and visitors and supports businesses' operation within this space.

The Discovery Trail (project 8), Lamu Old Town waterfront improvement (project 9) and Wiyoni Bay (project 10) could be a suitable pilot for a BID delivery mechanism where this would help to realise the potential benefits of an improved urban fabric with rationalised land uses, enhanced footfall, active mode access and flexible entertainment offerings which support business revenue. It would be in the business community's interests to coordinate and ensure that an appealing environment is maintained for residents, students, and visitors from the wider region.

Value Chain partners

The success of the coconut processing plant and fishing processing facility VCs outlined in sections 4.2.4 and 4.3.4, depends on establishing close partnerships with suppliers of the required agricultural and fishing produce. Close collaboration with farming and fishing cooperatives to establish collection networks would support each VC facilitating and formalising the relationship between VC facilities with farmers and fisherfolk. The land-based and sea-based aggregation models (sections 4.2.3 and 4.3.3) and solar-powered refrigerated storages (project 3) could either be managed entirely by a business to support the sourcing of coconut and fish catch or by an outsourced third-party agent supplying to manufacturers, retailers and markets.

In Kenya, Twiga Foods is an example of a business that manages its aggregation. It has set up several collection centres across the country targeting small-scale farmers, and supplies retailers and wholesalers in Nairobi city. The Municipality could formalise the relationship with Twiga Foods or similar to manage the collection centres within the County.

For the successful delivery of the waste collection and recovery facility VC, support from Takataka Heroes and Flipflop will be essential. The VC could enable Flipflop/ Takataka Heroes and similar NGOs to continue collecting and processing plastic waste and to collect a wider range of waste for processing, including organic waste for production of biogas/fertiliser. Training of waste collectors in safely handling and segregating waste could also be delivered by workers from Takataka Heroes, in addition to awareness campaigns regarding appropriate waste disposal. The waste management VC provides an opportunity to enhance the role of Flipflop in Lamu and encourage partnerships with other actors like Lamu Youth Alliance, Weka Lamu Safi (WELASA) and SERG, with the objective for all waste to be collected and processed for the benefit of the local community.

5.3 Estimated costs

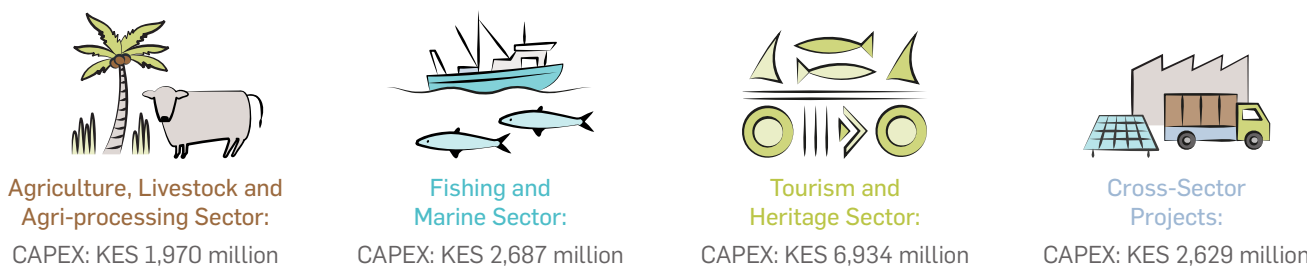
The UEP is an advisory document owned and administered by the Municipality and the main responsible authority for its future implementation. Similarly, the Municipality is responsible for agreeing appropriate funding from the County budget, as well as seeking any additional funding from IFI, donors, and/or private sector to support the implementation of the VC and climate-resilient infrastructure projects.

Table 5.2 summarises the implementation costs and delivery for the VCs, and infrastructure projects across the main sectors and the Municipality. Each project is considered by its sub-components, delivery partners and funding sources, capital costs and key cost elements, expected benefits to be realised, and timescale. This brings together the project information set out in section 3.5.3.

It is important to note that these costs do not include various cost items including land acquisition, design and planning (unless stated, where this could reflect 10% to 30% of the CAPEX costs). Inflation and optimism bias have not been included at this stage, where this would uplift the cost estimates. There will also often be sizeable operational expenditure which will need to be factored-in. At a development concept level, the project implementation is summarised below.

Table 5.2 Summary implementation cost estimates

Total estimated CAPEX for the UEP



In terms of the funding scale between private (PPP), public and other sources, the following is provisionally estimated: **18% public sector led** (County, GoK, providers and donors), **58% private and PPP, 14% IFI and donor funding.**

In terms of the cost scale over time, the following breakdown is estimated given the individual project schedules:

Short-term CAPEX: KES 8,300 million
 Medium-term CAPEX: KES 5,656 million
 Long-term CAPEX: KES 264 million

Source: Atkins analysis

Table 5.3 Implementation costs and delivery mechanisms

#	Project title	Project Location	Project sub-components	Implementation agency and stakeholders	Potential sources of financing/ funding and delivery mechanisms	Total Estimated Costs (KES)	Timescale
Agriculture, Livestock and Agri-Processing Sector							
1	All weather access roads	Lamu Island, Mpeketoni, Pate Island and Kiunga	<p>The improvements will cover a total of 41 km comprised of 13 km for Mkunumbi – Mpeketoni, 6 km of Matondoni-Lamu, 12 km of Kipungani – Lamu and 10 km of Mtangawanda – Shanga</p> <p>Tree planting on two roads to provide favourable environment for walking</p>	<p>Funding through development partners</p> <p>Maintenance through Kenya Road Board – Road Maintenance Fuel Levy Fund (RMLF)</p> <p>Agricultural producers and cooperatives</p> <p>Delivery of tree planting through County Government – Environmental Department</p>	<p>Donor/IFI, public sector</p> <p>Delivery of road upgrade through a partnership between Kenya Rural Roads Authority (KeRRA) and LC</p> <p>Delivery of tree planting through County Government – Environmental Department</p> <p>Funding through Development partners like World Bank, USAID.</p> <p>Maintenance through Kenya Road Board – Road Maintenance Fuel Levy Fund (RMLF)</p>	1,770,000,000	Medium-term
Fishing and Marine Sector							
2	Mangrove restoration	Municipality wide	<p>Stakeholder engagement</p> <p>Social and environmental analysis</p> <p>Development of implementation plans</p> <p>Training on mangrove management techniques</p> <p>Development of monitoring plans</p>	<p>Kenya Forest Service (KFS)</p> <p>The Nature Conservancy (TNC)Kenya Marine and Fisheries Research Institute (KMFRI)</p> <p>National Mangrove Management Committee (NMC)</p> <p>Lamu Conservation Trust (LCT)</p> <p>Sheldrick Wildlife Trust (SWT)</p> <p>Kenya Wildlife Service (KWS)</p> <p>Eden Rehabilitation Project</p> <p>Pate Conservancy</p> <p>Kenya Forest Research Institute (KEFRI)</p> <p>Northern Range Trust (NRT)</p> <p>The Fisheries Department</p> <p>Women Conservation Groups</p> <p>National Employment Agency (NEA)</p>	Donor/IFI	3,640,000	Short-term

#	Project title	Project Location	Project sub-components	Implementation agency and stakeholders	Potential sources of financing/ funding and delivery mechanisms	Total Estimated Costs (KES)	Timescale
3	Solar refrigeration cold storage and ice-making	Municipality/ County-wide	Establishment of needs for solar refrigeration and ice-making systems Preparation of design brief for refrigeration systems Development of procurement and deployment plan Develop training plan, for management, operation and maintenance	Site selection – LM with assistance from national agricultural specialists Equipment selection – LM with assistance from cold chain specialists Construction and implementation – LM Operation and maintenance – responsibility of LM	Donor/IFI, public sector Donor funding is available from numerous sources, including Self Help Africa and AGRA Public sector funding may be available from the central government via the Ministry of Agriculture, Livestock and Fisheries	13,750,000	Short, Medium and Long-term
4	Upgrading of landing sites and jetties	Municipality-wide	Demand-supply capacity assessment of the existing jetties and landing site and prioritise their upgrades	Study funded through Development Partners and Kenya Port Authority (KPA) Lamu County Government (LC) Kenya Maritime Authority (KMA) Public Private Partnerships Boat Owners and Operators Associations Maritime logistics companies	Public private partnership Demand/supply study, designs and implementation funding through a partnership between Kenya Port Authority, Development Partners and Lamu County Government	40,000,000	Medium-term
5	Marine Spatial Plan	County-wide	Identify lead organisation Define principles and objectives Data collection Mapping of marine and coastal resources, and human activities Stakeholder consultation Draft Marine Spatial Plan More stakeholder consultation	Municipal Government Ministry of Finance, Budget Strategy and Economic Planning Ministry of Public Health, Environment, Sanitation and Lamu Municipality Ministry of Food Security, Cooperative Development, Fisheries, Blue Economy, and Water Services Ministry of Lands, Physical Planning, Housing, Urban Development and Infrastructure Ministry of Trade, Tourism, Enterprise Development and Industrialization Ministry of Public Service Management and Administration	International donors/IFI, public sector Central Government Co-finance Public sector at County/Municipality level	550,000,000	Medium-term

#	Project title	Project Location	Project sub-components	Implementation agency and stakeholders	Potential sources of financing/ funding and delivery mechanisms	Total Estimated Costs (KES)	Timescale
6	Blue Economy Innovation and Training Centre	Mokowe	Feasibility study Location selection and design Facility establishment Curricula design/demand in Lamu area	Funding through development partners Operation through PPP with one of Kenya's universities Support from NGOs on specific learning topics, for example mangrove conservation, sustainable aquaculture, etc Employ local SMEs for boating services, centre maintenance, catering	Public Private Partnership The centre could be financed through a mix of donor/IFI funding for the establishment of the facility, followed by a funding blend from a Private Public Partnership (PPP) (including academia) for demand-led courses and centre's operations	1,000,000,000	Short-term
7	Fishing cluster Mokowe landing site upgrade	Mokowe	a. VC/fish processing plant (total site area 4,000 sqm) b. Road upgrade c. Quay wall upgrade (3-8 m) d. Commercial jetty with 6 m wide walkway e. Public realm f. Public realm - market plaza, visitor's entrance g. Market and offices/mixed use h. Hospitality and food and beverage i. Lighthouse/viewing platform j. Natural protective mound	Implementation agency/leading partner: - Ideally Port Authority - Private Investor (partial investment in certain assets) Supporting stakeholders: Maintenance responsibility of County/Municipal government	Public Private Partnership Items c, d, e, g Enabling infrastructure: PPP/Public Authorities Items a, b, f Private investor: Design Build Operate Maintain (DBOM)	730,000,000	Short-term to Medium-term
Tourism and Heritage Sector							
8	Discovery trail	Lamu Island	Wayfinding strategy and pedestrian or buggy trail to access various nodes Type 1 – Sand Dunes Type 2 - Farmland Type 3 - Mangrove Type 4 – Generic Bikeshare Lamu Town	Implementation agency and stakeholders Local Authority, (International Financial Institutions) IFIs Central government Value capture following completion: levies, leases on temporary events and local businesses	Public Private Partnership Private investor: Design Build Operate Maintain (DBOM) Public Authority or a mix Public Private such as Business Improvement District (BID)	3,275,000,000	Short to Medium-term

#	Project title	Project Location	Project sub-components	Implementation agency and stakeholders	Potential sources of financing/ funding and delivery mechanisms	Total Estimated Costs (KES)	Timescale
9	Lamu Old Town waterfront improvements and town centre enhancements	Lamu Town	<p>Corniche path upgrade 5 km</p> <p>Wayfinding along sea front</p> <p>Quay walls with 0.6 m parapets</p> <p>Permeable paving (concrete blocks and public realm drainage)</p> <p>Multi-purpose Pods (25/30 sqm) wooden decks with steel structure</p> <p>3D printed concrete tiles bolted on quay walls</p>	<p>Local Authority, IFIs,</p> <p>Central government</p> <p>Pods might be delivered in a PPP framework with Private businesses implementing and managing the spaces</p>	<p>Public Private Partnership</p> <p>Pods -private investor: Design Build Operate Maintain (DBOM)</p> <p>Quay walls and paving</p> <p>Public Authority or a mix of Public Private such as Business Improvement District (BID)</p>	1,354,000,000	Short to Medium-term
10	Wiyoni Bay clean-up	Lamu Town	<p>Waterfront path/boardwalk</p> <p>Reedbed filtration system (subject to feasibility)</p> <p>Quay wall upgrade (4-6 m)</p> <p>Visitor jetty with 6 m wide walkway</p> <p>Public realm - market plaza, visitor's entrance</p> <p>Hospitality and food and beverage</p>	<p>Waterfront path/boardwalk</p> <p>Reedbed filtration system (subject to feasibility)</p> <p>Quay wall upgrade (4-6 m)</p> <p>Visitor jetty with 6 m wide walkway</p> <p>Public realm - market plaza, visitor's entrance</p> <p>Hospitality and food and beverage</p>	<p>Public Private Partnership</p> <p>Private investor: Design Build Operate Maintain (DBOM)</p> <p>Public Authority or a mix of Public Private such as Business Improvement District (BID)</p>	631,000,000	Short to Medium-term
11	Ring road	Lamu Town	<p>Feasibility study</p> <p>A preliminary design</p> <p>Detailed road design with Bill of Quantities (BOQ), project costing, and construction tendering plan</p> <p>Actual construction and supervision for works Development of road maintenance plan</p>	<p>Implementing agency will be the Municipality</p> <p>They will complete the pre-feasibility study and provide the land to the developer</p>	<p>Public sector</p> <p>KURA road agency</p> <p>LC Government</p> <p>Development partners i.e. FCDO, WB etc</p>	683,000,000	Medium-term

#	Project title	Project Location	Project sub-components	Implementation agency and stakeholders	Potential sources of financing/ funding and delivery mechanisms	Total Estimated Costs (KES)	Timescale
12	Lamu Old Town drainage and wastewater conveyance and disposal	Lamu Town	Feasibility study Covering of open drains Small scale rainwater harvesting Storm water interception drain along sea wall Wastewater conveyance pipeline to treatment facility Floating reed/mangrove beds at Wiyoni Bay and along the sea wall	Implemented through the County/Municipality or LAWASCO as part of the wastewater masterplan Maintenance of the system should be undertaken by LAWASCO	Donors/IFI Public Private Partnership Potentially Climate funds	264,000,000	Medium to long-term
13	Streetlighting	Lamu Town and key jetties	Review current implementation plan Review current commercial and technical arrangements Design study to ensure suitable coverage of target area Equipment review and selection Development of new commercial plan	Site selection – LM Equipment selection – street lighting design specialist Construction and implementation – LM Operation and maintenance – responsibility of LM	Donor/IFI Financing can be sourced from a number of options, including World Bank-funded Kenya Urban Support Programme, which has funded streetlighting in Thika, Ruiru and Limuru The World Bank also offers advice, sample legal documents and further reading on using a Public Private Partnership	50,000,000	Short to medium-term
14	Solar-powered abstraction for water to increase supply	Lamu Island	LAWASCO piped network renewal feasibility study Solar pumps for the 60 shallow wells and 10 boreholes on the island Last mile connections for 500 households Rolling loan fund to support the connections of 500 low-income households	The main implementation agent would be LAWASCO	Donor/IFI or Water Sector Trust Fund	66,000,000	Short to medium-term
15	Desludging business and sludge-handling facility	Lamu Island/ Municipality-wide	Feasibility study Donkey drawn Vacutug Handheld Gulper pump BSFL handling facility	The project could be implemented by LAWASCO in partnership with a SME from the local community The operation and maintenance of the sludge handling facility could be undertaken by LAWASCO or be part of the desludging business Local community groups such as the Flipflop foundation could help to deliver Gulper pumps by manufacturing them from recycled materials	Public Private Partnership The desludging business could be run by a PPP in partnership with LAWASCO and a local SEM The BSFL sludge-handling facility could be delivered through Donors/ IFI funding	280,500,000	Short to medium-term

#	Project title	Project Location	Project sub-components	Implementation agency and stakeholders	Potential sources of financing/ funding and delivery mechanisms	Total Estimated Costs (KES)	Timescale
Cross- sector projects							
16	Ferry services	Municipality wide	Feasibility study and operation model of introducing a ferry service	Ferry and boat traffic is governed by Kenya Ports Authority and Kenya Maritime Authority and coordination with the authorities will be required Boat operators and users	Public Private Partnership A combination of public and private sector investment should be considered Ferry services are typically management by the government and operations contracted to a private sector	40,000,000	Medium-term
17	Solar desalination	Municipality/ County-wide	A pre-feasibility study Outline design of plant Development of procurement and deployment plan Development of maintenance plan, focusing on upskilling of local marginalised groups to work as maintenance staff	Implementing agency will be the Municipality They will complete the pre-feasibility study and provide the land to the developer	Public Private Partnership Donor/private sector Commercial viability is not fully proven so this project may be dependent on some donor finance Solar power plants are typically financed using a Build, Own Operate model	250,000,000	Short-term
18	Lamu Municipality drainage masterplan	Municipality-wide	Drainage masterplan	The drainage masterplan could be developed by the County government in partnership with LAWASCO and/or the Kenya National Highways Authority	Public sector	60,000,000	Short-term
19	Landfill	Municipality/ County-wide	Feasibility study Construction of new engineered landfill cells Construction of landfill gas collection and process system for biofuels	Implementation and maintenance responsibility of Municipality Employment and training by Municipality or private entity/CBOs Support from NGOs, community groups Use of local SMEs for waste services	IFI/ Donor Finance Revenue generating aspects: biofuel is a marketable product	479,000,000	Short to medium-term

#	Project title	Project Location	Project sub-components	Implementation agency and stakeholders	Potential sources of financing/ funding and delivery mechanisms	Total Estimated Costs (KES)	Timescale
20	Solar PV power generation	Lamu, Manda and Pate Islands	<p>A pre-feasibility study</p> <p>Outline design of solar park</p> <p>Development of procurement and development plan</p> <p>Development of maintenance plan</p> <p>Securing necessary land</p>	<p>Implementing agency will be the Municipality</p> <p>They will complete the pre-feasibility study and provide the land to the developer</p>	<p>Private sector</p> <p>Solar-powered plants are typically financed using a Build, Own Operate model</p> <p>Companies such as Globeleq provide finance and construct utility scale projects, whereas specialist impact investors such as Empower can finance smaller scale projects</p>	1,800,000,000	Medium-term
Value Chain projects							
	Coconut processing plant	Mokowe	<p>This VC project is for the coconut processing facility which would process raw coconuts</p> <p>The facility will utilise each part of the coconut in order to produce many different products, for example; coconut flour, milk, cream and oil as well as coconut water and charcoal from the shells and husks</p>	Lamu County	SUED programme with potential for other public and private funding involvement	200,000,000	Short-term
	Fish processing plant	Mokowe	<p>This VC project is for the fish processing facility which would process sea and freshwater fish as well as other crustaceans such as lobsters and crabs</p> <p>The facility will produce canned and filleted fish products</p>	Lamu County	SUED programme with potential for other public and private funding involvement	350,000,000	Short-term
	VC waste collection and recovery facility	Lamu Municipality	<p>Waste collection</p> <p>Materials recovery facility</p> <p>Organic waste processing</p>	<p>AD plant developer/operator to implement and maintain</p> <p>NGOs, community groups, local SMEs, waste pickers</p> <p>Employment and training by Municipality or private entity</p> <p>Maintenance responsibility of Municipality or private entity</p> <p>Use of local SMEs for waste services</p>	<p>Public Private Partnership</p> <p>Introduction of Private Public Partnership (PPP) and/or private waste services into waste collection effort</p> <p>Employment and training by Municipality or private entity/CBOs</p> <p>Funding for Personal Protective Equipment (PPE), collection vehicles, training and wages for the CBOs</p>	330,000,000	Short to medium-term

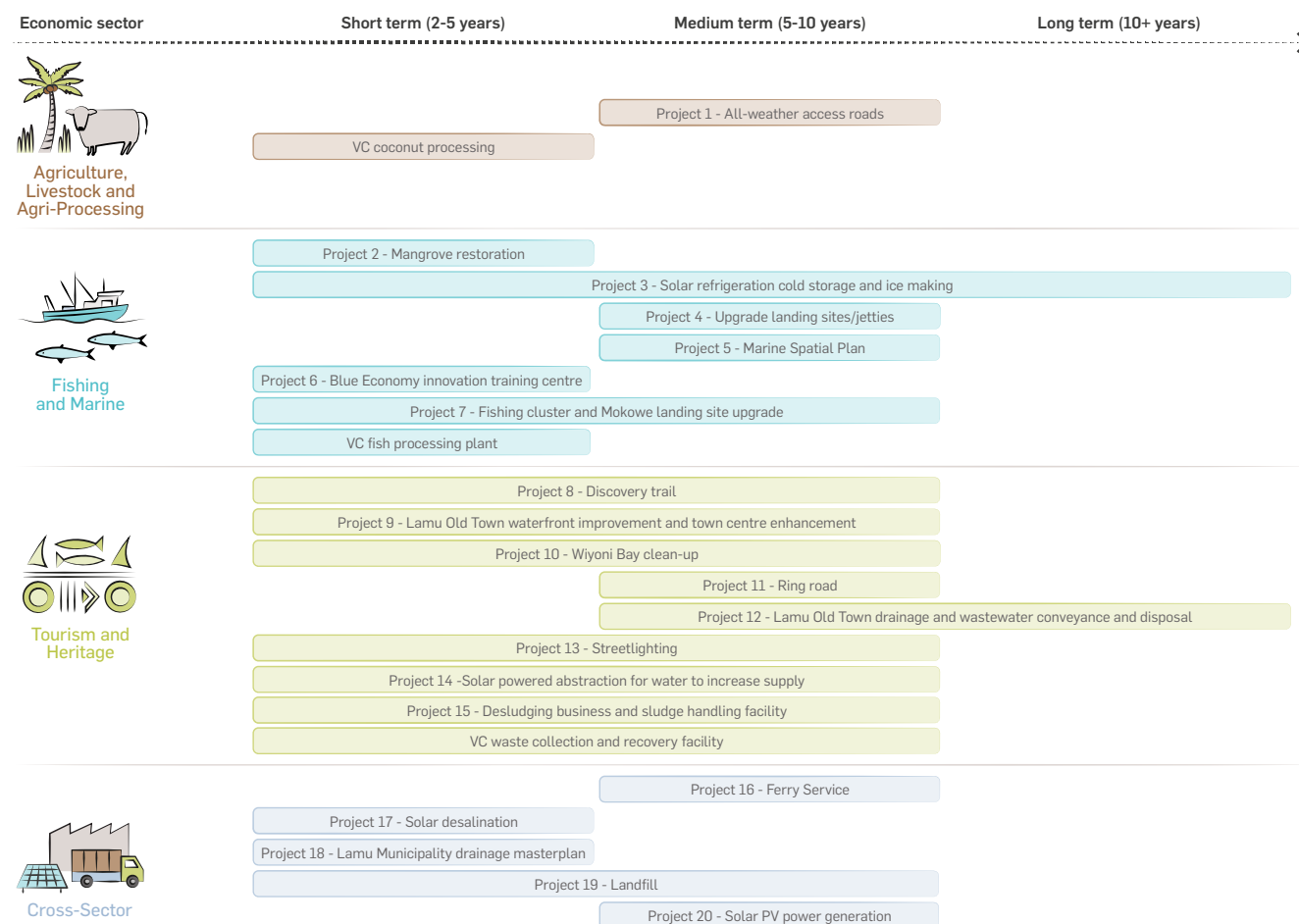
Source: Atkins analysis

5.4 Scheduling and Phasing

This section sets out a scheduling plan for each respective sector, reflecting the key interactions between different projects.

The synergies for each sector are also described in relation to the whole Economic Development Plan, Figure 5.1, demonstrates the full set of proposed VC and infrastructure projects, showing where implementation would suitably begin.

Figure 5.1 UEP Development Framework Schedule



Source: Atkins analysis



5.5 Climate Change Funding

The investment experts, as part of the SUEP programme, will develop feasibility studies for the proposed projects which will include estimated capital expenditure and operating expenditure requirements. It will likely be necessary to blend and combine a range of different sources of financial and non-financial support to meet the projects' expenditure requirements. Careful consideration will have to be given to the differing eligibility criteria of the various sources in order to successfully structure blended finance arrangements.

Grant funding can help improve the financial viability of projects which have significant, upfront capital expenditures, improving the overall investment appeal of a project and attracting additional private investment as a result. The proportion of grant finance of the total project finance amount should be carefully justified, as simply seeking a maximised grant finance proportion can seed doubts in the private sector about the long-term financial sustainability of the project. Grant funding is also available to less commercially-viable projects with significant socio-economic or environmental benefits, particularly relating to climate change and resilience. They may also be focused on certain activities such as technical assistance in project preparation or capacity development.

Philanthropic and NGO grant funding could also be leveraged through initiatives such as businesses dedicating 1% of profits to corporate social responsibility (CSR) initiatives. The World Bank's Kenya Urban Support Programme (KUSP) has also been identified as a source of potential funding support for some of the UEP projects, including public realm improvements and urban drainage solutions.

Private sector finance for a range of sectors is available in East Africa from both local and international sources. Existing investors in the region include impact investors, venture capitalists and private equity funds who are able to provide relevant instruments for the value chain projects such as equity, quasi-equity (mezzanine finance) or concessionary

debt. Access to private finance will be contingent on the concrete demonstration of viable business models and strong governance structures. Projects will also benefit from blending in non-financial support in the form of social capital, such as volunteer efforts from the community. Actions to build social capital include mobilising community organisations and volunteers to be involved with the development and implementation of projects. The most successful mobilisation of human and social capital resources occurs in projects where there is a demonstrated, direct and visible relationship between the project and the future benefits for community and volunteer stakeholders. Examples of projects could include raising awareness campaigns for more efficient use of water and solid waste collection and management.

Climate resilient infrastructure and VCs funding

It is now widely recognised that there is an urgent need to scale up investment in climate change adaptation, low carbon development, and the Blue Economy in Africa, and the assessments carried out in the development of this UEP highlights that sustainable urban development can only occur if there is significant investment in climate resilience.

There is an increasing focus on how to finance activities related to climate change adaptation, mitigation, and the Blue Economy, with a range of specialised funds and financial instruments available. This includes a significant number of donor and IFI-led initiatives, but the field of private sector sustainable finance is also growing rapidly, and many investors are starting to look for investments which demonstrate clear environmental, social and climate benefits. The growing appetite to invest in projects which are aligned with low carbon and climate resilient development outcomes, or which specifically contribute to the development of the Blue Economy, provides a new potential source of finance to bring to bear to finance adaptation, resilience, and climate mitigation in East Africa.

Successfully accessing resources to support adaptation, and low carbon development, depends on a good understanding of the investor's perspective and procedures. The IFI and MDBs for example, have adopted the following principles for a project to be classified as contributing to adaptation:

- > Include a statement of purpose or intent to address or improve climate resilience in order to differentiate between adaptation to current and future climate change and good development;
- > Set out a context of climate vulnerability (climate data, exposure and sensitivity), considering both the impacts from climate change as well as climate variability related risks; and
- > Link project activities to the context of climate vulnerability (e.g., socio-economic conditions and geographical location), reflecting only direct contributions to climate resilience.

Private sector financiers, on the other hand, are looking for clear metrics through which they can demonstrate the sustainability and impact of their investments. This is more closely aligned to existing impact investing and guidelines for demonstrating environmental, social and governance elements of an investment, or emerging criteria for sustainable finance, such as those outlined in the EU Taxonomy on Sustainable Finance. International climate funds have more stringent eligibility requirements, and a comprehensive grasp of eligibility criteria, as well as the different financial mechanisms and the extent to which they can be combined, is important.

The VCs and infrastructure projects have had climate change resilience actions embedded in their proposals, and further recommendations have been made, as per sections 0 to 4.4. This will aid the projects in accessing funding by demonstrating their significant contribution to climate change actions.

The section below provides a brief overview of some of the main sources of funding available for Blue Economy projects, and to support low-carbon and climate-resilient development.

5.5.1 Blue Economy Funds

Blue Economy funds that could support the sustainable urban economic development in Lamu include:

The Blue Planet Fund: The UK's £500 million Blue Planet Fund supports developing countries to protect the marine environment and reduce poverty¹⁸⁸. The Fund seeks to tackle issues related to climate change by achieving four objectives:

- > Improving marine biodiversity;
- > Improving resilience, adaptation to and mitigation of climate change;
- > Reducing marine pollution; and
- > Ensuring sustainable seafood is produced and distributed in ways that support healthy ecosystems.

Financed by the ODA, the fund is managed by DEFRA and FCDO and will run for at least five years (as of 2021). Funding is subject to UK government guidelines and rules for designing and implementing ODA projects. The fund typically provides 'soft' loans and technical assistance.

Go Blue: The EU and the Kenyan government have partnered to progress the Blue Economy agenda along coastal developments nationally. Focusing on three objectives, including inclusive and sustainable economic growth, sustainable spatial planning initiatives for conserving the marine environment, and promoting effective maritime governance. The EU has funded the scheme with €25 million over four years¹⁸⁹.

Go Blue are already working in Lamu on a number of projects including mangrove reforestation, sustainable tourism initiatives, fisheries management for job creation and aquaculture projects.

PROBLUE: Led by the World Bank, PROBLUE is a multi-donor trust fund which encourages and funds sustainable ocean activities¹⁹⁰. It supports key blue recovery projects in SIDS and coastal nations in the tourism sector, as well as activities focused on water, sanitation, and hygiene (WASH), interventions in fisheries and aquaculture, and their value chains. In FY21, the overall PROBLUE portfolio has increased to a total of USD \$60.3 million to support 85 activities across 71 countries. To date, more than USD \$150 million has been donated by donor countries. It focuses on four key areas:

- > Sustainable fisheries and aquaculture;
- > Marine pollution, including litter and plastics, from marine or land-based sources;
- > Sustainable development of oceanic sectors e.g. tourism, maritime transport and offshore renewable energy; and
- > Strengthening government capacity to manage marine resources, including nature-based infrastructure such as mangroves, to deliver more and long-lasting benefits to communities.

PROBLUE is committed to cross-cutting themes: gender and climate adaptation and mitigation. In FY21, 90%¹⁹¹ of the approved projects considered these elements in their proposals. Applications for PROBLUE funding can be made via federal ministries in-country, working with World Bank representatives, who will make the funding application to PROBLUE on the ministries' behalf.

188 GOV.UK, Policy Paper, Blue Planet Fund (2021), Available at: <https://www.gov.uk/government/publications/blue-planet-fund/blue-planet-fund> (Accessed: 15/12/2021).

189 GoBlue, (2021), Available at: <http://goblue.co.ke/>, (Accessed: 15/12/2021).

190 The World Bank, PROBLUE: Healthy oceans, health economies, healthy communities (2021), Available at : <https://www.worldbank.org/en/programs/problue/overview>, (Accessed: 15/12/2021).

191 The World Bank, PROBLUE 2021 annual report (2021).

EIB: The EIB's Sustainable Ocean Strategy (Blue SOS) has committed €2.5 billion in lending to sustainable ocean projects over the period 2019-2023, with a pledge to raise €5 billion in investments to contribute to building sustainable coastal environments and blue economic initiatives¹⁹². Blue SOS offers loans and technical support to sustainable ocean development and sustainable seafood projects, green shipping and relevant biotech projects¹⁹³.

The **Clean Oceans Project Identification and Preparation Programme** (COPIP) is another EIB led programme, which identifies projects in sub-Saharan Africa that contribute to reducing the discharge of plastics into the ocean. The programme works with a variety of partners, from local authorities to private sector companies. The Clean Ocean Initiative forms the basis and framework for the COPIP and provided lending commitments of up to EUR 2 billion annually between 2018 to 2023 for projects focused on: solid waste management, diversion of plastic waste away from the ocean, and wastewater management systems.

Commonwealth Blue Charter: A group of commonwealth countries protecting oceans through ten targeted Action Groups. Each group focuses on a specific ocean issue – from mangrove reforestation¹⁹⁴ to the clean ocean alliance¹⁹⁵ – many of which could be utilised in Lamu. The fund is worth more than £125 million and aids Blue Economy projects via grants, technical assistance, impact investment and fiscal sponsorship¹⁹⁶. The Commonwealth Climate Finance Access Hub helps vulnerable member states successfully achieve

climate finance funding and build their skills base by providing skilled regional advisors in government roles.

AfDB African Natural Resources Centre/Sustainable Energy Fund for Africa: A multifaceted partnership approach from the African Development Bank, this facility can provide the climate finance for the implementation for Blue Economy initiatives via financial delivery mechanisms such as grants, loans, equities, guarantees and special funds, based on the country or project requirement¹⁹⁷. As part of this, the Sustainable Energy Fund for Africa is a multi-donor fund that that seeks to promote private investment in sustainable energy projects across Africa. These organisations work in tandem with the African Natural Resources Centre, which provides specialist knowledge to engage with relevant policy discourse.

Blue Invest Platform: The European Commission, together with the European Investment Fund, has launched a platform to connect sustainable Blue Economy projects to interested investors, supporting readiness and access to climate finance. Since the launch last year, €45 million has been deployed to successful blue economy initiatives. What's more, the platform offers a range of useful tools for those looking to engage with Blue Economy initiatives, and in terms of financing, offers a grant programme¹⁹⁸.

Blue Action Fund: A public fund promoting marine conservation and sustainable livelihoods in coastal communities¹⁹⁹. Providing grants for relevant projects related to marine protected areas implemented by NGOs, the Blue Action Fund's objectives are focused on conservation of

biodiversity and enhanced livelihood and food security. The financing mechanism usually involves 25% of the project to be match-funded by the NGO or third party.

Ocean 14 Capital: A private equity firm focusing investments on the SDG14. Ocean14 Capital invest capital in companies and technologies that sustain and advance marine health²⁰⁰.

The Ocean Foundation: Offers smaller grants via philanthropic channels to projects and organisations targeting marine conservation²⁰¹ and fiscal sponsorship for those seeking legal and tax-exempt status for projects.

Bezos Earth Fund: A commitment of USD \$10 billion in grants to projects focused on mitigating against the impact of climate change and promoting conservation over the next decade. Current projects include Blue Economy initiatives such as Eden Restoration – planting trees in Kenya and southern Africa – and mangrove reforestation across a number of regions globally²⁰².

Blue Mangrove Fund: A public-private partnership aiming to implement mangrove reforestation projects. The group connects investable projects with the appropriate assistance via two pathways: direct investment for projects and a carbon credit scheme²⁰³.

Global Mangrove Alliance: With the aim of strengthening and conserving global mangrove forests through sustainable planning practises and the establishment of protected coastal areas. The Alliance offers grants to areas interested in participating in their projects²⁰⁴.

192 EIB, Clean oceans and the blue economy overview (2021), Available at: https://www.eib.org/attachments/thematic/clean_oceans_and_the_blue_economy_overview_2021_en.pdf, (Accessed: 15/12/2021).

193 EIB, Blue Sustainable Ocean Strategy (2021), Available at: https://www.eib.org/attachments/thematic/eib_blue_sustainable_ocean_strategy_en.pdf, (Accessed: 15/12/2021).

194 The Commonwealth Blue Charter, Action group on mangrove ecosystems and livelihoods, Available at: Mangrove Ecosystems and Livelihoods – Commonwealth Bluecharter (thecommonwealth.org), (Accessed: 15/12/2021)

195 The Commonwealth Blue Charter, (2012), Available at: Sustainable Blue Economy – Commonwealth Bluecharter (thecommonwealth.org), (Accessed:15/12/2021).

196 The Commonwealth Blue Charter, Commonwealth Blue Charter ocean funders database (2021), Available at: Commonwealth Ocean Funders (thecommonwealth.org), (Accessed:15/12/2021).

197 African Development Bank Group, Blue Economy flagship a briefing note for partnership (2018), Available at: https://www.riob.org/sites/default/files/documents/AfDB%20Blue%20Economy%20Flagship%20_%20Briefing%20Note_November%202018.pdf, (Accessed: 15/12/2021).

198 European Commission, BlueInvest (2021), Available at: , (Accessed: 15/12/2021).

199 Blue Action Fund, What we fund (2021), Available at: Funding Opportunities - Blue Action Fund, (Accessed: 15/12/2021).

200 Ocean 14 Capital (2021), Available at: About | ocean14capital.com, (Accessed: 15/12/2021).

201 The Ocean Foundation, About The Ocean Foundation (2021), Available at: About - The Ocean Foundation (oceanfdn.org), (Accessed: 15/12/2021).

202 Benzos Earth Fund, Our Programs (2021), Available at: Our programs - Benzos Earth Fund, (Accessed: 15/12/2021).

203 Blue Mangrove Fund (2021), Available at: Home (bluemangrove.fund), (Accessed: 15/12/2021).

204 Global Mangrove Alliance (2021), Available at: Mangroves (mangrovealliance.org), (Accessed: 15/12/2021).

Nature Vest: The Nature Conservancy's in-house impact investment team. As part of their commitment to investment in climate change, NatureVest works with governments to restructure debt in exchange for local governments' commitments to marine protected areas. By using private investment sources to purchase debt, it frees-up capital to fund conservation efforts²⁰⁵. So far, NatureVest has undertaken similar projects worth USD \$1.3 billion²⁰⁶.

5.5.2 Climate action funds

Presented below is a snapshot of the available climate change funds that cover climate adaptation and mitigation.

Green Climate Fund (GCF): The GCF seeks to promote a paradigm shift to low emission and climate-resilient development, taking into account the needs of nations that are particularly vulnerable to climate change impacts including African nations and Small Island Developing States (SIDS). The GCF aims to deliver equal amounts of funding to mitigation and adaptation measures. Its activities are aligned with the priorities of partner countries through the principle of country-led programmes and implementation. The financial delivery mechanism for the GCF is grants, loans, equity or guarantees. In addition, two specific GCF investments provide further opportunities:

- > **The ACUMEN Resilient Agriculture Fund (ARAF)**
The ARAF, which is currently operational, and is scheduled to end in 2031, provides finance to support innovative private sector businesses that enhance the resilience of smallholder farmers in Uganda, Kenya, Ghana and Nigeria. There is a specific focus on providing innovative MSMEs with the finance they need to adopt longer-term approaches to adapting to climate change, including increased use of digital approaches and climate-smart agriculture. Given the needs outlined through the UEP development process, there is a potential opportunity to attract finance

for innovation, developing models and approaches that could then be replicated more widely.

- > **The Global Sub-National Climate Fund (SnCF Global)**
The SnCF Global uses GCF backing to overcome the barriers to the financing of smaller-scale adaptation and mitigation projects at a sub-national level. The fund is managed by the International Union for the Conservation of Nature (IUCN) and was approved in November 2020. It will operate in Kenya, Rwanda and Uganda, and will attract private finance to projects previously not deemed to be investible on a commercial finance basis. There is a focus in the fund on nature-based solutions, and it represents a possible avenue for investment in some of the project opportunities identified.

The National Treasury: This is the Kenyan National Designated Authority (NDA) for the GCF in Kenya. It has developed the Kenya National Green Climate Fund (GCF) Strategy, with a vision to channel investment from the GCF for a climate-resilient society and low-carbon economy. The Strategy identifies County governments as critical co-financiers who can take the role of executing entities and/or implementing entities of climate-resilient and low-carbon initiatives. The Strategy provides a roadmap for stakeholders in harnessing resources from the GCF.

The Adaptation Fund (AF): The AF finances projects and programmes that help vulnerable communities in developing countries adapt to climate change. Initiatives are based on country needs, views and priorities. The financial instrument/delivery mechanism used by the Adaptation Fund is grants. NEMA is the National Implementing Entity (NIE) for the Adaptation Fund in Kenya. The AF raised USD \$35,6 million at COP26, which will be used to continue supporting developing countries in their adaptation measures, as well as encouraging climate-resilient economic recovery from the COVID-19 pandemic²⁰⁷.

²⁰⁵ The Nature Conservancy, Rising tides dept for nature swaps finance climate resilience (2021), Available at: [Rising Tides: Debt-for-Nature Swaps Let Impact Investors Finance Climate Resilience](#), (Accessed: 15/12/2021).

²⁰⁶ The Nature Conservancy, NatureVest (2021), Available at: [NatureVest: Conservation Investing](#), (Accessed: 15/12/2021).

²⁰⁷ Adaptat Fund, Adaptation Fund raises record US\$ 36 million in new pledges at COP26 for its concrete actions to most vulnerable (2021), Available at: [Adaptation Fund Raises Record US\\$ 356 Million in New Pledges at COP26 for its Concrete Actions to Most Vulnerable](#) - Adaptation Fund ([adaptation-fund.org](#)), (Accessed:15/12/2021).



The Least Developed Countries Fund (LDCF):

The LDCF was established to meet the adaptation needs of least-developed countries (LDCs). Specifically, the LDCF has financed the preparation and implementation of National Adaptation Programs of Action (NAPAs) to identify priority adaptation actions for a country. The financial instrument/delivery mechanism used by the LDCF is grants. The Global Environment Facility (GEF) administers the LDCF and Operational Focal Points (OFPs) are responsible for coordination in country. The Ministry of Environment and Forestry is Kenya's GEF Operational Focal Point.

The Special Climate Change Fund (SCCF): The SCCF was established to address the specific needs of developing countries to cover the incremental costs of interventions to address climate change relative to a development baseline. Adaptation to climate change is the top priority of the SCCF and in addition to this, it finances projects relating to technology transfer and capacity-building in the energy, transport, industry, agriculture, forestry, and waste management sectors. The SCCF is administered by the GEF and its financial instrument/delivery mechanism is grants. The Ministry of Environment and Forestry is Kenya's GEF Operational Focal Point.

The Pilot Program for Climate Resilience (PPCR):

The PPCR provides funding for climate change adaptation and resilience-building. It aims to demonstrate ways in which climate risk and resilience may be integrated into core development planning and implementation by providing incentives for scaled-up action and initiating transformational change. This may include technical assistance to integrate climate resilience into national development plans, or funding for public and private sectors when implementing climate resilience initiatives. It is a targeted program of the Strategic Climate Fund (SCF), which is one of two funds within the Climate Investment Funds (CIF) framework. The financial instrument/delivery mechanism for the PPCR is grants and loans. The CIF Secretariat is housed at the World Bank.

Following on from the PPCR the CIF is supporting four thematic programme areas aiming to support the transition to a low carbon, climate-resilient economy. There may be particular opportunities to access funding under the Climate Smart Urbanisation programme, and the Nature, People and Climate Investment programme.

Clean Technology Fund (CTF): A multi-donor fund and part of the Climate Investment Funds (CIF). The CTF promotes financing for the implementation of renewable energy technologies with potential to reduce emissions, with the aim of making these more attractive to public and private sector investors. The fund can be accessed via the African Development Bank, and uses a variety of financial instruments including grants, loans, equity and guarantees.

The Africa Climate Change Fund (ACCF): This aims to support African countries' transition to climate-resilient and low-carbon modes of development, as well as scaling-up their access to climate finance. The fund offers grants for projects related to the following themes: supporting small-scale or pilot adaptation initiatives to build resilience of vulnerable communities, and supporting direct access to climate finance. The secretariat is housed at the African Development Bank.

The Kenya County Climate Change Fund (CCCCF)

Mechanism: The expansion of the CCCC across the country is one of the priorities in the Kenya National Climate Change Action Plan (NAP), 2018-2022. The CCCC improves a county's readiness to access and distribute national and global climate finance to support community-prioritised investments to build climate resilience. The CCCC are aligned with national priorities set out in the NAP and enable county governments to strengthen and reinforce national climate change policies while delivering on local adaptation priorities. Post COP26, the Kisumu County government has pledged to allocate 2% of its annual budget towards climate change mitigation measures, in line with Kenya's commitments outlined in its NDC, with other counties set to make similar pledges.

African Financial Alliance on Climate Change (AFAC):

AFAC was established with the aim of increasing financial sector participation to drive climate change initiatives across Africa. Bringing together key financial players, including private banks, multilaterals and sovereign funds, the pan-African alliance will help to mobilise private capital investment towards a climate-resilient development path. AFAC's main aim is to engage in knowledge-sharing and increase private sector participation in climate action, as well as attracting climate investment into national and regional climate projects²⁰⁸.

Africa Adaptation Acceleration Program (AAAP):

Endorsed by the African Union, the AAAP was established to raise USD \$25 million for adaptation of the impacts of climate change²⁰⁹. The program focuses on four pillars: the creation of climate technologies to combat agricultural losses and food security, building resilient infrastructure, and empowering youth through green job creation. The fourth focus is on the mobilisation of funding for climate action, with consideration given to promoting green growth post-COVID-19.

Sustainable Energy Fund for Africa (SEFA): This is a multi-donor fund managed by the African Development Bank. The fund was set up with the aim of contributing to the development of sustainable energy services across Africa. The fund supports initiatives through technical assistance grants, combined with concessional investment, via loans and equity instruments²¹⁰. A recent focus has been on Blue Economy initiatives such as offshore renewable energy sources.

Africa Regional Climate and Nature Programme (ARCAN):

A newly-established programme supported by ODA funding and by the World Bank, ARCAN will offer support for adaptation measures including water management and

resource, and technical assistance to African partners to integrate climate action into policymaking. The programme also offers access to climate finance for adaptation projects and received new funding for relevant projects at COP26.

5.6 Recommendations for Social Inclusion

Considerations for social inclusion have been embedded into the development, design, prioritisation and proposed implementation of the Development Framework and the Economic Development Plan and VC projects. Apart from the specific recommendations for the different projects, key recommendations include:

- > Ensure participation of all in the UEP planning, development, implementation, monitoring and decision-making processes. Stakeholder engagement should be a live process of the programme;
- > Commit to always engage SIGs, local communities and community-based organisations and give them a chance to be informed, to contribute to decision-making, and to actively give views on, and participate in, different matters associated with the programme, especially those that affect them;
- > When developing measures that target SIGs, take into consideration that they are not homogenous groups and that they face differentiated challenges according to their age, gender, ethnicity, religion, education levels, (dis)ability, etc;

²⁰⁸ African Development Bank, African Investment Forum 2018: African Financial Alliance on Climate Change (AFAC) unveiled guiding principles (2018), Available at: Africa Investment Forum 2018: African Financial Alliance on Climate Change (AFAC) unveils guiding principles | African Development Bank - Building today, a better Africa tomorrow (afdb.org), (Accessed: 15/12/2021).

²⁰⁹ African Development Bank, Africa adaptation acceleration program, (2021), Available at: https://www.afdb.org/sites/default/files/2021/10/19/africa_adaptation_acceleration_program.pdf, (Accessed: 15/12/2021).

²¹⁰ African Development Bank, Sustainable Energy fund for Africa (2021), Available at: Sustainable Energy Fund for Africa | African Development Bank - Building today, a better Africa tomorrow (afdb.org), (Accessed: 15/12/2021).

- > Always communicate to local residents and adjacent businesses about the implementation schedule of different infrastructure and urban development projects to mitigate the disruption of livelihoods and everyday socio-economic activities. Provide accessible channels to receive and address complaints that might emerge from the development and implementation of the programme;
- > Ensure all communication is timely, and in formats and languages that are accessible for all. This may include material for visually-impaired people (audio, Braille), for people with learning disabilities and literacy difficulties (audio, easy-to-read written material), for people with hearing impairments (written material, sign language), and for people with co-ordination difficulties (easy-to-read written material, audio). The material should also consider people with low-literacy levels;
- > The UEP represents an opportunity for working towards a more inclusive Blue Economy in Lamu Municipality. Ensure quotas for PWD (established by the Persons with Disabilities Act, 2003) are implemented in all employment opportunities and prioritise SIGs for the programmes' employment and capacity-building opportunities. If possible, determine target participation of SIGs in the different components of the programme. Ensure all new infrastructure and services adopt inclusive design standards;
- > The introduction of new climate-resilient approaches and technologies that support income generation should be accessible to low-income groups. Prioritise culturally-appropriate and affordable options, and provide financial and technical support to these groups. Green jobs should also be available to SIGs by providing them with adequate training;
- > Mainstream gender into all stages of the programme and its interventions. This will contribute to better understanding and addressing the programme's implications for men and

women, and to better-integrate them to minimise negative impacts over them and maximise the programme's benefits. Always accompany women's economic empowerment measures with awareness sessions targeting women and men at both household and community levels;

- > Accompany ICT-based measures with strategies to close the digital gap (i.e. digital skills development, increased access to technology and the internet), particularly for women²¹¹. A gender-sensitive approach is required to understand different needs, access, and control of ICTs;
- > Assess, prevent, and mitigate social risks that could be associated with LAPPSET. Despite there being several socio-economic benefits associated with the initiative, mega-development projects that do not consider safeguarding measures could have a negative impact on local communities. There are examples in the past²¹² that have shown that a large influx of temporary foreign workers and contractors could generate harmful social dynamics in local communities, with particular negative consequences on sexual and reproductive health, and gender-based violence. Urban development planning for Lamu should consider these risks, and develop mechanisms that could contribute towards preventing and mitigating potential negative impacts; and
- > Establish a Gender and Social Inclusion Implementation Unit, which will work under the leadership of the UEP implementation manager to ensure inclusivity proposals in the UEP are implemented and monitored.

The full GeSI Report is provided in Appendix C.

5.7 Recommendations for Climate Change and Resilience

The projects and recommendations outlined in this report will help to strengthen the resilience of Lamu Municipality to climate change. While the projects and interventions outlined represent strong foundations on which to build, much more will be needed, both in terms of infrastructure investment, and strengthening institutional capacity, to ensure that Lamu can reach its goals despite the challenging climate conditions.

Key to increasing the resilience of Lamu is the ability to attract funding to implement climate adaptation projects, alongside overcoming barriers to implementation.

Neighbouring Garissa was one of the pilot counties to develop a County-level climate change fund designed to be used to finance key climate change activities in the County and deliver locally on the priorities of Kenya's National Adaptation Plan. Initial evidence shows that these funds are effective not only in terms of finance, but also for the coordination of climate resilience programmes among different actors, and there are important lessons that could be applied from their experience.

We recommend that the County explores whether it is feasible to establish a similar fund for Lamu, or a body designed to attract inward investment of climate and sustainable finance. Any such fund would need to consider inclusion to help support livelihoods. The projects presented here have undergone a climate screening process and are designed to meet the basic funding criteria for climate finance, although specific requirements will vary, and full project concepts would be needed.

²¹¹ FAO, Gender and ICTs: Mainstreaming gender in the use of information and communication technologies (ICTs) for agriculture and rural development (2018).

²¹² For example, the WB funded project in Uganda that ended in the inspection panel due to sexual assaults claims Available from <https://www.theguardian.com/global-development/2016/jan/12/world-bank-cancels-uganda-road-sexual-assault-claims> and <https://documents1.worldbank.org/curated/en/482251502095751999/pdf/117972-WP-PUBLIC-recommendations.pdf>

Lamu already has a hot, dry climate, and experiences extremes of temperature, drought and flooding. Recent events around the world have demonstrated that there is a significant risk of unprecedented temperature extremes, which may well be more severe than climate models currently capture. For Lamu specifically, there is a risk of extreme heat events that can have severe impacts on human health, and it is therefore important to develop an emergency heat response plan, with clearly identified roles, and measures to reduce the risk of heat-related mortality during possible extreme events.

The Kenya Meteorological Department (KMD), through the FCDO-funded WISER programme, has been developing marine forecasts for neighbouring coastal counties, in order to improve preparedness for storms and dangerous marine conditions. These forecasts are not yet available for Lamu, however, there is an opportunity to work with the County Meteorological director, and KMD to learn from experience in neighbouring counties, and expand forecasts for Lamu.

Climate-resilient Agriculture and livestock, Fishing and Marine, and Tourism and heritage sectors will be essential both for driving growth in the County, as well as for improving livelihoods and reducing poverty. Initiatives such as the Kenya Climate Smart Agriculture Programme provide important learning opportunities and can start to lay the foundations for a resilient agricultural sector. Scaling-up the lessons from this and similar programmes will require a coordinated programme of investment.

In summary, key recommendations include:

- > Training programmes on Climate Smart Agriculture;
- > Improved access to seasonal and ten-day forecasts;
- > Increased awareness of appropriate insurance products (e.g. weather-based index insurance);
- > Reducing post-harvest losses;
- > Planting drought and pest/disease resistant cultivars;
- > Adopting soil and water conservation measures (including water use efficient irrigation methods);
- > The design of the processing facilities to include water harvesting, increasing the resilience of the plants to drought; and
- > The design of buildings to take into account higher maximum temperatures to ensure thermal comfort.

This report has highlighted important linkages between poverty, exclusion, climate change, and conflict.

There is a need to establish the mechanisms so that traditionally-marginalised groups are included in decisions about both the development and implementation of the development framework, the development concept and the wider decision-making processes on climate risk and resilience.

Ensuring that there is representation from groups particularly vulnerable to climate change will reduce the risk that activities designed to increase resilience have unintended consequences and exacerbate existing vulnerabilities and inequalities.

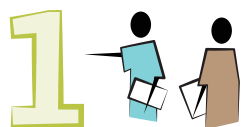
There are a range of VCs that have been selected across Agriculture and Livestock, Fishing and Marine, and Tourism and Heritage. Individually some of these VCs are vulnerable to climate change, however the diversity across these VCs will in itself be a source of resilience for Lamu. Further to this, there are opportunities to integrate appropriate adaptation measures, as detailed for each prioritised VC in section 4.2, 4.3 and 4.4.



5.8 Next Steps

Following the completion of the UEP, during the next phase of the SUED Programme the proposed projects will be developed further by:

Figure 5.2 Next steps



Capacity building specialists to help:

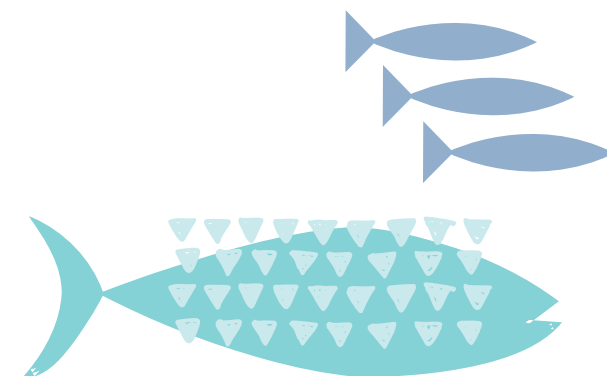
- Enhance municipal and local capacity to implement the identified projects, and;
- Enable revenue generation to ensure financial sustainability beyond the programme.



Investment experts to help:

- Develop feasibility studies and business cases for specific projects to establish their bankability, and;
- Develop investment promotion strategies to draw in investment (including seed financing through the programme).

Source: Atkins analysis



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Appendix A

Diagnostics Report

See attached document.



Appendix B

Technical Briefing Paper

See attached document.



Appendix C

Gender and Social Inclusion Study

See attached document.



Appendix D

Climate Change Vulnerability Assessment

See attached document.



Appendix E Swahili Heritage Guide

Lamu Old Town - World Heritage Site

Community based catalogue of small scale
development strategies.



Premise:

The following guidance seeks to address some of the issues raised by the WHC and Advisory bodies in their 2021 property assessment.

Whilst the SUED's remit is limited in scope and reach, particularly on the heritage and conservation aspects, the following recommendations/proposals attempt at identifying "quick wins", namely a series of actions potentially easy to implement, whose objective is of preserving Lamu's WHS status.

If adopted and implemented, such actions might have a relatively big impact on the WHS designation. The proposals are intended to be easily implementable by individuals, small groups of citizens and/or business associations.

It is noted that a series of reports illustrating improvement progress are to be submitted to the WHC throughout 2022. The review period it will culminate with a site mission in 2023 to review status of the WHS conservation, as such, 2022 it will be a strategic year for implementation of any protection and development measure.

Relevant issues hereby identified include:

(extract from "Analysis and Conclusion by World Heritage Centre and the Advisory Bodies in 2021" [link](#))

- > The poor state of conservation of the property and lack of building controls observed by the mission, which pose a threat to its integrity and authenticity, remains of significant concern.
- > [...] the Outstanding Universal Value (OUV) of the property should be thoroughly taking into account in the conceptualization of the three KUSP projects. (The State Party further submitted three inception reports for planning projects being undertaken under the World Bank funded Kenia Urban Services Project (KUSP). The projects are:

- > Solid Waste Policy for Lamu Municipality;
- > Lamu Municipality Integrated Development Plan;
- > Lamu Island Integrated Urban Development Plan (2020-2035)

Decisions adopted by the Committee in 2021

- > Expresses its concern about the overall state of conservation of buildings within the property, and further requests the State Party to complete the survey of the building stock and strengthen enforcement of building controls to halt the deterioration and use of inappropriate materials;
- > Requests in addition the State Party to invite a joint World Heritage Centre/ICOMOS/ICCROM Reactive Monitoring mission to the property in the first half of 2023 to review the progress made on the recommendations of the 2019 mission and the Decisions of the World Heritage Committee, for examination by the World Heritage Committee at its 46th session;
- > Finally requests the State Party to submit to the World Heritage Centre, by 1 February 2022, a progress report, and by 1 December 2022, an updated report on the state of conservation of the property and the implementation of the above, for examination by the World Heritage Committee at its 46th session.

One of the key observations raised by the heritage bodies, indicate that development in the Lamu Old Town is inconsistent with the Swahili vernacular. In detail, materials palette, places and public realm current articulation all clash with local identity and detract from the heritage's integrity.

The following "catalogue" identifies key issues observable in town and good examples to help guide further small scale physical interventions that can be implemented by individuals or small groups of stakeholders. The underlying objective is to illustrate what small, incremental changes might look like.

Other interventions might require a more systemic approach (ie.: lighting, paving, local transport) and coordinated approach, but these are instrumental in preserving the historical traits of the town.

The review of local influences (which in turn derives from a wide range of backgrounds, namely Swahili building techniques incorporating Arabic, Persian, Indian and European influences) capture both tangible and intangible attributes.

The sections cover:

- > Street and Spaces;
- > Wayfinding and Signage
- > Lighting
- > Street furniture
- > Examples of Practical Applications

Swahili architecture elements

The Swahili culture and building techniques reflect a variety of influences. Arabic, Persian, Indian and European traits inform both tangible and intangible attributes.

This section illustrates key physical elements (carving patterns, walls, materials, doors and architraves, verandas and arcades) as well as the intangible flavour of traditional festivals (and their rites) that capture the Swahili tradition.

These should be considered as references for both refurbishment and development of existing building stock.

Swahili architecture - Lamu



Source: [Erik \(HASH\) Hersman from Orlando - Lamu Island](#)

Carved doorways - Rectangular frames represent an older Swahili style with straight lintels, while arched lintels were more prevalent in the later nineteenth century.

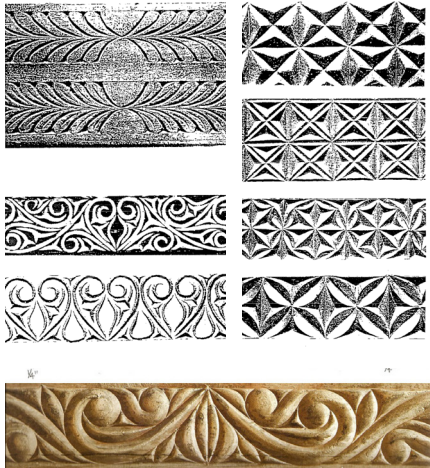


Source: waridihouse.com/



Source: [Justin Clements](#)

Traditional carving patterns



Source: [Semantic scholar](#)

Walls of Lamu



Source: [Hayon N hay0nn](#)

Mangrove poles



Coral rag - limestone rubble



Source: [Tv CNN](#) and <https://www.charlotteplansatrip.com/en/kenya/travel-guide-lamu/>

Lamu “Island of Festivals”

The Swahili culture is built on trade and exchange both commercial and cultural. Intricate patterns, colourful costumes and a coastal way of living are the result of the geographical location and historical influences.



Source: [picuki.com](https://www.picuki.com)



Source: thefortshela.com



Source: Superstock photos
John Warburton-Lee



Source: (Flickr/USAID/Kenya SECURE Project/
Samia Omar Bwana)



Source: Adam Musa YouTube
movie and [Unsplash.com](https://www.unsplash.com)



Source: <https://www.hoaexp.com/2020/02/18/lamu-cultural-festivals/>



Source: lamu-art-festival.org

Streets and Places

The following images document the challenges and issues currently faced in Lamu Old Town.

Congestion, poor quality urban space, signage cluttering, inappropriate construction materials, coastal flooding, open air sewerage and poor drainage, all contribute to a general low quality environment perception.

Furthermore, uncoordinated and sporadic street furniture, and a series of "make-do" temporary solutions (ie.: concrete streets, further the problems).



Lamu streets - issues

Lamu Corniche Path

Poor drainage and sewage system, street elements alien to traditional culture



Source: Atkins site visit

Poor drainage and sewage system



Source: Atkins site visit

Poor sewage system, street clutter, poor aesthetic



Source: Atkins site visit

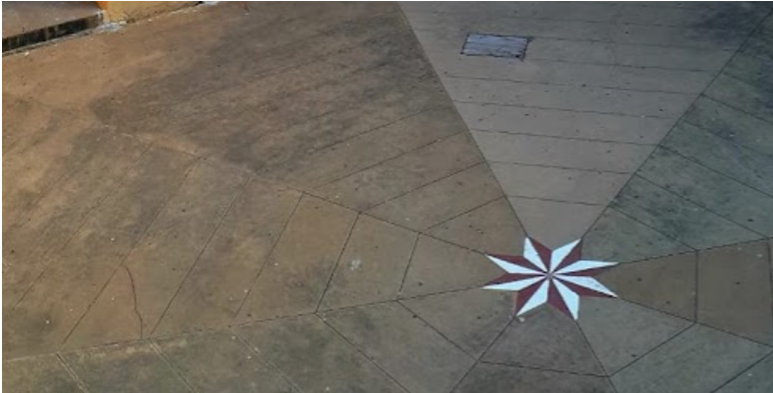
Metal doors, signage, overhanging cables



Source: Atkins site visit

Lamu main square

Lamu Fort inner square



Source: Atkins site visit

Light pole – material and shape do not match surrounding architecture



Source: Atkins site visit

Lamu Main Plaza



Source: Atkins site visit

Existing drainage



Source: Atkins site visit

Corniche Path



Source: [Mark Wiens YouTube](#)



Source: [Mark Wiens YouTube](#)



Source: [Mark Wiens YouTube](#)



Source: [Mark Wiens YouTube](#)

Lamu streets – good examples

Shela and Lamu Old Town, both offer examples of good practice. The following pics illustrate where traditional material, techniques and styles have been adopted or retained and contribute to preserving the spirit of the town: ground floor cladding in coral stone, appropriate colour palette, ancient and contemporary materials usage, restoration of doors, windows and fixtures, and juxtaposition of old and new urban fabric.

Further afield, other similar towns have also adopted a sensitive approach to heritage management that keep intact the spirit of the place.

Shela



Source: [Reece McMillan](#)

Lamu Old Town



Source: [Atkins site visit](#)



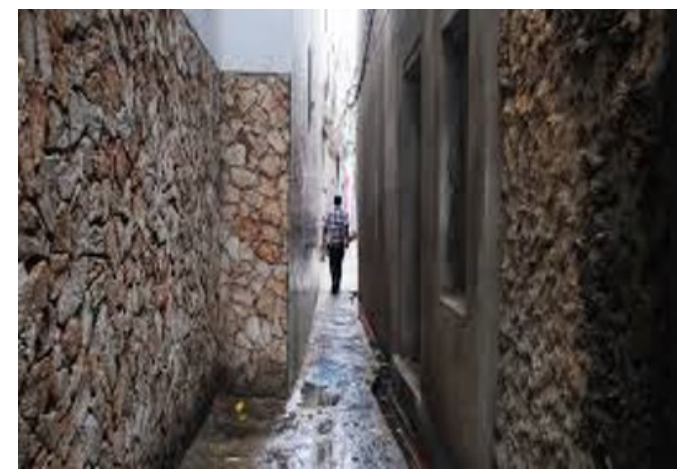
Source: [Mex Andalusi twitter.com](#)



Source: [skyscrapercity.com](#), [andegwa](#)



Source: [Lamu Old town Trip.com](#)



Source: [canduh.wordpress.com](#)

Lamu streets – good examples

Paving complement surrounding architecture



Source: [Atkins site visit](#)

Hanging sign



Source: [couleurlocale.eu](#)

Traditional doorway, stone elevations and painted walls



Source: [Atkins site visit](#)

Traditional doorway and local art



Source: [couleurlocale.eu](#)

Best practices - Paved streets

Fez, Morocco



Source: thisworldtraveled.com



Source: [Xinhua](http://Xinhua.com)



Source: Jenny Gustafsson

Zanzibar



Source: Justin Fox



Source: sandieszanzibar.com



Source: midlife-leap.com

Concrete paving for main streets and plazas

Paving is one of the most impactful and yet underrated component of an historic town. Many approaches can be adopted that allow for maintenance or improvement of the town. These include the use of traditional material and techniques in the build up and decoration of the place paving. Contemporary approaches can still be sensitive and meaning full – see illustrations.

Lamu, existing Cornishe path



Source: Atkins site visit

Traditional

Concrete block paving – colour to match surrounding architecture



Source: floorcoveringsinternational.com

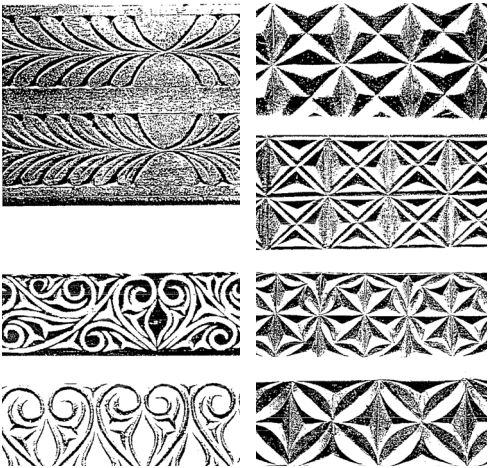
Source: uniqueallstone.com

Contemporary



Source: Asphalt Paving (www.oneilspaving.net)

Traditional patterns



Source: Semantic Scholar

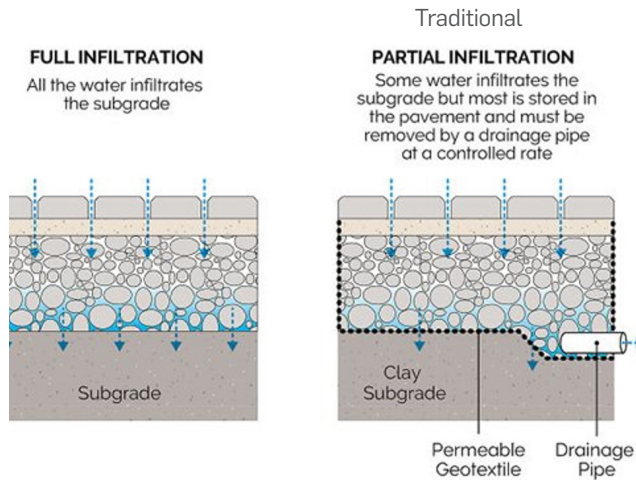
Traditional pattern imprinted concrete



Source: Kinnear Landscape Architects (Pinterest.com)

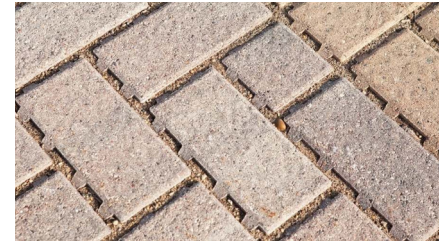
Permeable paving for Corniche Path

Given the challenges of surface drainage and flooding in Lamu, innovative systems could be adopted, these include permeable paving systems that allow for storm water infiltration and managed discharge. When appropriately installed these systems allow for further protection of nearby structures from direct infiltration.



Source: www.midlandbrick.com.au

Contemporary



Source: jsbrickcorporation.com

Concrete pavers with gaps for infiltration



Source: gardenista.com



Source: landscapearchitecturemagazine.org



Source: landscapearchitecturemagazine.org

Porous pavers



Source: wef.org

Coral stone paving for main streets and plazas

Coral stone from Manda



Source: www.stonecontact.com

Stone flags



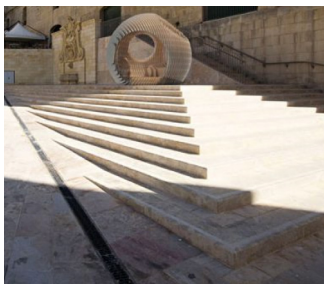
Stone setts



Irregular stone



Stone paving exaples



Wayfinding and Signage

Wayfinding and Signage systems are among the latest interfaces between visitors and town. How to move about places, destinations are, what things are inform the user experience. A successful experience is when the user is able to experience discovery and yet don't be overwhelmed by the complexity of a place – particularly ancient towns.

A coordinated strategy to wayfinding and signage, ensures that the townscape does not become cluttered and disorienting, but allows for a coherent experience.



Wayfinding

Wayfinding systems have a number of options, can be deployed on vertical, horizontal supports, tactile and on stand-alone posts or integrated in larger urban settings. The experience of embedding wayfinding on paving also makes the visiting experience enjoyable and accessible to all.



Source: Marrickville Metro deucedesign.com.au



Source: Maena design
Conecta



Source: Louise Taylor
www.behance.net



Source: Amanda Cooley
Pinterest.com



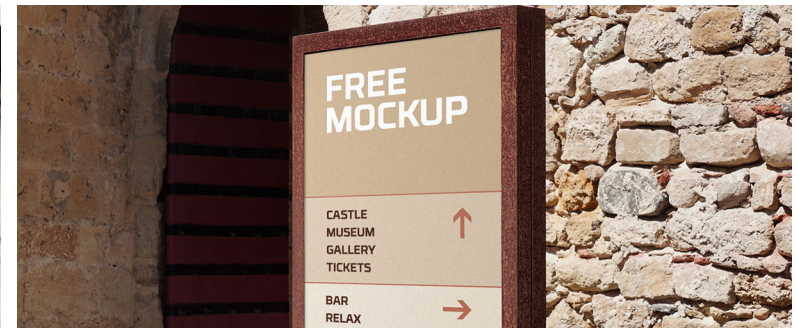
Source: Barcelona Points of Historical



Source: Richard Ouk Pinterest.com



Source: Anne Claude Poulin
pinterest.com



Source: unblast.com/free-wayfinding-sign-mockup-psd



Source: is-group.co.uk



Source: Triggerdesign.com.au



Source: Foto Freddie Mercury Museum, Zanzibar

Shopfront signage

Unmanaged signage often is the cause of clutter and uncoherent messaging of a place. In historic urban settings, it's important to identify the original form of signage and how they used to be integrated with buildings and public spaces. Colour palette, materials, scale and location, are all fundamental parameters to consider.

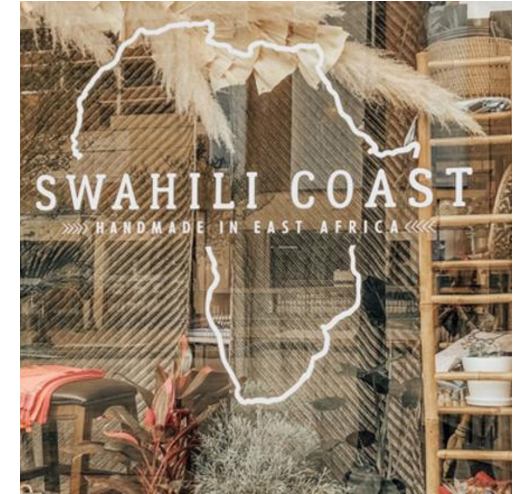
A coordinated strategy to wayfinding and signage, ensures that the townscape does not become cluttered and disorienting, but allows for a coherent experience.



Source: [jonistravelling](#)



Source: [couleurlocale.eu](#)



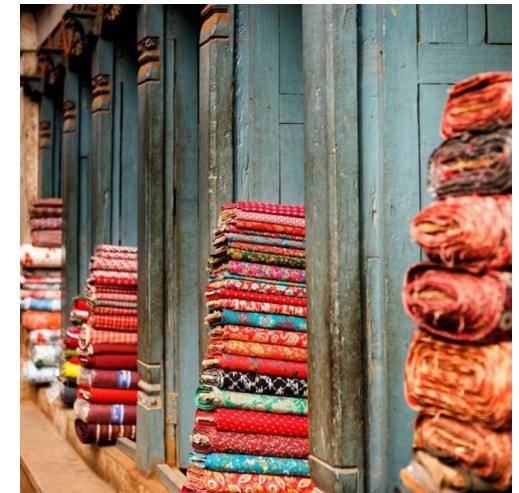
Source: [www.swahilicoastdesign.com](#)



Source: [the189](#)



Source: [forgraphictm](#)



Source: [shruseternity.com](#)



Source: www.swahilicoastdesign.com



Source: Zanzibar Café - [Tripadvisor.com](https://www.tripadvisor.com)



Source: www.spiritedpursuit.com



Source: www.spiritedpursuit.com

Lighting

The role of lighting in urban environments is subtle and yet fundamental. A properly lit space at night creates a sense of security, it complies with guidance and regulations but, most of all, contributes to extending the life of the town after dark.

Column for text.



Lamu lighting

Good access to places and usage of lighting to underpin or accentuate particular urban values (landmarks, corners, view points, paths, links, hotspots, etc..) contribute to the economic viability of many business operating after dark, particularly around hospitality restoration leisure and art.

Lighting it is also a device used to emphasise physical and cultural values of a town, often domes and pinnacles are lit to, somehow, reinforce places identity.

Lamu – night life



Source: www.monitor.co.ke

Lamu - Corniche Path - various street lighting style



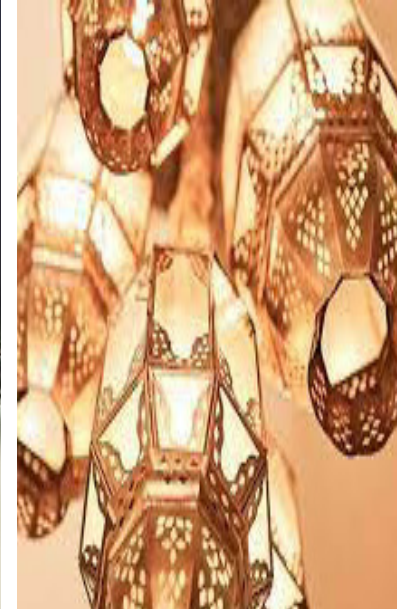
Source: REUTERS | www.hindustantimes.com



Source: www.hoaexp.com



Source: Lamu Fragrance
www.tripadvisor.com



Source: baraza-zanzibar

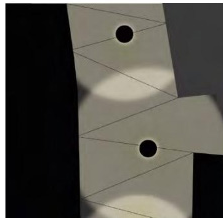


Source: theswahilihousezanzibar

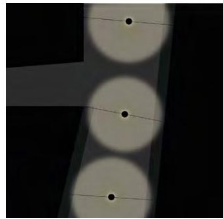
Lighting types

Innovative uses of lighting also contribute to leisure and entertainment, these do not contrast with heritage values of a place, but, to the contrary help point the spotlight to assets worth celebrating.

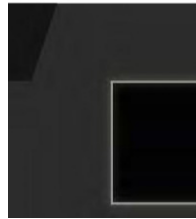
Semi-Shielded
Down Lighting



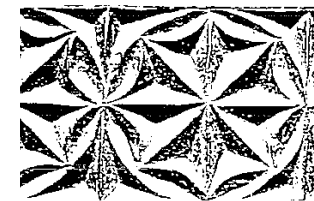
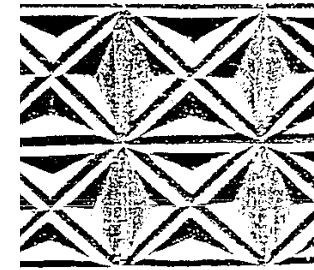
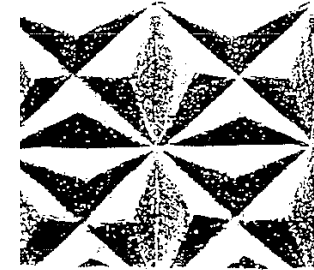
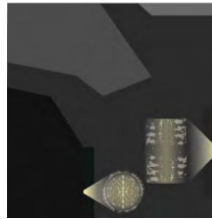
Wired Fully Shielded
Down Lighting



Accent Light



Gobo Light



Swahili pattern used to create interior lamp made of recycled glass bottles- Zanzibar

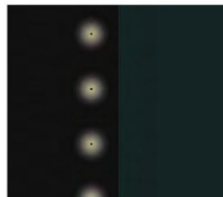


Source: [issuu.com](https://issuu.com/caprifolium) | Caprifolium

Up-lighting



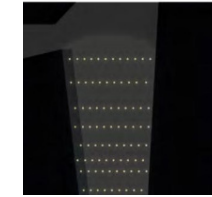
Spread Lighting/
bollard lighting



Ground Light



Fairy Light



Source: Semantic Scholar

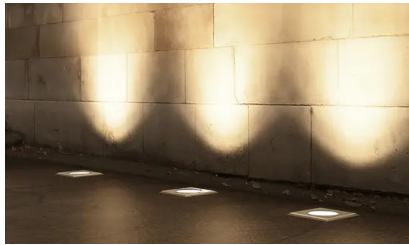
Source: Chako (wfto.com)

Source: [issuu.com](https://issuu.com/caprifolium) | Caprifolium

Lighting examples

These solutions also help extend the offering of a town or natural place. Finally, intelligent and efficient lighting can contribute to the green credentials of a place, balancing technological innovation with service and user comfort.

Example of refined, hidden lighting



Source: Javier Callejas | [Archdaily.com](https://www.archdaily.com) and Influence of Swahili Architecture

Fez



Source: [Thisworldtraveled.com](https://www.thisworldtraveled.com)

Medina – Marrakesh



Source: James Andrews | [Alamy.com](https://www.alamy.com)

Restaurant lamp - Zanzibar



Source: Zanzibar Island - [Tripadvisor.com](https://www.tripadvisor.com)

Fez



Source: [Thisworldtraveled.com](https://www.thisworldtraveled.com)

Tulip lamp – Hotel in Zanzibar



Source: Golden Stonetown - [Tripadvisor.com](https://www.tripadvisor.com)

Street lamp post- Zanzibar



Source: [naTemat.pl](https://www.natemat.pl)

Lighting project - gobo light - Zanzibar



Source: [issuu.com](https://www.issuu.com) | Caprifolium

Street Furniture

Street furniture represent the most direct interface between people and places. The physical interaction with benches, fountains, streetlamps, bins, bollards and items to lean on, all contribute to creating spaces for people to stop, socialise, explore and, ultimately, enrich and animate spaces.

In an historical context, location of such items might be restricted or challenging, sometime might be directly embedded with its urban setting and made of rare materials, often sourced locally.

A careful understanding of the role of each component and where these can contribute to improvement of the user experience, will help identify the most suitable approach.

The following images, illustrate a series of historical and contemporary solutions that can be adopted in Lamu Old Town and across the study area.

Such solutions, if adopted at scale, might spur both local employment and perpetuate the traditions of stone and wood carving, woodworking, etc.. If properly marketed, demand for such skills and products, might expand beyond Lamu's geography.



Wooden furniture

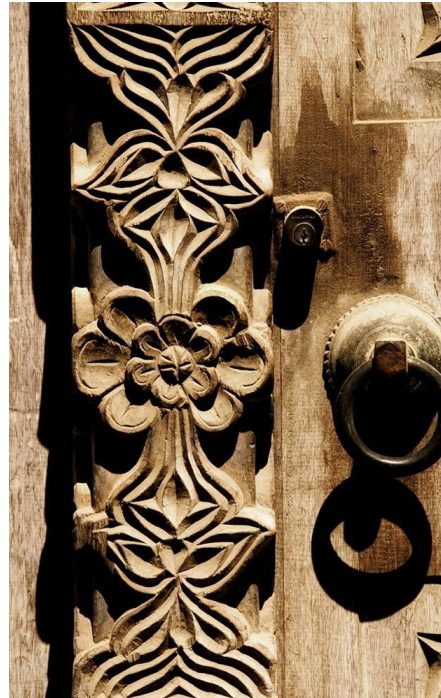


Source: craftingkenya.com

Wooden bench in Lamu



Source: bobbyneptune.com



Source: Carol Beckwith (pinimg.com)



Source: heartwoodcarving.com



Lamu furniture



Source: XodusHouse.com



Source: craftingkenya.com

Swahili modern furniture



Source: Jua Deck | Saba Studios

Wooden bench examples



Source: craftingkenya.com



Source: Wilhelminadesigns.com

Slat bench with backrest



Source: ww-99.top



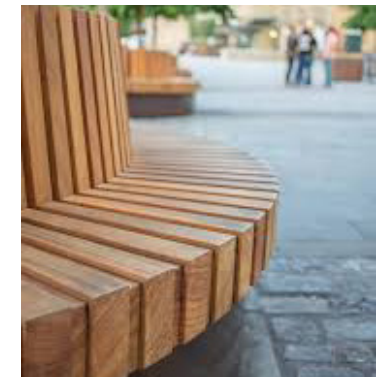
Source: Jardinessinfronteras.com



Source: www.pinterest.com

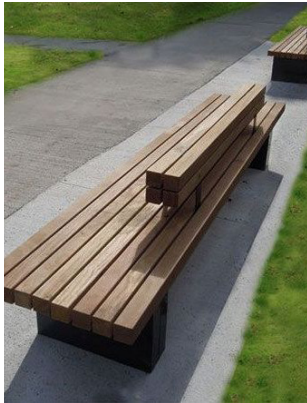


Source: urbansf.co.uk



Source: Macgregor Smith /
Woodscape.com

Wood log bench
with backrest



Source: [FresHOUZ.com](https://www.freshouz.com)



Source: Tiptree Seat: BX14 4030-BP | [Broxap.com](https://www.broxap.com)

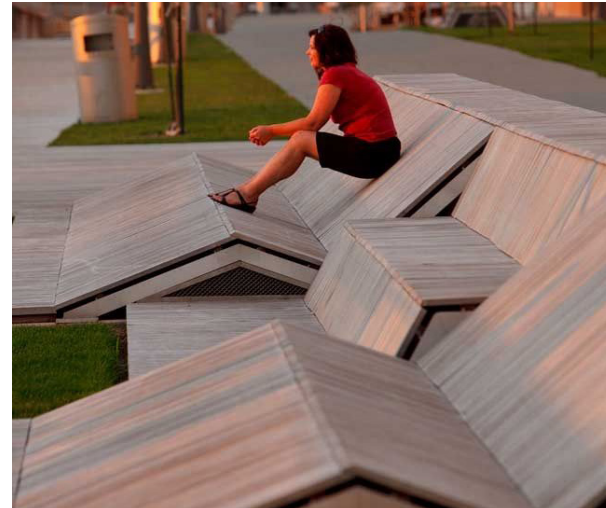
Wood log bench



Source: [decirculairebouwcatalogus.nl](https://www.decirculairebouwcatalogus.nl)



Source: [Foter.com](https://www.foter.com)



Source: Chris Reed | [metropolismag.com](https://www.metropolismag.com)



Source: [Landezine.com](https://www.landezine.com)

Stone/concrete bench examples

Swahili carvings



Source: fraplastar.com

Coral stone



Source: www.stonecontact.com

Zanzibar bench



Source: Charles . O. Cecil / Alamy.com



Source: Nigel Pavitt / Alamy.com



Source: pl.wikipedia.org

Traditional



Source: www.indiamart.com



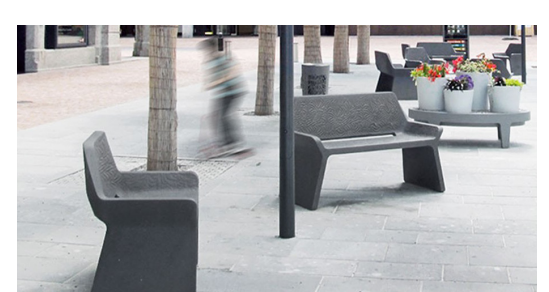
Source: www.stonecontact.com



Source: Escofet Architonic

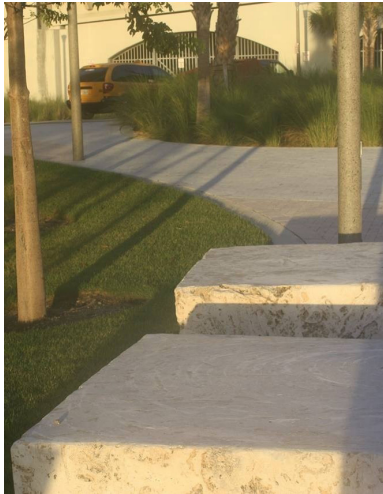


Source: ESCOFET



Source: Aurel design urbain

Contemporary



Source: lcrsperspectives.com



Source: BaranaArchitonic

Concrete bench with wooden seat



Source: Margarita Jover (3dmdb.com)



Source: Escofet Architonic

Woven concrete bench



Source: CANET Federico Arrieta (pinimg.com)



Source: www.architonic.com



Source: 3dprintingmedia.network



Source: lulu-stories.com

Practical Applications



Current Issues



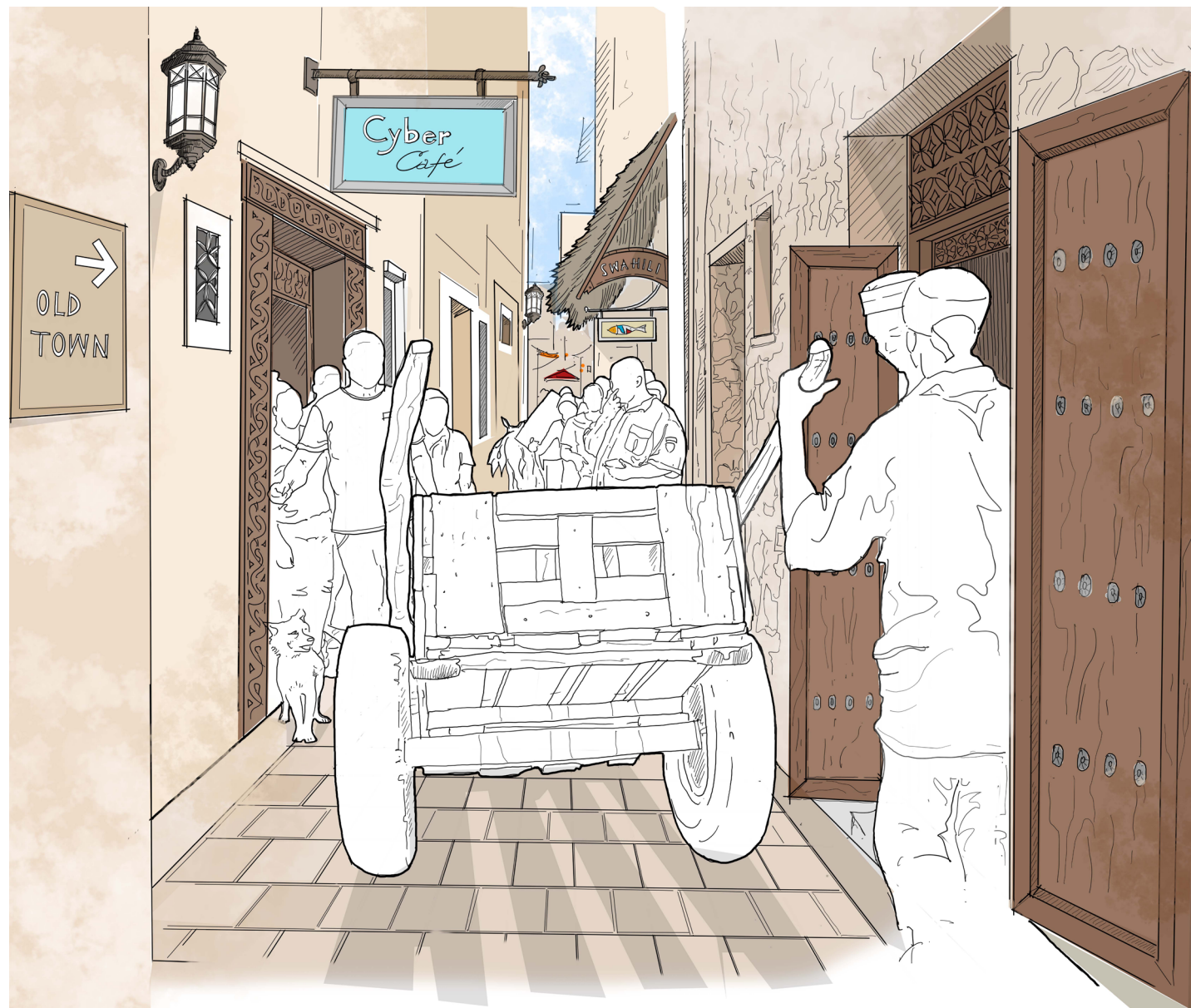
Source: Atkins site visit

Sketch



Source: Atkins site visit

Sketch: Traditional delivery



Source: Atkins site visit

Sketch: Future of Lamu Old Town



Source: Atkins site visit



