AN ECONOMIC STUDY OF THE MOI SOUTH LAKE ROAD (C707), NAIVASHA

FINAL REPORT

SEPTEMBER 18, 2020

HEZEKIAH AGWARA

OGIVES LTD

OGIVES Limited conducted an economic study of the Moi South Lake Road to build a business case for its upgrading to improve market access and competitiveness of enterprises operating in the area. This report demonstrates the linkages between road investment and local economic development and industry competitiveness by highlighting the case for and value of upgrading the road. The report proposes reclassifying the road to class C, upgrading it to traffic class T3 and building a 7m wide carriageway with proper drainage. It finds that the road is worth at least KES 160 billion annually and the proposed upgrading project is economically viable – generating KES 105 billion in economic benefits, an EIRR of 50%, and BCR of 85. The project would also create 21,000 additional jobs. The results strongly support investment in its rehabilitation and recommend that the ongoing project be restructured in favor of the proposed alternative.

AN ECONOMIC STUDY OF THE MOI SOUTH LAKE ROAD (C707), NAIVASHA

FINAL REPORT

EXECUTIVE SUMMARY

To effectively improve the competitiveness of the horticultural and tourism industries, stakeholders have identified transport infrastructure as a major constraint to market access. Specifically, the Moi South Lake Road in Naivasha, a major transport artery for export horticulture, tourism and hospitality, and geothermal energy is vital for Kenya's global competitiveness, foreign exchange earnings, and energy futures. Despite its critical role, the road has remained in disrepair because its economic value is less understood. This prompted the Kenya Horticulture Market Access Programme (KHMAP) to commission an economic study of the road in May 2020 to build a Business Case for its rehabilitation. The purpose of the assignment was to analyze and document the socio-economic value of the road to the local and national economies and its impact on Kenya's competitiveness in horticultural exports, tourism and energy sectors.

The study applied the local economic development and economic base approaches to develop a value proposition for reclassifying and upgrading the road. It involved profiling and conducting an economic base analysis of the Naivasha economy to classify the various sectors and demonstrate the role of the road in economic development. Specifically, the study sought to investigate the road's potential impact on the competiveness of businesses and investment. Economic and financial analyses were done using the cost-benefit analysis approach to derive a set of project valuation metrics to be used in building a business case for the investment. The analysis road user costs applied the Highway Development Model (HDM-4) 2018 developed by the World Bank. The results of the study are summarized below and discussed in the report.

A CRITICAL ROAD NEGLECTED

The road is a critical artery serving KES 160 billion local economy with over 40 export horticulture farms, 50+ tourism/hospitality businesses, rapidly growing geothermal energy sector, and nascent industrial and commercial parks. Its persistent poor state hinders market access, global competitiveness and growth of these key sectors.

APPRAISAL SUMMARY

A. Economic Analysis

Economic Base Analysis. The export horticulture, tourism and hospitality, energy, and fisheries sectors are basic sectors of the Naivasha economy; i.e., they earn and employ significantly more than their national share. The sectors contributed about 45% of the local income in 2019 – about KES 54 billion (57% from horticulture). Naivasha earns between 1.7 and 42 times the normal incomes from the four basic sectors annually – the excess is export income. The basic sectors have remained highly resilient and competitive over the years. Each shilling earned in the horticulture, tourism/hospitality and energy sectors injects about 3.90, 6.60, and 8.70 shillings, respectively, into the local economy, and each job generates another 2.3 jobs.

Value of the road. The road supports four major economic sectors that generate approximately KES 160 billion annually. Its upgrading is expected to generate about KES 1.1 trillion over 20 years – i.e., KES 139 billion more than with the current project.

Reconstruction of the entire road. The economic analysis for the upgrading of the Moi South Lake road was sub-divided into three sections: (a) carriageway with shoulders; (b) carriageway with shoulders and narrow foot/cycle paths on either side; and (c) carriageway with shoulders and foot and cycle paths on either side. The road covers 27 kilometers, from the junction with the Old Naivasha – Mai Mahiu Road to Kongoni Center. It is compared to the current project – the ongoing restoration works set for completion in March 2021.

Road User Cost Saving. Upgrading the road would save road users about 31% in transport cost over 20 years, with the highest coming from reductions in value of time cost (60%). The biggest beneficiaries will be passenger buses that could save 47%, followed by cargo transporters and users of personal cars (33%). Overall, vehicles operating on the road would save KES 22 per vehicle-km, on average, with cargo trucks and buses saving KES 40 and KES 88, respectively. The vehicle fleet expected on the road could cumulatively save approximately KES 1.2 billion annually.

The cost savings have enormous implications on the cost of doing business. Businesses using trucks to transport horticultural produce and those using vans/buses to transport workers and tourists could save about 10% in transport costs annually on the road. Users of personal cars are expected to save about KES 260,000 per year – which is equivalent to about 35% increase in salary, which would inject about KES 2.7 billion into the economy annually.

The traffic level (Annual Average Daily Traffic-AADT) and results of the economic analysis. Economic Internal Rate of Return (EIRR) and Net Present Value (NPV), using a 12% discount rate and traffic projections over a 20-year design life, are summarized in Table 12. The results suggest that the economic viability of the project is robust, with the defined changes in the key parameters having little impact on overall viability. The road is expected to generate between KES 104 billion and KES 105 billion in economic benefits. The total economic impact of upgrading the road is about KES 226 billion.

Sensitivity Analysis. The EIRR sensitivity analysis results 40% and is robust. In a base case scenario, the EIRR is 50% while options PRO3 and PRO4 returned 39% and 31%, respectively. With a reduction of traffic of 20 percent and increase in construction cost of 20 percent, the EIRR is 40%.

Rationale for public involvement. Due to the current poor road condition and high value economic activity in the project area, traffic volume is high but the distance too short for a toll road option at this stage. This is a development project, which is considered as a public domain, as it will improve connection to important public infrastructure installations and economic sectors. Although, it is difficult to develop a Public and Private Partnership (PPP) for this specific project at this moment, the project can pool funds from the Kenya Roads Board and other the Ministry of Transport, Infrastructure, Housing and Urban Development (MoTIHUD). In addition, the investment is expected to generate between KES 33 billion and KES 72 billion in additional tax revenues and create about 21,000 additional direct jobs (64,000 total) that would support about 200,000 people in Naivasha.

B. Technical

An Engineer's BOQS was developed to facilitate economic analysis of the project. However, detailed engineering design and feasibility study, including measures of traffic flows, should be undertaken before rehabilitation commences. The road will have one carriageway with two lanes, each with a width of 3.5 meters. The width of the shoulders is 0.5 meters on each side. There are provisions on each side for pedestrian footpaths and cycling lanes of 1.5 meters each. It provides for drainage on each side and bus bays and road furniture. The pavement design proposed constitutes a 300 mm class S3 subgrade, a 150 mm 6% cement/lime stabilized natural gravel sub-base, a base of 125 mm of 2% cement improved graded crushed stone (GCS), and 50 mm thick asphalt concrete (AC) wearing course. The pavement on the shoulders and NMT lanes is similar to the carriageway standard but finished with 35 mm thick AC wearing course. The cost estimate is in the range of KES 1.73 billion to KES 2.9 billion (KES 64 to KES 106 million per km), including construction, contingencies of 7.5%, and 14% VAT.

Alternatives. The engineering design was based on a higher and heavy traffic forecast, which resulted in T3 design traffic class and the subsequent thicker pavement. The traffic assumption can be revised to be in the acceptable range and a design traffic class modified accordingly to make pavement design option economical and technically sound. To ensure sustainability, it proposed that the upgrading works be followed up by long term Performance Based Maintenance Contracting.

THE BUSINESS CASE

The CBA results strongly suggest that the road not only offers higher value for money but is also closely aligned with Kenya's policies and strategies.

- **Strategic Case.** The project is well aligned with Kenya's Vision 2030, the Big Four Agenda, and the Agricultural Sector Transformation & Growth Strategy (ASTGS) 2019-2029, all of which emphasize the vital role of infrastructure in economic development. In addition, it aligns closely with the Nakuru County development strategies outlined in the CIDP 2018-2022 and the Spatial Plan 2015-2045. It also addresses the competitiveness of sectors at the center of Kenya's economic strategy – exports, energy, tourism and the blue economy. The project is equally vital for the viability of the special economic zones (SEZ) being developed in the area.

- **Economic Case.** The project is on a high-value road supporting major economic sectors that generate approximately KES 160 billion annually. It is found to be high value for money with a BCR of 2.7; about 85 if induced economic benefits are included. Each shilling invested on the road is expected to generate about KES 2.70 and potentially up to KES 85. Moreover, the NPV

per km is KES 124 million (170% of the unit investment cost), which rises up to KES 3.9 billion with wider economic benefits; each shilling invested would return benefits about 85 times the unit cost. As such, the project is high value for money and more than able to pay for itself.

- Financial Case. Results of project affordability and budgetary analysis show that the EIRR is 31-50%, which is 30-40% points higher than comparable market returns in Kenya (e.g., the infrastructure bonds). The repayment period is approximately 5.5 years. Furthermore, the government will earn about KES 27-59 billion in tax revenues; the tax burden of the project is about 2-4% of the expected tax revenues. Consequently, the project is not only financially viable and more than capable of paying for itself from road user cost savings alone but also highly budget friendly – affordable.

  Results of the budgetary implications are shown in Table 15. The total cost of the project is about 2-3% the allocation for design, rehabilitation and maintenance of roads and bridges in the Kenya Budget 2020/21; the annual capital investment alone is between 0.8% and 1.3%. The total investment is about 3-5% of the KRB's total disbursement for FY2019/20, and about 2-3% of KeNHA's development and maintenance budget for FY2019/20. The annual capital investment is equivalent to about 1-2% of the GOK roads & bridges budget and KeNHA's annual budget for roads development and maintenance.

CONCLUSION AND RECOMMENDATIONS

The results presented provide strong strategic, economic and financial support for the road investment; there not only is very high value for money but the project can also more than pay for itself. It is recommended that the road be reclassified to category C and placed under KeNHA because the standards and level maintenance required is beyond KeRRA's current capabilities. Moving it to KeNHA will avail more resources not only for rehabilitation and maintenance but also allow for better traffic management. The road should be designed with the ultimate goal of joining it up with the North Lake Road Phase 2 project to form a Loop from A8 and linking it to Mai Mahiu, the Naivasha ICD and the upcoming Industrial Parks via the Kongoni-Duka Moja-Maela section. Since the upgrading is considered urgent, it requires implementation and financing mechanisms that can mobilize the necessary resources fastest. The most obvious option is to restructure the ongoing project and boost the budget to accommodate the proposed alternative.

ACKNOWLEDGEMENTS

The study was conducted by OGIVES Limited (Kenya) under the leadership of Dr. Hezekiah Agwara, with research assistance from Mr. Michael Kalo and Ms. Maureen Juma. Eng. Caren Oyollah (civil engineering and project management expert) conducted the analysis of the road and prepared the BOQS that guided the economic analysis done and reported herein.

This report is made possible by the support of FPEAK through the Kenya Horticulture Market Access Programme (KHMAP). The consultancy was backstopped by Mr. Hosea Machuki, the CEO FPEAK, who assisted with information and provided feedback and guidance on key deliverables. We would like to express our sincere thanks for his tremendous support during the preparation and implementation of the assignment.

We further extend our thanks to all those who participated in the study, especially the business establishments that agreed to provide information that helped our understanding of the area and selected sectors and upon which some of the findings are based. We are grateful to all the participants and contributors at the Stakeholders' Workshop held in Naivasha on August 27, 2020. Our sincere thanks go to those who offered very useful comments and suggestions to improve the report.

It is our hope that this product of a collaborative effort will not only better inform advocacy for this critical project but also assist other partners and private sector actors in contributing to Naivasha's continued competitiveness and transition to long-term sustainable business.

This report is a product of a consultancy contract with FPEAK. Whereas it was prepared in close consultation with FPEAK and great care taken to ensure accuracy of its contents, the views, findings, interpretations, and conclusions expressed herein do not necessarily reflect those of FPEAK. The contents and any errors or omissions are the sole responsibility of OGIVES Ltd.

Hezekiah Agwara, PhD
Executive Director & Principal Consultant
OGIVES Ltd
Nairobi, Kenya
September 2020

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

AADT	Average Annual Daily Traffic
AC	Asphalt Concrete
ADF	African Development Fund
AfDB	African Development Bank
ASTGS	Agricultural Sector Transformation & Growth Strategy
BCR	Benefit/Cost Ratio
BKS	Billion Kenya Shilling
BOQS	Bill of Quantities
CAGR	Compounded Annual Growth Rate
CBA	Cost-benefit Analysis
CIDP	County Integrated Development Plan
EBA	Economic Base Analysis
EIRR	Economic Internal Rate of Return
EMC	Emissions Cost
EPRA	Energy and Petroleum Regulatory Authority
ESIA	Environmental and Social Impact Assessment
FDI	Foreign Direct Investment
FLF	Fuel Levy Fund
FPC	Fresh Produce Consortium of Kenya
FPEAK	Fresh Produce Exporters Association of Kenya
GCP	Gross County Product
GCS	Graded Crushed Stone
GDP	Gross Domestic Product
GLP	Gross Local Product
GoK	Government of Kenya
GWh	Gigawatt Hour
HDM	Highway Development Model
HIV/AIDS	Human Immunodeficiency Virus Infection/Acquired Immune Deficiency Syndrome
ICAF	Industry Competitive Analysis Framework
ICD	Internal Container Depot
JKIA	Jomo Kenyatta International Airport
KenGen	Kenya Energy Generation Company
KeNHA	Kenya National Highway Authority
KeRRA	Kenya Rural Roads Authority
KES	Kenyan Shilling
KETRACO	Kenya Transmission Company
KFC	Kenya Flower Council
KHMAP	Kenya Horticulture Market Access Programme
KHRC	Kenya Human Rights Commission
KIHBS	Kenya Integrated Household Budget Survey
KNBS	Kenya National Bureau of Statistics
KRA	Kenya Revenue Authority
KRB	Kenya Roads Board
KTA	Kenya Tourism Authority
KTSSP	Kenya Transport Sector Support Project
KURA	Kenya Urban Roads Authority

KWS	Kenya Wildlife Service
LED	Local Economic Development
LNGG	Lake Naivasha Growers Group
LQA	Location Quotient Analysis
MICE	Meetings, International Conferences, Events and Exhibitions (MICE)
MNC	Multinational Companies
MoTIHUD	Ministry of Transport, Infrastructure, Housing and Urban Development
MSLR	Moi South Lake Road
NMT	Non-motorized Traffic
NPV	Net Present Value
PPP	Public and Private Partnership
RSIP	Road Sector Improvement Program
RST	Road Safety Cost
RUC	Road User Costs
SCF	Standard Conversion Factor
SEZ	Special Economic Zone
SSA	Shift/Share Analysis
STDs	Sexually Transmitted Diseases
THS	Tourism and Hospitality Services
TMEA	Trade Mark East Africa
ToR	Terms of Reference
TTF	Transit Tolls Fund
VAT	Value Added Tax
VfM	Value for Money
vkm	Vehicle-kilometre
VOC	Vehicle Operating Costs
VTC	value of time cost
WB	World Bank

1.0 PROJECT RATIONALE

The Fresh Produce Exporters Association of Kenya (FPEAK) is implementing the Kenya Horticulture Market Access Programme (KHMAP), a two-year project supported by Trade Mark East Africa (TMEA), in a consortium with the Kenya Flower Council (KFC) and Fresh Produce Consortium of Kenya (FPC Kenya). The project aims to improve the competitiveness of and enhance market access for Kenya's horticultural produce. To effectively improve the competitiveness of the horticultural industry, the KHMAP identified transport infrastructure as a major constraint to horticultural production due to the key role transport and logistics costs play in enterprise and export competiveness. It is for this reason the Moi South Lake Road (MSLR) is a priority to the industry. It not only serves the backbone of Kenya's export horticulture industry, Naivasha, but is also an important artery for the tourism and hospitality and geothermal energy generation industries.

Despite its critical role serving key strategic and economic installations and businesses, the road has remained in disrepair for years and increasingly unsuited to serve the needs of rapidly expanding businesses and economic activity. Key stakeholders have identified the development of the road as of immediate priority for the continued competitiveness of the export horticulture and tourism businesses. The KHMAP consortium considers the case for the road's upgrading very strong. However, there are no studies to document the roads impact and build this case. Consequently, the Consortium commissioned an economic study to build a Business Case that can be presented to the government and key stakeholders to support the road investment.

The study sought to profile the economy served by the road and conduct economic analyses to:

1. Assess and document the financial and economic importance of the road to the local and national economies;
2. Evaluate the financial and economic feasibility and viability of upgrading the road;
3. Examine the implications of the road remaining in its current state on the competitiveness of Kenya's horticultural exports and other sectors were; and,
4. Build a business case to support advocacy for its upgrading.

Upgrading the MSLR encompasses all the five strategies for local economic development. The main case for it is the considerable value it presents in pursuing a coordinated program of business retention, expansion and development for the area. It is vital for not only retaining the existing business establishments and encouraging them to invest more in the area but also attracting new investments. Its development will encourage the strategic use of the community's natural attributes to create an environment more conducive to investment, specifically by companies already established in the area.

The road is absolutely critical for the retention and expansion of the well-developed horticulture, hospitality/tourism, and energy businesses. These industries are diversifying to integrate vertically and horizontally, including the development of mixed use special economic zones (SEZ); these require good infrastructure support to be attractive to private investors, viable and competitive. The MSLR is central to these endeavors and must be made fit for current and future socio-economic purposes.

2.0 STUDY METHODOLOGY

The KHMAP Consortium commissioned the study to provide a comprehensive economic analysis of key sectors in the economy of Naivasha and Kenya and the impact of the road on their competitiveness. This is aimed at developing strategies to expand market access, increase incomes, and improve food security. The consultant interpreted this as an analysis of strategic investment to make the local economy healthy, vibrant and growing, by increasing the net flows of new money. It is an effort to unlock a major development bottleneck to spur business growth, enhance competitive advantage and increase wealth.

The consultant was required to conduct detailed analyses based on reviews of literature, data gathered from other sources and experience, and field surveys. A strong focus was on the different aspects of the local economy and the industries supported by the road, with a goal of making a Business Case to lobby the national and county governments to allocate resources for its upgrading. For the selected industries, the assessment exercise needed to answer several related questions:

- What is the contribution of the industry to Kenya's economy and household livelihoods?
- How well is the industry developed, where are the binding constraints that limit its development and sustenance, and how can these constraints be alleviated?
- How significantly would the road investment improve market access, the business environment, and the standards of living of residents?
- What kind and levels of investment is required to upgrade the road? Is the investment feasible and viable in the short, medium and long term? Who will make the investment?

These questions entailed the assessment of two sets of parameters – the magnitude of the net benefit derivable from upgrading the road and the feasibility of the project, including long-term sustainability. Generally, local economic development (LED) analysis guided the study. It considered LED as a combination of individual programs or initiatives – each having multiple stakeholders, selected as part of a strategy to stimulate the economy of a region and the competitiveness of its sectors. The consultants evaluated and estimated the costs and benefits of upgrading the road and the kind of investment necessary. Particular emphasis was placed on sufficient analysis to effectively determine market attractiveness, size, growth, and competitive environment for the industries served by the road.

Specifically, the study examined how upgrading the road would help exploit the available opportunities and mitigate against any threats. The assignment was implemented in three phases, starting with an Inception report, followed by collection and analysis of data, and finally the preparation of draft and final reports with the Business Case.

The study applied the following methods:

Economic Base Analysis

The first task was to profile and analyze the local economy to understand its dynamics and key economic drivers. The economic base theory guided this exercise. The theory postulates that strengthening and growing local economies require the development of the basic (non-local) sectors. The study, therefore, first profiled and identified the major economic sectors and evaluated their natural competitive advantages. The economic base analysis (EBA) sought to:

- Understand the local economy served by the road and the role of the targeted sectors.
- Appraise the costs, benefits, and gross value added in upgrading the road.
- Make projections about the local economy using the shift-share projection technique.
- Build a Business Case to demonstrate that the stated objectives of the investment can be met and the anticipated benefits can be realized.

The preferred approach to the EBA was the Location Quotient Analysis, which calculates and analyzes location quotients (LQ) for each industry/sector. The LQ is a measure of the relative concentration of each industry or sector in a region compared to a reference area. It is a method for estimating the potential economic impact of a project derived from comparisons of local sectors' share of employment and/or income with their share in the reference area, in our case, Kenya. The LQ can be equal to, less than, or greater than 1, which are interpreted to mean the local sector's share is the same, less than, or greater than its national share; if the latter, the it produces more goods and services than are consumed locally, and therefore exports to other regions or foreign markets. This simple calculation also helps analysts to examine changes in sector competitiveness over time – whether declining or increasing, and from what size.

The specific objective of conducting the EBA is to calculate **Base Multipliers** – a method for estimating the impact of the basic sector upon the local economy. It measures the amount an injection of employment or income from the sector increases income or employment in the local economy. The base multipliers are applied in the estimation and projection of the impact of changes in the basic sectors.

Cost-Benefit Analysis

The next step after the identification of the base sectors using the EBA was to propose a solution for the road investment and evaluate its economic value. Financial and economic analysis was conducted using the cost-benefit analysis (CBA) method, which compares the "with" and "without" project scenarios over a period of time. The road transport CBA was conducted using the Highway Development and Management Model (HDM-4), which applies multiple road and traffic characteristics and cost parameters to calculate the effects of road/traffic development on road user costs (RUC). The economic costs consist of (i) the capital investment costs; (ii) the routine and periodic maintenance expenses; and, iii) capital investment for major restoration works. The benefits consist of savings in vehicle operating costs and travel time for passengers and cargo. The appraisal period was 25 years, with 2 years of construction, followed by annual routine maintenance starting at 25 months after completion and major works in Year 12 to restore it.

To identify the impacts of upgrading the road on value and risk under different economic and investment scenarios, the net present value (NPV), the economic internal rate of return (EIRR), the benefit-cost ratio (BCR), and the NPV per kilometer (NPV/km) were calculated. The BCR assesses the value for money (VfM) and includes the 'near certain' and 'more than likely' direct user benefits and budget and tax implications. The VfM helps in assessing the magnitude of impacts of the road on commuting users, other users, and businesses. The BCR was adjusted to include additional benefits, such as induced economic and investment impacts, as well as qualitative and non-monetary factors. The EIRR and NPV/km help evaluate the financial affordability of the project – whether the economic returns are sufficiently high to pay for the financial costs of implementation.

Business Case

To persuade the stakeholders of the importance of upgrading the road, a case was built to robustly demonstrate the need for its development and how the investment meets those needs and aligns with broader public policy and strategic objectives. We provide evidence that the investment provides value for money, is financially affordable and deliverable, and is valuable to society. That is, the BC makes the 'strategic case' to demonstrate the need for the upgrading and how the investment meets those needs and aligns with broader policy objectives. It also demonstrates that the project is: 1) Value for money – the 'economic case'; 2) Financially affordable – the 'financial case'; 3) Achievable – the 'management case'; and, 4) Sustainable. This study focused on the strategic, economic, financial and sustainability cases, leaving out details on the 'management case' for later – after definite decisions are made to develop the road.

Data Collection

The study relied on secondary data and information because the prevailing conditions during the COVID-19 pandemic control do not permit free movement out of Nairobi. The following approaches were used for data collection: 1) Literature and document review; 2) Key informant interviews; and, 3) Semi-structured interviews. Data was collected economic activity, demographics, employment, inputs/output, tourist visits, income, traffic volume, transport cost and time, and cost of road building. These were extracted from various publications by Kenya National Bureau of Statistics (KNBS), FPEAK and KFC, Kenya Tourism Board, Kenya Tourism Authority (KTA), KenGen, KWS, and Nakuru County government (e.g. CIDPs).

Because statistical inference was not required and the population of the various actors are known, additional data collection emphasized getting respondents with a high diversity of opinions, knowledge of (or linkages with) the sectors and markets, and accessibility to the consultants in short notice. This process included a Stakeholders' Workshop held in Naivasha on August 27, 2020 to present the report to a diverse audience of key stakeholders and solicit feedback. The discussion and feedback were used to revise the report to the version presented here.

3.0 SITUATION ANALYSIS

The key constraint hindering sustained competitiveness of the export horticulture industry is transport and logistics bottlenecks that exert significant costs on exporters. The state of the roads connecting remote farms to the main highways is relatively poor; given the perishable nature of fresh produce, this leads to high produce losses – quantity, quality and market timing. According to Hortiwise (2012), poor roads in production areas negatively impact on transport quality and time – delayed deliveries of cut flowers to the airports can cause significant deterioration (excessive warming) in quality (vase life). For the hospitality and tourism industry, poor roads reduce the attractiveness and value of a location, thus leading to fewer visitors and lower bed occupancy rates, particularly during the low seasons.

Roads are essential for economic development, as they facilitate movement of people, goods and services to and from areas of economic and social activity. The safety and efficiency by which such movement is facilitated is a key driver of economic performance, particularly in local economies. As enablers of production and trade, roads generate several benefits, such as increased business and

trade, agricultural productivity, and access to social amenities. According to the World Bank (2014),[1] road infrastructure investment and GDP growth are nearly perfectly correlated; a 1% increase in road investment increases GDP by 1%. A review of evidence on the impact of extending rural roads networks by Hine et al (2016) found a strong increase in opportunities for non-agricultural employment, traffic volume, agricultural output, and access to services, and reduction in transport costs and poverty.

3.1 Role and Condition of the Road

Road infrastructure is one of the most important public assets in Kenya. In addition to the significant value of the stock of roads, over 90% of freight and passenger traffic is transported by road, which means accessibility and conditions of roads network greatly influence various costs incurred by households and businesses. Being the big business and strategic assets they are, roads require prudent and effective continuous development, management and maintenance.

Naivasha is a strategic economic region because of its significant contribution to Kenya's GDP, investment, trade and foreign exchange. For Nakuru County, the region is a major economic engine – contributing over 20% of the gross county product (GCP). The main economic anchors to the region are the export horticulture, tourism and hospitality, and energy industries, which generate about KES 72 billion annually for the national and local economies – equivalent to approximately 1.5% and 30% of the Kenya and Nakuru GDP, respectively.

The fulcrum of the economy is the south of Lake Naivasha, specifically that traversed by the MSLR, which hosts several multinational companies that anchor Kenya's horticultural exports and high value tourism, and bring significant foreign direct investments; it is their only link to international markets through the Jomo Kenyatta International Airport. These companies are responsible for about 65% of Kenya's exports of cut flowers, particularly global suppliers of cuttings for propagation of flower plants. In addition, with more than 50 tourism establishments, including one five-star and three four-star hotels, and the famous Hell's Gate and Mount Longonot national parks, this region accounts for approximately 4% of Kenya's annual tourism activity, earning over KES 10 billion annually. Most importantly, the area hosts Kenya's strategic public and private geothermal energy generation installations that account for about half the national electricity supply.

Despite its demonstrably important role in the local, national and international economies, the MSLR has remained underdeveloped. It is not only unclassified but also in a state of disrepair. It is unsuitable for the current traffic needs, which include medium and heavy trucks hauling bulky agricultural inputs and fresh produce, tourism vehicles, and personal cars. Problems related to the poor condition of the road result in enormous loses for industries and employees, with horticulture industries suffering losses related to product shipment and the tourist sites and hotels suffer losses related to local and international guest canceling bookings. In addition, it results in increased operational costs related to transporting products to the market.

[1] Calderon & Serven (2014). Infrastructure, Growth, and Inequality: An Overview. The World Bank.

Part of dilapidated Mos South Lake Road in Naivasha, Nakuru county. Photo/PD/Kinera Mwiti

The road is in dire need of improvement to provide accessibility to increasing numbers of people and volumes of goods and services. In September 2019, the horticulture and tourism/hospitality industry representatives brought the status of this road to the attention of the national government. The government procured and allocated funds for repairs, with the contractor commencing the works in late October. However, not only have the works performed been below the basic minimum standards required but also the project has stalled. During and after the heavy rains in April and May 2020, the road became impassable because of flooding due to poor technical design and construction flaws. This continues to impose serious problems and high costs on the users of the road. The following pictures depict the current state of the road.

Side road detour to avoid badly damaged sections. Author's photo

Badly damaged shoulders. Author's photo

Private sprinklers at V.D. Berg Flowers to reduce dust on the road. Author's

After numerous complaints, the Cabinet Secretary for Transport and Infrastructure visited the site in early June and promised to revive the works with a budget of KES 398 million and a completion date of March 2021. The contractor has been on site since July and done the first section by end of August. Major industry players however are dissatisfied with mere repairs of the road and want it reclassified and upgraded to a higher capacity capable of safely and efficiently carrying the heavy loads of trucks serving the horticulture and energy establishments and increasing number of cars and vans ferrying tourists and employees. The observed quality of the works is below the expected standards. The photos below show the condition of the road during repair works in July, giving a hint to the kind of repairs being undertaken – scraping off the tarmac over 21km, stabilizing the carriageway pavement over the first 13km, and applying a new 35 mm AC wearing course.

Current contractor's site at entrance to the road in July 2020. Author's photo

3.2 Solution Requirements

In this section, we propose an alternative solution that meets most requirements of the stakeholders at an affordable cost. It evaluates the cost and benefits of reclassifying and building a road of traffic class T3 capable of carrying the moderate to heavy loaded wide trucks and serving the current and expected higher traffic volumes as the area economy and population grow. In the sections that follow, we compare this option to the ongoing project to determine its economic viability. The objective of this step was to collect information and data on key variables to build a case for upgrading the road.

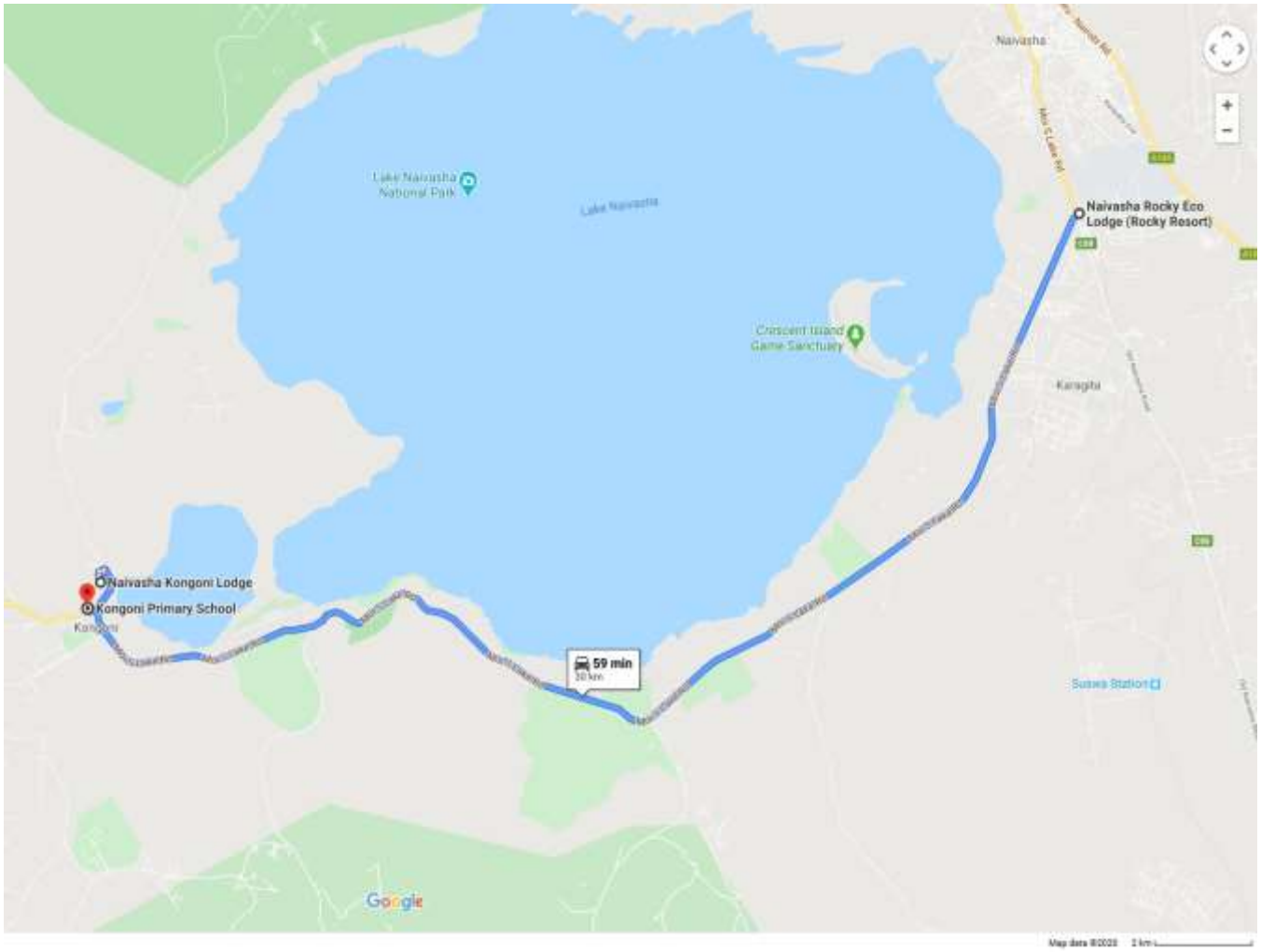
The proposed road runs for 27 kilometers from the junction with Old Naivasha Road to Kongoni Market Center, and also links to Kongoni Primary School, Kongoni Police Station and Kongoni Lodge. The following solutions were considered:

1. Current project: Repair works on the carriageway to apply 35 mm AC wearing course over 21 km, including base stabilization over 13 km. The basic characteristics include: i) roughness = 5.3; ii) road texture depth = 0.35; ii) roadside friction = 0.45; and, iv) NMT friction = 0.45.

2. Proposed project: Reclassification to road class C and upgrading to traffic class T3. The basic characteristics include: i) 2-lane carriageway width = 7 m; ii) AC wearing course = 50 mm; iii) roughness = 3.0; iv) road texture depth = 0.69. This alternative has four options, as shown in Table 1.

An Engineer's BOQS was developed to facilitate economic analysis of the project. However, detailed engineering design and feasibility study, including measures of traffic flows, should be undertaken before rehabilitation commences. The road will have one carriageway with two lanes, each with a width of 3.5 meters. The width of the shoulders is 0.5 meters on each side. There are provisions on each side

for pedestrian footpaths and cycling lanes of 1.5 meters each. It provides for drainage on each side and bus bays and road furniture. The pavement design proposed constitutes a 300 mm class S3 subgrade, a 150 mm 6% cement/lime stabilized natural gravel sub-base, a base of 125 mm of 2% cement improved graded crushed stone (GCS), and 50 mm thick asphalt concrete (AC) wearing course. The pavement on the shoulders and NMT lanes is similar to the carriageway standard but finished with 35 mm thick AC wearing course. Key features of the project alternatives are presented in Table 1.



Our analysis suggests that the current project is untenable even in the short to medium term because the condition of the road pavement is bad and drainage poor, making the road to wear off and erode easily during the rainy season. Our assessment is that it is not any better than the status quo, for it proposes a very short term and more expensive solution in the medium to long term. The maintenance repairs that will be required either annually or biannually to keep the road in reasonably usable condition are neither financially viable nor likely to improve the road condition significantly. Consequently, we anticipate persistent deterioration that will continue to impose additional costs on road users and businesses. If not upgraded, its persistently poor state might force some of the existing businesses to exit and tourists to continue shunning the area.

From all possible alternatives, the best is that that rebuilds the road to the standards matching the current needs of users and anticipated future needs. These needs include an increasing demand for a

wider road, given the increasing number of medium to heavy loaded trucks on the road, and provision for non-motorized traffic (NMT) to cater for workers, residents and tourists. We retained PRO2 for purposes of analysis – road Class C, traffic class T3, 7m carriageway with 0.5 m shoulders on both sides on 50 mm Asphalt Concrete (AC) wearing course. The road should be capable of carrying moderate to heavy loaded trucks common on the route and serving the increasing traffic volumes. It will ensure wider and better connections, better linking the area with Nairobi and global markets. The project works will be confined to the existing alignment, while improvements to the horizontal and vertical alignments will be contained within the road reserve. The BOQS estimates the cost of building the road are contained in Table 1 and Appendix 2, Table 23. In subsequent sections, we analyze its economic viability through financial and economic analysis.

Table 1: Project Alternatives for Moi South Lake Road

Description	**Current Project**	**Proposed Alternative****			
		Base (PRO1)	*Project 1 (PRO2)*	*Project 2 (PRO3)*	*Project 3 (PRO4)*
Length (km)	21	27	27	27	27
Width (m):					
Carriageway	6	7	7	7	7
Shoulders (each side)	None	None	0.5	0.5	0.5
NMT (each side)*	None	None		1.5	3
Drainage (both sides)	None	Invert block drains	*ditto*	*ditto*	*ditto*
Pavement structure:					
Subgrade	As is	300mm class S3	*ditto*	*ditto*	*ditto*
Sub-base	As is	150mm 6% cement / lime stabilized natural gravel	*ditto*	*ditto*	*ditto*
Base	Stabilize	125mm 2% cement improved graded crushed stone (GCS)	*ditto*	*ditto*	*ditto*
Wearing course (AC)	35mm	50mm	*ditto****	*ditto****	*ditto****
Traffic class	??	T3	*ditto*	*ditto*	*ditto*
Cost (KES Million):					
Sub-total 1 (construction)		**1,245**	**1,415**	**1,878**	**2,341**
Sub-total 2 (incl. contingency + variation)		**1,339**	**1,521**	**2,019**	**2,517**
Grand Total (*incl. VAT*)	**398**	**1,526**	**1,734**	**2,302**	**2,870**
Total Per Km	*19*	*57*	*64*	*85*	*106*

Note: * Non-motorized Traffic (NMT) includes pedestrian footpaths and cycling lanes; ** The only difference between the Base case and the other alternative options is provision for road shoulders and NMT; *** A variation of Engineer's BOQS to 50mm for carriageway and 35mm for NMT.

Source: Author's tabulations from Engineer's BOQS

4.0 ECONOMIC ANALYSIS

The study undertook an economic base analysis to assess the economic significance of the industries to understand the potential for maximizing their impact. This included an assessment of the social and economic profile of the Naivasha area and key sectors that provide employment and income. The profiling includes analysis of industry competitiveness to assess each sector's competitive advantage.

4.1. Profile of the Local Economy

4.1.1. PHYSICAL DESCRIPTION

Climatically, Naivasha is a semi-arid area, with bimodal annual rainfall ranging from less than 500 mm to more than 1900 mm. Geologically, the area is characterized by generally deep groundwater tables with shifting subsurface volcanic dynamics. The Sub-County forest cover is estimated at 4% - comprising of mostly indigenous trees, with the rest natural cover dominated by shrublands, arid grasslands, and a rich riparian zone bordering Lake Naivasha. Lake Naivasha is a freshwater crater lake covering 139 km^2 and is the only fresh water lake situated in the Kenyan Rift Valley, approximately 100 km northwest of Nairobi city. Its catchment area is large – approximately 3400 km^2, stretching from the Aberdares ranges in the north to the Longonot mountains in the south, and between Mau escarpment in the west, Eburru in the North and Kananga plateau in the east. The Lake has rich natural biodiversity that attracts thousands of local and international tourists.

4.1.2. DEMOGRAPHIC AND HEALTH PROFILE

The population of Kenya was enumerated at 47.5 million during the 2019 Kenya Population and Housing Census, growing at about 2.2% annually. Nakuru County population was 2,162,202 and is expected to rise to 2,400,367 in 2030 and 3,013,869 in 2050. One of the most populous areas of the County is Naivasha sub-county, with 16% of the county's population. Naivasha experienced significant increase in population over the decade between 2009 and 2019, from 253,224 people to 355,383 – an annual growth rate of 3.4%. The population lives in 111,493 households (3 persons each) at density of 181 persons per km^2. It comprises of 179,222 males and 176,132 females, with about 198,444 people living in urban areas. The major population centers are found around Lake Naivasha, a majority of whom (54%) live in the south lake basin (approximately 190,780 people). An estimated 221,700 people were in the labor force in Naivasha in 2019, with 156,874 employed (59,143 in the rural areas).[2] From the employed, we estimate that 96,454 people are formally employed (working for pay) and the rest working in either family businesses or family farms. In addition, there were approximately 33,061 farming households in Naivasha in 2019, with 26,981 engaged in subsistence farming and 5,336 in commercial farming.

4.1.3. ECONOMIC PROFILE

The Naivasha area accounts for 0.75% of Kenya's total population and contributes about 1.0% of its GDP. Approximately 27,884 hectares of the area are considered agricultural land, with 20,669 ha and 6,817 ha used for subsistence and commercial agriculture respectively. The Lake Basin is primarily an agricultural area with some tourism and energy. The major economic activities include horticulture, environmental tourism, geothermal energy, fishing, and urban industrial and business activities. Agriculture is the main anchor of the local economy, with activities ranging from traditional pastoralists, subsistence and smallholder farmers to commercial dairy and beef farmers, high-tech vegetable and cut flower farming, and wildlife ranching. The agricultural sector is estimated to contribute over 70% of the economy of Naivasha.[3] Trade and services are located around towns and settlements, consisting of

[2] The population attending educational institutions is 122,184 (34% of the total); with 23,165 in pre-primary, 65,447 in primary, 26,881 in secondary, 3,989 in middle level/TVET colleges, and 2,647 in university. This means that the Naivasha population is relatively older than the Kenyan average.

[3] WWF (2011).

both formal activities and informal markets in wholesale/retail trade, transport and communication, financial intermediation, construction and real estate, and renting and other business services.

Table 2: Gross Domestic, County and Local Product (KES million, constant 2019)

Year	Kenya GDP	Nakuru GCP	Naivasha GLP
2013	7,034,881	339,213	67,847
2014	7,411,761	382,714	76,995
2015	7,835,602	428,508	86,952
2016	8,296,255	515,153	100,896
2017	8,694,954	550,991	109,594
2018	9,244,325	574,540	115,264
2019	9,740,360	590,230	120,253
5-year CAGR	5.6%	8.3%	8.4%
3-year CAGR	5.8%	3.5%	4.8%

Source: KNBS and author's calculations

4.2. Sectoral Profiles

The South Lake basin hosts Kenya's thriving export horticulture industry with over 40 cut flower and fresh vegetable farms. It also has two popular national parks – Hell's Gate and Longonot, which also host a thriving national geothermal energy installations that produce electricity, steam and water. Across this belt, over 50 hotels, lodges and camping sites are located that host hundreds of thousands of domestic and foreign tourists annually. These sectors are briefly discussed below.

4.2.1. HORTICULTURE

Due to its proximity to Nairobi Jomo Kenyatta International Airport (JKIA), altitude and climate, access to a reliable supply of high-quality fresh water, and fertile soils, Lake Naivasha area is known for producing premium cut flowers and fresh vegetables for export. Naivasha is the home to the lucrative export horticulture sector, with premium cut flowers exported daily to major global destinations. About forty flower and fresh vegetable farms, majority of which is multinational companies (MNCs), that pioneered and have anchored Kenya's horticultural exports for decades are based in Naivasha, including half of the 40 largest flower farms in Kenya.[4] They not only have invested billions of shillings in the high-tech capital intensive farms but also continue to be a major source of FDI.

According to the Agriculture and Food Authority, between 2017 and 2019, Kenya exported over 494,909 and 245,754 metric tons of fresh cut flowers and vegetables, respectively, compared to 371,284 and 218,800 metric tons during the period 2014-2016 (33% and 12% increases, respectively). The total values of the flower and vegetable exports were KES 300 billion and KES 79 billion, respectively, in the 2017-2019 period, which represented 55% and 25% increases, respectively, from the period 2014-2016. The two horticulture sub-sectors are not only key earners of foreign exchange but also powerful contributors to Kenya's income and employment.

Across its 40 or so farms, the Naivasha region produces the bulk of the cut flowers (65-70%) and about 20% of the fresh vegetables exported by Kenya (about 50% of annual total). As shown in Table 3, over

[4] It is estimated that 97% of cut flower farms in Kenya belong to MNCs, and Naivasha hosts half of them. This claim, however, is not supported by the data; a study by Uche & Kazimierczuk (2017) on Dutch MNCs in the floriculture industry estimated the number of farms at approximately 176 – with 15 of them being breeders of cuttings for propagation; Dutch MNCs accounting for 9% of the total, including five of the breeders.

the past three years (2017-2019), Naivasha exported about 321,690 and 49,150 MT of flowers and vegetables, respectively, and earned approximately KES 70 billion annually (in real 2019 prices).

Table 3: Exports of Cut Flowers and Fresh Vegetables, 2015-2019

Year	Kenya total exports (MT)		Naivasha exports (est. MT)		South Lake exports (est. MT)		Total value CFV (M KES) *constant (2019=100)*		
	Cut flowers	Fresh vegetables	Flowers	FV	Flowers	FV	Kenya	Naivasha	South Lake
2015	122,825	69,700	79,836	13,940	71,054	10,873	104,584	50,942	44,505
2016	133,658	78,800	86,878	15,760	77,321	12,135	111,274	53,756	46,853
2017	159,961	87,200	103,975	17,440	91,498	13,429	113,202	55,609	48,057
2018	161,227	85,819	104,798	17,164	91,174	13,044	146,429	72,289	61,773
2019	173,721	72,735	112,919	14,547	97,110	11,056	131,390	67,954	57,665
Average (2018-19)	167,474	79,277	108,858	15,855	94,142	12,050	130,340	70,122	59,719
CAGR %									
5-year	9	1			8	0	5.9	7.5	14.8
3-year	4	-9			3	-9	7.7	10.5	9.5

Source: Author's own calculations

The central hub for the export horticulture industry is the South Lake Basin, which is estimated to account for 85% of the total Naivasha area production (43% of national annual total). During the 2018-2019 period, this averaged about 94,142 MT and 12,050 MT of cut flowers and fresh vegetables annually, respectively, and worth about KES 60 billion. The exports earnings grew at 14.8% p.a. during the 2015-2019 period, making the industry a critical engine of local economic growth directly through jobs, wages and taxes, and indirectly through support activities, such as inputs suppliers, service providers, small businesses, and tourism, among others.

According to the Kenya Flower Council (KFC), the Naivasha flower industry employs about 30,000 people directly and another 240,000 people indirectly depend on the farms for income through a variety of formal and informal activities, such as transport, packaging, providers of farm inputs and office supplies, irrigation engineers, consultants and auditors, and informal trade. In addition, fresh vegetable farms employ about 10-20% of horticultural employees. Using production and yield data, we estimate that these farms employed about 34,000 people in 2019, double that in 2010. The structure of export flower and vegetable production is that operations are split nearly 50:50 on the farm and pack houses, particularly for vegetables. Since production and most of the packaging of flowers are done on the farm before transportation to Nairobi, we estimate that about 35% of operations are performed off-farm. As such, an additional 21,000 people are directly employed in Nairobi.

Further, it is estimated that approximately 85% of the horticulture jobs in Naivasha was on farms located in the south lake region – both permanent and casual. From historical data, approximately 70% of these workers is female. The level of employment on the farms suggests that another 17,000 are employed in Nairobi. In addition, typically, every job created on horticulture farms generates another job off the farms; consequently, an additional 29,000 people indirectly derive their income from the farms. The area's export horticulture activities, therefore, employ about 76,000 people – about 58,000 locally. In addition, about 4000 to 5000 small-holders in the Lake basin are engaged in flower and vegetable farming (mostly in open fields) and supply about 5% of the export flower market, primarily through the large farms. Given Naivasha's average household size of three people, we estimate that about 180,000 local people derive their livelihoods from export horticulture in the south lake area – that is nearly 50% of the total population of Naivasha sub-county in 2020.

Table 4: Estimated employment in the Naivasha commercial export horticulture

Sub-sector	Est. area (ha)	Direct local jobs	Indirect local jobs	Related national jobs	Total
Floriculture	2,000	29,000	29,000	16,000	74,000
Vegetables	2,000	5,000	5,000	5,000	15,000
Total	4,000	34,000	34,000	21,000	89,000

Source: Author's own calculations

It is clear that the export horticulture farms are extremely powerful job and income generators, given they are cultivated on only about 4000 hectares. In addition, the export horticulture industry is highly capital and technology intensive and requires scarce skilled workers. A typical commercial farm has greenhouses, shade cloth, drip irrigation, hydroponics units, cold storage facilities, packing sheds and refrigerated trucks that cost approximately $500,000 per hectare to set up[5].

Transportation needs of the horticulture industry is enormous; these include trucks transporting fresh produce to JKIA and delivering inputs and services daily and buses, vans and cars ferrying employees to and from Naivasha town, where a majority resides. The combination of the two transportation activities generates substantial daily traffic on the road and impose relatively high costs on the businesses.

4.2.2. TOURISM AND HOSPITALITY

Naivasha lake basin boasts major tourism attraction sites and establishments. Located between the famous Aberdare National Park in the north and the Hell's Gate National Park in the south, it attracts more than 250,000 visitors annually. Hell's Gate and Mt. Longonot National Parks are the main nature tourism attractions; other tourist sites include Lake Naivasha, Ol-doinyo Eburru volcano, and private wildlife conservancies, such as Marula, Mundiu, Kongoni Game Valley, Kedong' Ranch, and Oserian. The main tourist activities include bird watching, camping, hiking, rock-climbing, picnics, excursions and game drives, boat riding and game fishing, and geothermal spa, among others.

The tourism and hospitality sector (THS) caters for a diverse range of markets, from international, political and business delegations to national parks visitors and excursionists. Due to its high profile from proximity to Nairobi and major tourism corridors, the regions THS has experienced significant growth, particularly in the meetings, international conferences and exhibitions (MICE) segment. Naivasha is profiled as one of the leading MICE destination in Kenya, attracting several repeat visits by delegates and their families for leisure and business.[6] The area is unique in the MICE space because domestic tourism accounts for about 60% of the tourists.

The THS within the lake basin comprises of more than 50 establishments - hotels, lodges, cottages and campsites. Among these are one 5-star and three 4-star hotels with approximately 560 beds. We identified 40 establishments with data on capacity and found more than 2,300 beds – equivalent to about 847,900 bed nights annually. In total, we estimate the area has about 2,600 beds (approximately 959,000 bed nights annually – about 4% of Kenya's total available bed nights). In 2019, about 590,000 bed nights were occupied, earning about KES 12 billion (Table 5). Including earnings from the over 225,000 visitors to the two national parks, the total earnings was approximately KES 14 billion; this is

[5] WWF (2011)
[6] Tourism Sector Performance Report. Tourism Research Institute, 2018

equivalent to about 8% of Kenya's annual tourism earnings. The sector's earnings grew at 6.3% annually during the 2017-2019 period.

The THS establishments directly employ an estimated 3,600 people annually, on average, many of whom are seasonal workers engaged during peak demand. However, the largest proportion of employment is indirect / informal, which makes estimates of total employment less than precise. However, our estimate of the base multiplier suggests that total THS-related employment is about 2 to 7 times larger.

Table 5: Tourism and hospitality sector earnings, in million KES

Year	Naivasha				Kenya
	Hotels	Tourist sites	Total (nominal)	Total (real)	(real)
2015	5,998	1,265	7,263	9,056	105,486
2016	6,996	1,724	8,720	10,301	117,776
2017	8,977	2,530	11,508	12,253	127,669
2018	11,317	1,982	13,299	13,826	163,635
2019	11,832	2,022	13,854	13,854	163,600
CAGR %					
5-year	18.5	12.5	17.5	11.2	11.6
3-year	14.8	-0.6	9.7	6.3	13.2

Source: Author's calculations from secondary data

4.2.3. ENERGY

Naivasha hosts Kenya's strategic public and private geothermal energy generation installations at Olkaria, operated by KenGen and OrPower4 Inc. that produce electricity, steam and water. The area sold about 5,053 GWh and 5,200 GWh in 2018 and 2019, respectively (about 49% of Kenya's total electricity sales). Earnings from electricity have grown rapidly since 2014, by 198% total and 4% annually. In addition, the geothermal plants generate steam used for heating, including at flower farms and hospitality establishments. In total, KenGen and OrPower generated about KES 24 billion and KES 11 billion, respectively, from geothermal electricity, steam and water in 2018.[7] We estimate that the energy sector in Naivasha generated approximately KES 37 billion in 2019, growing at about 5.3% annually since 2015 (Table 6).

Table 6: Electricity sector earnings and employment, 2015-2019

Year	Income (M KES)				Employment	
	Kenya		Naivasha		Kenya	Naivasha
	nominal	real	nominal	real		
2015	89,358	111,418	23,904	29,805	16,925	3,100
2016	131,617	155,480	31,488	37,197	17,306	3,400
2017	145,693	155,133	32,219	34,307	18,934	3,300
2018	159,217	165,524	35,275	36,672	19,112	3,500
2019	163,643	163,643	36,686	36,686	19,676	3,700
CAGR %						
5-year	16.3	10.1	11.3	5.3	3.8	4.7
3-year	6	2.7	6.7	3.4	1.9	5.7

Source: Author's estimates from KNBS & industry publications

[7] We estimate that these two constitute about 90% of the total earnings from the energy sector in Naivasha. The rest comprises distributions companies and other energy-related businesses.

In addition, the sector is estimated to employ between 3,000 and 3,700 people directly, which comprise of about 1,500 people directly employed by KenGen and another 1,000 by four of its contractors.[8] In addition, approximately 1,200 people are employed by the other major player in geothermal development, OrPower, and electricity distribution companies – i.e. Kenya Power and KETRACO.

There are several plans to expand the energy sector in the area, with two industrial parks planned by KenGen and Oserian. According to Ronoh (2020), plans are underway at Olkaria to set up a green energy park to utilize geothermal resources for the benefit of KenGen and the community. A feasibility study identified the available geothermal resources that include cheap electricity generated from the geothermal plants, more than 2,000 t/h of brine from several separator stations at 130°C, steam from low to medium enthalpy wells, wells with unique characteristics, and drilled wells far from the existing power plants. The Geothermal Development Prioritization Task Force Report (2018) earmarked more than sixteen geothermal wells not assigned to electricity generation for connection to the industrial park. The identified industrial and service applications to be developed within the park range from mineral extraction from geothermal brine, textile, steel and glass manufacturers, eco-friendly fertilizer production, milk processing plants and recreation facilities (Ronoh, 2020). These industries have different energy needs will lead to better resource utilization and sustainability.

KenGen has completed plans to set up a 453-ha Industrial Park at its geothermal power generation hub at Olkaria to take advantage of its competitively priced and reliable utilities and energy (electricity, high pressure steam and Brine at 130°C). The park will provide industrial, commercial and recreational facilities and will be developed in two phases, with the first phase complete by 2022. The Geothermal Recreation and Health Spa was commissioned in 2015 and has successfully operated since then, attracted about 45,000 people annually. In addition, it has developed a large conference and meeting facilities, an Exhibition Hall for events or exhibitions, and restaurants. When fully developed, these will significantly boost the attractiveness of the already popular Hell's Gate and Mt. Longonot Parks' nature tourism. Manufacturing firms expressed interest to work within the park and after evaluation the following were identified as early locators include textile and apparel processing, steel manufacturing, glass manufacturing, fertilizer manufacturing, leather processing, milk processor, and food processing and packaging (grain dryers).

Oserian Limited is establishing a Special Economic and Export Free Zone on 5000 acres of land to utilize its vast geothermal energy resources in Olkaria.[9] The company already generates geothermal energy from three wells for use in electricity generation, steam and water for powering and heating its flower farms – the world's largest geothermal heating for agricultural plant (USEA, 2019). It currently heats about 140 acres of greenhouses using geothermal steam and generates 3.41 million liters of hot water per day and is the only company in Kenya licensed by EPRA to generate, transmit and retail electricity. The Master Plan consists of an industrial park, commercial center, game park conservancy and mixed-use housing scheme. The Two Lakes Park will host the Flower Business Park, the Business Park and the Industrial Park. The industrial park target manufacturers of greenhouse film, animal feed, fertilizers and textiles. The expansion of vital infrastructure will entail the installation of grey water treatment plants, rainwater harvesting as well a sizeable expansion to the existing in-house power generation capacity to supply at least 4MW of electricity.

[8] Personal communication with Mr. Willis Ochieng, Chief Energy Planner, KENGEN, on June 10, 2020.
[9] Riungu, Catherine (2019a).

Nine flower companies have set up at the Flower Business Park, namely: Two Lakes Packing Services Ltd, Oserian Flowers Ltd, Madumbi Kenya, Mavuno B.V., Oloidien Estate & Engineering Ltd, Dudutech, Select Rose Breeding, George Delbard Roses, and Selecta. Negotiations are at various stages with four other tenants lured by the Business Park 'pix and mix' offering of a wide array of services along with its ability to provide geothermal heating and cheap electricity. Maxim Agri, a Dubai-based animal feed company, became the first manufacturer to locate in the industrial park after signing an agreement with Oserian in September 2019 to invest US$ 1.0 billion in animal feed and breeding semen processing.[10] Another manufacturer is expected to sign on in 2020.

These planned expansions will add significant numbers of nature tourists, industrial production, and commercial activity, generate thousands of jobs, and demand quality infrastructure to be competitive. Oserian's Estate currently host over 11,000 people and it is envisaged that the population will surge to about 20,000 as the Industrial Park takes root. Assuming similar numbers for the KenGen's park, the anticipated increase is about 20,000 new residents during the project life. Importantly, they will draw thousands of new traffic into the area and, hence, greatly benefit the THS sector.

4.2.4. FISHERIES

Lake Naivasha fisheries has grown tremendously over the past decade. Fish production has increased from 688 metric tons in 2009 to 3,087 tons in 2019, valued at about KES 500 million. Fish from the lake is consumed locally and to a limited extent exported to other urban centers within and beyond Nakuru County. The main species of fish caught in the County is Common Carp and Tilapia. There are three landing sites along the lake, namely, Kamere, Central and Tarambeta. The lake fisheries support over 700 fishermen directly and more than 3,000 people indirectly. With the increasing output of fish, the area attracts significant vehicular and non-motorized traffic from fish mongers, traders, food and beverage service providers, and fish consumers. The fishing boats also dabble in tourism by provide boat rides into the lake during the day. Nakuru County plans to construct a modern fish market at Kamere to ensure better marketing, safety and sustainability (CIDP 2018-2022). The fish market will induce increased economic actitivity around fisheries and generate significant additional traffic d attracts significant traffic comprising of fishermen, fish mongers and traders, and fish transporters; a majority of these use motorcycles, vans and trucks. This will likely expand with the fish market.

4.2.5. OTHER ECONOMIC SECTORS

The KNBS (2019) economic data for Nakuru county in 2017 was used to estimate private trade and services at about 25%; these comprised of wholesale and retail trade (3%), transport and communication (7%), financial intermediation (6%), and construction and real estate (8%). Government services contributed 7% of Nakuru GCP; we adopt similar proportions for Naivasha economy. Together, the other sectors constitute about 32% of the local economy. This economic structure is retained for the rest of the analysis in this report.

[10] Riungu, Catherine (2019b).

4.3. Economic Base Analysis

Cumulatively, the four key economic sectors directly contribute about 45% of the Naivasha annual income, equivalent to about KES 54 billion (in 2019 prices) in 2019.[11] The impacts of these sectors are illustrated in Table 7, which shows the annual gross income, the location quotients and base multipliers from 2015 to 2019. The EBA results clearly identify the four sectors as basic economies of Naivasha. The local economy generates about 40, 3.0, 8.2, and 1.7 times the normal national horticulture, THS, energy and fisheries incomes, respectively; the excess is export income from regions outside the local area. The historical LQs show that the sectors have remained competitive and relatively stable, with fisheries recording significant increases in competitiveness. Combined, the four basic sectors earn Naivasha 20 times the normal national incomes.

Table 7: Economic Base Analysis Results

Year	Real Gross Value (BKES constant 2019)					Location Quotient					Base Multiplier			
	Hort	*THS*	*Energy*	*Fish*	*All*	*Hort*	*THS*	*EN*	*Fs*	*All*	*Hort*	*THS*	*EN*	*ALL*
2015	50.9	9.1	29.8	0.2	90	44	3.5	11	0.5	23	3.8	9.6	5.8	2.4
2016	53.8	10.3	37.2	0.2	101	40	3.2	8.9	0.5	20	4.2	9.8	5.4	2.5
2017	55.6	12.3	34.3	0.3	102	39	3.4	7.9	0.9	19	4.4	8.9	6.4	2.7
2018	72.3	13.8	36.7	0.4	123	40	3.0	8.0	1.2	20	3.5	8.3	6.3	2.3
2019	68.0	13.9	36.7	0.5	119	42	3.1	8.2	1.7	20	3.9	8.7	6.6	2.5
CAGR %														
5-year	7.5	11.2	5.3	26	7.2	-1.2	-3.0	-6.8	38	-3	0.9	-2.5	3.0	1.1
3-year	10.5	6.3	3.4	28	7.8	3.7	-5.1	1.7	35	2	-5.2	-1.5	1.3	-2.8

Source: Author's own calculations

In terms of economic impact, the base multipliers suggest that each shilling earned in the horticulture, THS and energy sectors injects approximately 3.90, 8.70, and 6.60 shillings into the Naivasha economy, respectively. Combined, they inject KES 2.50 into the local economy for each shilling earned. By implication, had the earnings from the four basic sectors been 10% higher in 2019, the Naivasha real income would have been larger by KES 5.4 billion.

The four basic sectors are equally powerful employers, accounting for about 45% of total formal employment in Naivasha in 2019, with the largest share being in the horticulture sector (Table 8). Over 40,000 people derive their daily livelihoods from the four sectors, supporting a total of over 120,000 people annually. There were about 21, 6 and 3.5 times the normal employment in the local horticulture, energy, and THS sectors than the normal national shares, respectively. In addition, each job created in the horticulture and energy sectors generated about 2.8 and 5.7 local jobs, respectively; combined, each job created in the sectors generates about 2.3 jobs.

Table 8: Employment in Naivasha and economic base metrics

Year	Employed	For Pay	Horticulture		Energy		Location Quotient		Base Multiplier		
			No.	Share	No.	Share	Hort	EN	Hort	EN	All Base
2016	133,544	81,624	28,297	35%	3,436	4.2%	20.0	6.5	2.9	6.5	2.3
2017	140,907	86,295	33,376	39%	3,321	3.8%	23.6	5.7	2.6	5.7	2.1
2018	148,677	91,233	33,497	37%	3,511	3.8%	22.6	5.8	2.7	5.8	2.2
2019	156,874	96,454	34,732	36%	3,713	3.8%	20.9	5.7	2.8	5.7	2.3

Source: Author's own calculations

[11] We derive this number by assuming that 45% of the total income from horticulture, energy and tourism and hospitality remain in the local economy in any given year. All fisheries income is assumed to be local.

4.4. Cost-Benefit Analysis

This section assesses the impacts of upgrading the road at the local, regional and national levels. We analyzed potential use, investment, cost, and financial and economic return using the CBA method run on the HDM-4 platform. We compared the "with" and "without" project scenarios over a period of 25 years and adopted a discount rate of 12% (because real values are used), a standard conversion factor (SCF) of 0.80 for converting financial into economic costs, a residual value of 20%, and varying amounts for annual maintenance costs from Year 5. The economic costs consist of capital investment costs and annual routine and periodic maintenance expenses (see Table 26 in Appendix 2). The project also includes annual routine maintenance from Year 5 and major restoration works in Year 12 totaling KES 587 million. The total cost over the 20 years is KES 2,321 million (NPV of KES 1,552 million). Since there is no information on planned maintenance under the current project, the proposed investment is compared with two scenarios, as shown on Table 9. For analytical purposes, only option A of the current project is evaluated in this report.[12]

Table 9: Estimated project costs

Cost item	Current project		Project Alternative
	A	B	
Capital investment	398	398	1734
Maintenance cost	357	1640	587
Total	755	2038	2321
PV Total	450	935	1552

Notes: Options A of the current project represents the case with capital investment followed by periodic maintenance every 3 years (Years 6, 14 and 18) and one major repair in Year 10. Option B represents capital investment followed by major repairs every 4 years, at Years 5, 9, 13 and 17.

Source: Author's own design and calculations

The benefits consist of savings in vehicle operating costs and travel time for people and cargo. The upgraded road is expected to reduce transportation costs, travel time, greenhouse gas emissions, and road safety costs. To fully demonstrate the full impact of the road investment, potential impacts on output, earnings, investment, employment, and tax revenue in the three leading basic sectors are also estimated. The upgraded road is expected to reduce transportation costs and travel time, promote trade and investment, and stimulate economic growth of agriculture, energy, tourism and hospitality, fisheries, and transportation sectors. This being an agriculturally rich area, communities will benefit from improved transportation systems to access farm inputs and markets for horticultural produce and dairy products in Naivasha, Nakuru, Nairobi and central Kenya. In addition, the easier access and lower road user costs are expected to make the area more attractive and competitive, particularly for THS sector. The main social impacts are anticipated from temporary land take, necessary for the purposes of the Contractor's camp, materials sites and deviations, which are accounted for in the BOQS. The BOQS includes social mitigation costs, which covers road safety and HIV/AIDS awareness and prevention campaigns, drainage and shoulders, bus bays, and road furniture.

These impacts are evaluated using several measures of project worth, including the net present value (NPV), economic internal rate of return (EIRR), benefit-cost ratio (BCR), and NPV per kilometer (NPV/km). Unless stated, all cost and benefits are in real economic value in 2019 prices using the SCF.

[12] Option B was also analysed but results not reported in this report. These are available upon request.

4.4.1. ROAD USERS COST ANALYSIS

The upgraded road is expected to reduce transportation costs, travel time, greenhouse gas emissions, and road safety costs.

4.4.1.1 Traffic Flow

Transportation needs of the economic sectors in the lake basin are enormous; these include trucks transporting fresh produce to JKIA and delivering inputs and services daily and buses, vans and cars ferrying employees to and from Naivasha area, where a majority resides. This section assesses the current traffic flow and transport needs of each sector. The combination of the diverse transport activities across the four major sectors generates substantial daily traffic on the road and, therefore, impose significant costs on road users and businesses. The limited scope of this study and Covid-19 related movement restrictions did not permit field data collection to determine traffic flows.

For analytical purposes, we estimated conservative daily traffic volumes for each of the four sectors. The results are contained in Table 10 and the approach is discussed in Appendix 2. It is estimated that the road attracts slightly over 7200 vehicles associated with the four sectors on any day, mostly private cars, buses and cargo trucks. It is also plausible that the four sectors represent about 70% of the traffic flows on the road and, therefore, the daily traffic could be much higher. The bulk of the traffic is private cars belonging to business owners and clients, employees, and tourists, followed by passenger buses and cargo trucks and vans. We included motorcycles because of their importance to local low-volume transportation, and are the preferred mode of transport for local residents doing shorter distances, including going to work and markets.

Table 10: Estimated Daily Vehicle Traffic

Sector	Cars	Trucks	Buses	Motorcycle
Horticulture	2,030	270	559	781
Energy	1,660	251	51	
THS	671	120	122	80
Fisheries		5	50	600
Total	4,361	646	782	1,461

Source: Author's calculation

For purposes of this study, we adopted a conservative estimate of 2010 vehicles of different types, as shown in Table 27 in Appendix 2. Non-motorized transport (NMT) is excluded in the analysis given the difficulty in estimating traffic volumes. However, the proposed design caters for NMT by providing for a wider carriageway, shoulders, and bus bays, and also alternatives with pedestrian footpaths and cycling lanes. Provision for NMT is particularly important given the vital role of nature tourism, Nakuru County's plans to build a Resort City and a modern fish market on the south side of Lake Naivasha, and the commercial and residential parks being planned for the area, among others. We recommend additional analysis during the road planning and assessment phase to incorporate this key component of sustainable transport systems.

The results of traffic and economic analyses over the appraisal period are presented in Appendix 2. We assume a cumulative annual average traffic growth rate is 3% over the 20 years. The traffic volume is expected to grow to about 3525 during the period (see Appendix 2, Table 28).

4.4.1.2. Road User Costs

The HDM-4 compared road user costs (RUC) for the two major project alternatives. For each class of vehicle and kind of road, the model tabulated the following costs (in US$/vehicle-km): i) vehicle operating cost (VOC); ii) value of time cost (VTC); iii) emissions cost (EMC); and, iv) road safety cost (RST). These are combined into road user costs (RUC). The results are summarized in Table 11. The results show that the road is expected to significantly reduce the RUC for the entire vehicle fleet by 36%, on average. The largest cost reduction is in the value of time that would decline by 60%, followed by 27% for VOC. These results suggest that time (delay) is the largest transport cost factor for users of the road. By broad vehicle classes, the largest cost reduction would occur for passenger vans and buses (47%), followed by cargo trucks and passenger cars (33%). Again, VTC is the largest cost reduction for each vehicle class – equivalent to 63%, 61% and 57%, respectively, for cars, cargo trucks and buses. Considering direct user cost alone, the road is expected to lower the VOC by 34%, 33% and 23% for bus, cargo and cars, respectively.

Table 11: Road User Costs "without" and "with" Project (US$ per vehicle-km)

Use/Cost	Project	Road User Costs	Vehicle Operating Cost	Value of Time Cost	Emissions Cost
Cargo	*Without*	1.2165	1.1437	0.0186	0.0244
	With	0.8206	0.7637	0.0072	0.0198
Bus	*Without*	1.8191	0.6623	1.1194	0.0182
	With	0.9553	0.4361	0.4853	0.0147
Car	*Without*	0.4386	0.2693	0.1316	0.0083
	With	0.2919	0.2066	0.0492	0.0067
Fleet	*Without*	0.606	0.383	0.183	0.0104
	With	0.390	0.279	0.073	0.009
Change:					
Cargo		*-33%*	*-33%*	*-61%*	*-19%*
Bus		*-47%*	*-34%*	*-57%*	*-19%*
Car		*-33%*	*-23%*	*-63%*	*-19%*
Fleet		*-36%*	*-27%*	*-60%*	*-16%*

Source: Author's calculations from HDM-4 model output

Over the 20 years, the upgraded road is expected to save users 31% in transport costs, on average, ranging from 31% to 43% annually. On average, road users on the upgraded road are expected to spend about KES 40 per vkm, compared to KES 62 without the project.[13] Specifically, bus operators and cargo trucks are expected to spend KES 97 and KES 84 per vkm, respectively; this compares to KES 186 and KES 124, respectively, without project. The least impact is on personal cars, whose unit cost would decline by KES 15, on average. While relatively small, the large number of cars would make the cumulative effect is significantly large.

Overall, vehicles operating on the proposed road would save KES 22 per vkm for the fleet, with cargo truck and bus operators saving KES 40 and KES 88, on average, respectively. For the entire fleet of 2010 vehicles on the road daily for the first year, the cumulative user cost savings would be about KES 1.12 billion per year. The cost and competitiveness implications of these RUC savings on individual sectors are enormous. For example, the export horticulture farms, who currently spend about 33% more to transport fresh produce, inputs, and workers on the road, could save an equivalent of KES 41

[13] Exchange rate used in conversions is 1US$ = KSh 102

million annually; this is equivalent to about 9% reduction in the total transport cost to JKIA. The entire fleet of trucks on the road is expected to save approximately KES 450 million annually.

For hotels, farms and tourist firms using vans and buses to transport workers and tourists, the annual savings would be about KES 4.4 million per vehicle – a total of KES 1.8 billion per year. Specifically, the horticulture farms and tourist hotels could save approximately 19% and 11%, respectively, on the annual cost of transporting workers; cumulatively, they would earn an additional 20% and 12% from cargo and workers transport cost savings. Finally, every user of personal cars, including tourists, are expected to save approximately KES 259,000 annually; this is equivalent to KES 275 million total savings and 33% increase in net earnings (disposable income). At the average marginal propensity to consume of 90% (income multiplier of 10), the total induced increase in disposable income is expected to inject about KES 2.75 billion into the local economy annually.

4.4.2. ECONOMIC AND FINANCIAL ANALYSIS

4.4.2.1 Direct Economic Benefits

Direct benefits of upgrading the road on road users were calculated to understand its potential impact on the cost of transportation. The HDM-4 compared the total cost and benefits to society for the different project alternative options, yielding four CBA scenarios, as shown in Table 12 and Tables 29 to 31 in Appendix 2. The results show that the proposed road investment is expected to generate about KES 3.4 billion in NPV of society costs savings, with an EIRR (base case) of 50%. The NPV/km is KES 124 million – which is 170% higher than the unit cost of investment, and the BCR is 2.7. These results suggest that each shilling invested in upgrading the road is expected to generate a return of 50% and yield 2.70 shillings in benefits. Consequently, the proposed project is not only economically viable but also high value for money, with relatively high investment returns. The results are robust to variations in cost and traffic flow, i.e., the project remains economically superior even with significantly lower benefits.[14]

Table 12: Comparison of Key Economic and Financial Figures between With and Without Project Alternatives

Parameter		Base case	Project Alternatives				
			PRO1	PRO2	PRO2 (A)	PRO3	PRO4
Costs & Benefits (KES million)	PV investment cost	295	1,010	1,148	1,378	1,524	1,899
	PV maintenance cost	65	85	93	112	85	85
	PV total cost	360	1,095	1,241	1,490	1,609	1,984
	NPV benefits	-	3,004	3,355	2,800	3,108	2,754
	Difference in costs	-	736	146	248	367	376
	Difference in benefits	-	-	+351	-556	-247	-354
	NPV/km	-	111	124	104	115	102
Financial measures	BCR	-	2.74	2.70	1.88	1.93	1.39
	EIRR	-	49.6%	50.0%	40.1%	38.7%	31.3%
Cost savings	RUC	-	-27%	-31%	-31%	-32%	-32%
	CO2 emissions	-	-22%	-18%	-18%	-9%	-5%

Source: Author's analysis of HDM-4 CBA output

[14] The alternative case assuming 20% higher costs and 20% lower traffic volumes yields an NPV of KES 2.8 billion, NPV/km of 104 million, EIRR of 40%, and BCR of 1.9.

4.4.2.2 Induced Economic Benefits

To fully demonstrate the full impact of the road investment, we estimated its potential impact on output, earnings, investment, employment, and tax revenue in the three leading sectors. The upgraded road is expected to reduce transportation costs and travel time, promote trade and investment, and stimulate economic growth of agriculture, energy, tourism and hospitality, fisheries, and transportation sectors. This being an agriculturally rich area, communities will benefit from improved transportation systems to access farm inputs and markets for horticultural produce and dairy products in Naivasha, Nakuru, Nairobi and central Kenya. In addition, the easier access and lower road user costs are expected to make the area more attractive and competitive for tourism and hospitality.

The estimation approach applied the historical data generated for this study and selected economic and road development literature to the EBA results in the preceding sections. The estimates are briefly discussed in A2.4. in Appendix 2 and summarized in Table 13. Additional results are shown in Table 14. The results show that upgrading the road is expected to induce KES 506 billion in direct economic benefits, with the South Lake basin earning about KES 216 billion, and potentially KES 540 billion with economic multipliers. The present value of the benefits is approximately KES 116 billion (KES 251 billion with multiplier effects). These induced benefits could earn the National Government between KES 27 billion and KES 59 billion in additional tax revenues.

Table 13: Induced economic benefits

Economic Benefits	Employment (No. '000)		Economic Benefit (Real BKES)				
	Direct	Total	Total	Local injection	Economic Multiplier	NPV Local	NPV total multiplier
1. 31% increase in horticulture exports	17.4	48.6	263.7	118.7	462.8	56.9	99.8
2. 55% increase in tourism/hospitality*	1.8	3.4	51.6	23.2	201.9	11.8	46.1
3. 60% increase in geothermal energy	1.8	10.2	38.6	13.5	52.7	14.3	18.6
4. 30% higher agricultural investment			148.7	59.5	392.5	31.5	83.0
5. 45% higher investment in hotels	0.8	1.4	3.1	1.2	10.7	1.1	3.8
6. 50% increase in employment	21.0	63.6	64.9	64.9	149.3	13.6	31.3
Total**			**506**	**216**	**540**	**116**	**251**
Tax revenue			**91**	**42**	**191**	**27**	**59**

Notes: * This is a result of about 30% and 87% increases in bed occupancy rate to 80% and total bed nights, respectively, due to about 120% increase in the number of tourists; ** Total excludes employment income because these are subsumed in the sectoral earnings.

Source: Author's own analysis

The employment impact of the induced economic activity is about 21,000 additional direct jobs (64,000 total), a majority of which will be in the export horticulture sector. These jobs are expected to support about 200,000 people in – equivalent to 30% of the projected Naivasha population in 2040.[15]

Broader results in Table 14 suggest that the economic impact of upgrading the road from the three basic sectors is KES 888 billion in net real income. In present value terms, the induced economic

[15] Assuming the current household size of 3 in Naivasha. We project he population to expand from 368,000 people in 2020 to 720,000 in 2040.

benefit is expected to be approximately KES 139 billion. This is the value that would be lost if the road is not upgraded – equivalent to about 74% points lower growth in total earnings over the 20 years. Consequently, instead of generating about KES 1.1 trillion in additional earnings, the basic sectors would earn about KES 963 billion. In terms of growth, instead of the three basic sectors growing at about 3% annually with an upgraded road, they would grow only tepidly at 0.4%, with the widest growth differential (3.1%) expected in the export horticulture sector. The second largest impact will be in the energy sector, where the annual growth differential is expected to be 2.5%. Future growth in the energy sector heavily hinges on increased uptake of steam and water from geothermal electricity generation; we assume these will not be forthcoming if the road is not upgraded. For the THS sector, upgrading the road would add about 2% points to the expected annual growth.

Table 14: Induced Economic Impact

Parameter	Export horticulture		THS		Energy		Total		
	WP	PR	WP	PR	WP	PR	WP	PR	Diff.
Real earnings (BKS):									
2019	59.7	59.7	14	14	37	37	110	110	-
Year 20	60	107	15	23	45	72	120	202	82
Total	966	1,230	119	463	1,047	1,327	2,132	3,020	888
Total NPV	**456**	**519**	**100**	**113**	**407**	**469**	**963**	**1,101**	**139**
Growth:									
Total	1%	81%	20%	81%	167%	325%	9%	83%	74%
CAGR	0.1%	3.2%	1.0%	3.2%	5.0%	7.5%	0.4%	3.1%	3%

Notes: Acronyms represent: BKS – Billion KES; WP – Without Project Alternative; PR – With Project Alternative; THS – tourism & hospitality services; NPV – net present value; and, CAGR – compounded annual growth rate.

Source: Author's own estimation from secondary data

The above results strongly suggest that the sectors are likely to lose significant value if the road is not upgraded, partly because of lost competitiveness due to high cost of doing business. Results of the CBA with induced economic benefits are summarized in Table 16. Overall, the road project is expected to generate about KES 105 billion in net economic benefits, with an EIRR of 115%; the benefits would rise to about KES 226 billion if local economic multipliers are included. The adjusted BCR for the project is 85 and the NPV/km of KES 3.9 billion; that is, the project could generate KES 85 for every shilling invested. If project alternative options PRO3 and PRO4 are selected instead, the total economic benefits remain high at about KES 104 billion; the EIRR fo 88%-99% and BCR is 84. Therefore, all the project alternative options are extremely rewarding. The economic benefits are equivalent to expanding Naivasha's 2019 real income by 49%; i.e., approximately 2% annual growth over the 20 years.

Table 15: Induced economic benefits

Measure	Direct	Induced benefits		
	(PRO2)	PRO2	PRO3	PRO4
NPV (M KES)	3,355	105,181	104,644	104,009
EIRR	50%	115%	99%	88%
BCR	2.70	85	84	84
NPV/km (M KES)	124	3,896	3,876	3,852

Source: Author's own calculations

4.4.2.3 Tax Revenue

From the economic benefits, the local and national Governments will generate increased tax revenues. The energy, horticulture, and hospitality sectors in Naivasha already pay substantial taxes and levies in the form of income tax, corporate tax, VAT, import duties, and county cess, among others. For example, the cut flower farms pay the County about 20 cents per kg of produce harvested annually, which is additional to 48 other levies. Our estimates suggest that the road investment is expected to generate between KES 27 billion and KES 59 billion in additional direct tax revenue. Further revenue benefits are expected from indirect taxes from increased household consumption induced by the economic expansion and local, County and National government levies.

4.4.2.4 Export Earnings

Nationally, the expansion of the Naivasha export horticulture production is expected to generate approximately KES 519 billion in foreign exchange earnings, as shown in Table 14. This is KES 63 billion higher than maintaining the status quo, and equivalent to increasing Kenya's average total annual earnings from fresh horticulture exports in 2018/2019 by 42%. In addition, the expected increase in THS activity is estimated to generate another KES 45 billion in forex earnings; this is about KES 5.3 billion higher than without the project and equivalent to 3% increase in the Kenya total tourism revenues in 2019.[16] In total, therefore, Kenya is expected to earn about KES 565 billion in foreign exchange from the two sectors in Naivasha.

5.0 BUSINESS CASE

This study sought to gather enough information to build a case for upgrading the road. The financial and economic analysis results provide strong support for the road investment. We make this case fully in this section. The analytical results discussed in preceding sections are used in assessing project feasibility and making the strategic, economic and financial cases for implementation.

5.1 The Strategic Case

The 'strategic case' to demonstrate the need for upgrading the road and how the investment meets those needs and aligns with broader policy objectives. In addition to assessing the needs, we highlight the policy, regulatory and other potential constraints to its implementation, with a focus on (i) specific policies affecting returns and (ii) supportive institutions and infrastructure.

Effective transportation is necessary for creating a competitive business environment. For Naivasha basic economy to continue driving the economies of the region and nationally, further development of an integrated socioeconomic infrastructure is paramount. Additional investment in new roads and traffic networks is critical in addressing bottlenecks related to poor roads. Section 2 of this report highlighted the need for the road expressed by various stakeholders. The export horticulture, tourism and energy are absolutely critical and strategic sectors not only for Naivasha but also Nakuru County and Kenya; they attract massive investments and earn substantial foreign exchange for the country. The export horticulture sector is constantly innovating to stay competitive and the tourism sector has continued to

[16] We assume about 40% of tourists visiting the Naivasha circuit annually is foreigners.

attract new investments. Sustaining and expanding these sectors to greater competiveness is of critical strategic importance for the local economy and Kenya.

Transport infrastructure development is a priority focus area for the national government to attain the objectives of Vision 2030 and the Big Four Agenda. The social and economic pillars of the Vision 2030 strongly emphasize improved linkages and accessibility to national and international markets for improved livelihoods. Furthermore, the Kenya Agricultural Sector Transformation & Growth Strategy (ASTGS) 2019-2029, specifically Anchors 1 & 2, recognizes infrastructure as a critical pillar to increasing agricultural output and value addition and enhancing market access for a million smallholder farmers through farmer-facing SMEs and large-scale agricultural hubs.

The Nakuru County government recognizes the poor condition of its approximately 12,491 km of roads in the Spatial Plan (2015-2045) and the CIDP 2018-2022. Paved roads are only 993.7 Km and the road infrastructure is described as 20% good, 35% fair and 45% poor. Naivasha is identified in the CIDP as among the agricultural rich areas whose roads are in deplorable condition and leading to significant losses for perishable goods due to delays in transporting of produce to markets. To enhance county competitiveness, the government plans to upgrade the transport infrastructure by opening new roads, and rehabilitating existing road networks. These are critically linked to the commencement of the SGR inland terminal operations.

KenGen and Oserian are planning commercial, industrial and residential parks in the area that will be linked to the road and the Naivasha SGR and Internal Container Depot (ICD). This will not only bring massive new investment and traffic into the area but also require sound infrastructure for it to be competitive. Upgrading the road, therefore, is critical for the company's investment decisions and the viability and competitiveness of the park. In addition, the company's geothermal recreation spa and conference facility is expected to attract increased numbers of leisure tourists into the area; these are niche tourists market for highly discerning clientele that value good infrastructure.

Apart from directly contributing to the important strategy of infrastructure development to drive economic growth, therefore, the proposed road upgrade also addresses the competitiveness of four sectors at the center of Kenya's and Nakuru's economic growth strategies – agriculture (exports), energy, tourism and the blue economy.

5.2 Economic and Financial Case

5.2.1 ECONOMIC CASE

To make an economic case for the project, one needs to determine whether or not it offers good value for the money invested. Various measures of the project's direct and induced economic benefits and return have been calculated; of these, the BCR measures VfM. The results suggest that the project is of high value by virtue of the approximately KES 3.4 billion direct net society cost benefits generated from the RUC savings and another KES 105 billion of wider economic benefits. The BCR from direct RUC reductions is 2.7, which, according to criteria set out in the Methodology section in Appendix 1, suggests that the project is high value for money, even before adjusting for induced economic benefits. When induced economic benefits are included, the project BCR is significantly higher, 85. As such, each shilling invested in upgrading the road is expected to generate between KES 2.70 and KES 85 in

economic benefits. Including economic multiplier effects, the road project could inject up to KES 226 per shilling invested.

5.2.2 FINANCIAL CASE

We further analyzed the project's financial value to demonstrate its affordability and budgetary implications. The measures of financial worth are the EIRR, NPV/km and investment cost as a share of road budgets and expected tax revenue. The EIRR suggests that investing in the road upgrade is expected to generate 40-50% return.[17] The rate of return is 30-40 percent points higher than the average interest rate on GOK 10-year infrastructure bonds (12.5% in August 2020).[18] With the addition of wider economic benefits, the EIRR is between 88% and 115%. From the cost savings alone, the repayment period for the project is approximately 5.5 years. Furthermore, at the NPV/km of KES 124 million, the user cost savings derivable from the project is 170% the unit investment cost. This compares favorably against recent road development projects in Kenya, e.g. the Timboroa-Eldoret Raod (KES 30 million) and the Mau Summit-Kericho-Kisumu Road (KES 42 million). As such, the project is expected to more than pay for itself from the RUC savings alone. Including wider economic benefits, the NPV/km of KES 3.9 billion suggests that each shilling invested in the road would return about 85 times the unit cost in economic benefits.

In terms of affordability and budgetary implications, the results are contained in Table 16. The total cost of the project is about 2-3% the budget for design, rehabilitation and maintenance of roads and bridges in the Kenya Budget 2020/21; the annual capital investment alone is between 0.8% and 1.3%. Furthermore, the total investment is about 3-5% of the KRB's total disbursement for FY2019/20, and about 2-3% of KeNHA's development and maintenance budget for FY2019/20. The annual capital investment is equivalent to about 1% of the GOK roads & bridges budget and about 1-2% of KeNHA's annual budget for roads development and maintenance.

Table 16: Budget implications of proposed project

Financing source	Total project cost, as percent of:		Cost of investment, as percent of:	
	Full budget	Net of current budget	Full budget	Net of current
KRB Road Fund Revenue	2%	1.6%	1.0%	0.5%
Total Disbursement to NG	3%	2.3%	1.5%	0.8%
KeNHA	6%	5%	3%	1.6%
KeRRA	12%	9%	6%	3%
MoTI RSIP	26%	20%	13%	6.5%
KeNHA Total Budget 2019/20	2%	1.5%	1%	0.5%
GoK Roads Budget 2020/21				
Total	0.8%	0.6%	0.4%	0.2%
Rehab & maintenance	1.6%	1.3%	0.8%	0.4%

Source: Author's analysis of government data and CBA results

[17] For comparison, the 73-km Timboroa-Eldoret road (AfDB, 2010) returned an NPV (12% DR) of $ 21.14 million, EIRR (base case) of 21%, and EIRR (+20% costs & -20% benefits) of 13.4%. The estimated cost of the 160-km Mau Summit-Kericho-Kisumu road that involved rehabilitation and widening was $255 million, with an NPV of $66 million and an EIRR of 19% (16% with 20% higher cost).

[18] Central Bank of Kenya. Results for Re-Opened Five-Year & Ten-Year Treasury Bonds Issue Nos. Fxd3/2019/5 & Fxd4/2019/10 Dated 22/06/2020, available at https://www.centralbank.go.ke//uploads/historical_treasury_bond_results/2115019172_RESULTS%20RE-OPEN%20FXD3-2019-5%20AND%20FXD4-2019-10%20DATED%2022.06.2020.pdf

The result of budgetary implications strongly suggest that the project is financially affordable. Furthermore, as shown in Table 13, the government is expected to earn substantial additional tax revenues from the investment – more than enough to cover the total cost of investment. The tax burden of the project is about 2-4% of the expected local tax revenues. It therefore makes financial sense for the GOK to invest in upgrading the road.

5.3 Feasibility and Sustainability

As mandated by the Kenya Roads Act 2007, the Road Sector Investment Program (RSIP) (2010-2024) guides the development and maintenance of the road sector. Recent reforms in the road sub-sector has seen the establishment of three road authorities for the management, financing, and maintenance of roads, namely, KeNHA, KeRRA and KURA, to improve the sustainability of road investment. KeNHA has been mandated to manage the national road network, including maintenance, with financing from the Roads Fund. KeRRA is responsible for rural access roads, under which the road currently falls.

Additional reforms include the widening of the road user charging system by incorporating infrastructure bonds, public private partnerships, tolling, and increases of road maintenance levy fund charges. These have facilitated the establishment of the Road Maintenance and Axle Load Levy funds. The Kenya Roads Board (KRB) manages the Fuel Levy and Transit Toll Funds whose revenues are utilized to finance road maintenance under the Kenya Road Maintenance Program. Over the past decade, the Fuel Levy Fund (FLF) revenues have increased annually at 12% from KES 22.65 billion in 2009/10 to KES 72.5 billion in 2019/20 – which was 28% higher than in 2018/19. According to the Kenya Economic Survey 2020, in 2019/20, the FLF was projected to increase by 28% to KES 71.9 billion and the TTF by 22.4% to KES 660 million. The Fund allocates about 15% of its annual revenue to County Governments and the rest to the National Government.

For the financial year 2019/2020, the KRB disbursed KES 59.34 billion to towards maintenance of various roads across the country; this includes KES 8.98 billion to County Governments. Of the national government share, about 49% of its collection to the Kenya National Highways Authority (KeNHA), 26% to Kenya Rural Roads Authority (KeRRA), 12% to Kenya Urban Roads Authority (KURA), and 12% to the Ministry of Transport & Infrastructure for emergencies & roads under the Road Sector Investment Program (RSIP); the rest go to the Kenya Wildlife Service (KWS) and KRB. For the financial year 2019/2020, KeNHA received KES 24.6 billion, the KeRRA KES 13.05 billion and RSIP KES 5.99 billion. KeNHA's annual budget allocation was KES 74 billion in 2017/18 and KES 81 billion in 2019/20; about KES 78.3 billion of which is for road development (design and rehabilitation), maintenance and management. Furthermore, the GOK Budget FY2020/21 allocated KES 186.4 billion to support ongoing construction, rehabilitation, maintenance and design of roads and bridges. Of this, KES 94.4 billion will go into rehabilitation, maintenance and design of roads and bridges.

The reclassification to category C (Major Trunk Roads) will move the road to KeNHA, which contracts out design, rehabilitation and routine and periodic maintenance to the private sector and oversees axle-load control on its roads. Analysis of road maintenance funding shows that sufficient funds are available from the road fuel levy tax to cover routine maintenance of the road network in good and fair condition. Importantly, the national government has already committed to repairing the road through the ongoing project slated for completion by March 2021; implementing the proposed alternative, therefore, would only require a redesign, revaluation, reallocation and extension of the implementation period.

Road maintenance will be the responsibility of the project contractor during the construction phase and defects liability period. After completion, the contractor will be responsible for maintenance of the road for 8 years. Currently, private contractors carry out nearly 100% of the periodic and 95% of the routine maintenance and the role of roads agencies is limited to emergency response. The financial requirement for routine maintenance is approximately KES 12 million per year from Year 5, with KES 400 million budgeted for restoration works in Year 12. The impact of the project maintenance costs on Governments' recurrent costs will not be significant and there is financial and institutional capacity within the public agencies to carry out the maintenance.

6.0 PROPOSALS FOR IMPLEMENTATION MECHANISM

The objective of this study was to build a case for upgrading the road. From the foregoing discussion, it is demonstrably evident that implementation of the project will be sustainable. It is clearly demonstrated that investing in building the road is economically, financially and strategically feasible and viable. The question of implementation and management is important but we consider it too early to answer it in this study. It would be best to further interrogate it after a decision has been made to adopt and implement our proposal. We offer proposals of immediate importance to the consideration of the proposed project. Detailed analysis and proposal for implementation mechanism is recommended for a follow-up assignment after the project is adopted. We recommend the following implantation and financing mechanism:

1. **Classification:** The Stakeholders Workshop was informed that the road is already classified as category C (C707). However, the author could not verify this information with any government records or publicly available route maps. If true, then it is considered a major trunk road and, therefore, should naturally fall under the domain of KeNHA. Ideally, as a road connecting a major economic region to a major highway (A8), it should be category B. The current setup under KeRRA is not sustainable for a transport artery as economically important as the analyzed road. Such a move will not only avail more financial and human resources for rehabilitation and maintenance but also allow for better traffic management. Ideally, the road should be constructed with the aim of joining it up with the North Lake Road Phase 2 project and extending it in the future to provide direct access to Mai Mahiu, the Naivasha ICD and the Industrial Park.

2. **Widen the Road:** The BOQS recommends the road be widened to 7m two-lane and be provided with ample road shoulders, access, bus bays and road furniture to reduce roadside and NMT friction. This would ensure faster speeds and lower obstructions from medium to heavy trucks, some with wide loads.

3. **Implementation Period:** The BOQS recommends the project be implemented over 24 months, which will be followed by 8 years of annual routine and periodic maintenance by the contractor beginning 24 months after completion. The project proposes one rehabilitation at year 12 to restore structural integrity of the road and keep it in good shape.

4. **Financing Mechanism:** From stakeholders' expressed need and analysis in this study, we consider the proposed investment urgent and therefore in need of a financing mechanism that can be mobilized the fastest possible. The most obvious mechanism is to scrap the current

repairs and reallocate the budget to the proposed alternative. Results in this study strongly suggest that the current project is not a viable solution to the road problem – it is of low economic value and unsustainable in the long run. For expedited implementation, we recommend the government revises the budget allocation for the ongoing repairs to accommodate the additional financing estimated in this study. This will involve a quick redesign and reevaluation of the current project. Additional funds can be drawn from the Roads Fund through KeNHA.

7.0 CONCLUSIONS AND RECOMMENDATIONS

This report presents the results of an economic study conducted on the Moi South Lake Road, a key transportation artery for the horticulture, tourism and hospitality, and energy establishments straddling the Lake Naivasha basin. These businesses are critical for Kenya's economy in terms of foreign exchange earnings and are highly transportation-intensive; as such, road infrastructure conditions greatly impact their national and global competitiveness. The study applied the local economic development lens and economic base theory to analyze the value proposition for reclassifying and upgrading the road. We demonstrate that the road is critical for economic development of the local area and Kenya as whole, and therefore its poor condition diminishes the competiveness of existing companies and dissuades future investors from putting money into the local economy.

The alternative solution we have offered was analyzed using the cost-benefit analysis approach to extract metrics that are used to build a business case for the proposed project. The results suggest that the four sectors studied are all local basic economies that earn and employ significantly more than their national share. Furthermore, these sectors have remained highly resilient and competitive despite the poor and deteriorating state of the road. The key message from the results is that these are critical sectors not only to Naivasha economy but also Kenya's. Activities of the four sectors consistently inject significant amounts of income and jobs into the local economy, contributing more than half of Naivasha's GDP. The results suggest that the horticulture, tourism/hospitality and energy sectors earned about 20 times the normal national incomes and injected about 2.50 shillings into the local economy for each shilling earned.

Further analysis of the impact of upgrading the road on road user costs and wider local economy suggest that it not only offers higher value for money but also aligned with Kenya's development policies and strategies. Upgrading the road is expected to save road users about 31% in transport cost, with the highest coming from reductions in value of time cost (60% lower) and vehicle operating cost (27% lower). Overall, the road is expected to generate KES 105 billion in economic benefits and KES 27 billion in additional tax revenue.

The investment is very high value for money and of very high returns, with each shilling invested generating an additional KES 85 and the investment earning an economic return of 50-115%. These results provide very strong support for the adoption and implementation of the proposed road upgrading project. We therefore strongly recommend implementing it through a reclassification of the road to category C, traffic class T3, and widening to 7m. the responsibility for the road should be moved to KeNHA and the budget for the current repairs project reallocated to it, with additional drawing from the Roads Fund for the balance.

8.0 REFERENCES

African Development Fund (ADF). Nairobi Outering Road Improvement Project. Project Appraisal Report, October 2013.

African Development Fund (ADF). Timboroa-Eldoret Road Rehabilitation Project. Project Appraisal Report, October 2010.

Agnieszka Kazimierczuk. "Challenges for inclusive development in the flower sector in Kenya," INCLUDE Platform *News & Blogs*, 31 March 2016. Retrieved from http://includeplatform.net/news/challenges-for-inclusive-development-in-the-flower-sector-in-kenya/

Anker, R. & Anker, M. 2014. *Living Wage for Kenya with Focus on Fresh Flower Farm area near Lake Naivasha.* Report prepared for Fairtrade International, Sustainable Agriculture Network/Rainforest Alliance and UTZ Certified. Retrieved from http://www.globallivingwage.org/wp-content/uploads/2018/05/LivingWageReport_non-metropolitan-urban_Kenya.pdf

Calderon & Serven (2014). Infrastructure, Growth, and Inequality: An Overview. The World Bank, available at http://documents1.worldbank.org/curated/en/322761468183548075/pdf/WPS7034.pdf

Daily Nation, June 4th 2020. "Over one million rendered jobless as Covid-19 takes toll on businesses." Available at http://www.nation.co.ke/dailynation/business/over-one-million-rendered-jobless-as-covid-19-takes-toll-on-businesses-494134

Daily Nation, March 24th 2020. "Flower sector faces collapse as Covid-19 hits main markets." Available at http://www.nation.co.ke/business/Flower-sector-faces-collapse-as-Covid-19-hits-main-markets/996-5498896-n77mbbz/index.html

Embassy of the Kingdom of the Netherlands. Horticulture Study, Phase 1: Mapping of production of fruits and vegetables in Kenya. Final report prepared by Match Maker Associates, March 2017.

Hine J.; Abedin M.; Stevens R.J.; Airey T.; Anderson T. *Does the extension of the rural road network have a positive impact on poverty reduction and resilience for the rural areas served? If so how, and if not why not? A systematic review.* EPPI-Centre, Social Science Research Unit, UCL Institute of Education, University College London (2016), 143p. http://assets.publishing.service.gov.uk/media/57bb2631e5274a096800000c/Extension_of_the_rural_road_network.pdf

Ronoh, Irene J. 2020. "Geothermal Fluid for Industrial Use in the KenGen Green Energy Park, Kenya," #SGP-TR-216 in the proceedings of the 45th Workshop on Geothermal Reservoir Engineering, Stanford University, Stanford, California, February 10-12, 2020. Retrieved in July 2020 at http://pangea.stanford.edu/ERE/db/GeoConf/papers/SGW/2020/Ronoh.pdf

Kachumo, Moses K. 2016. "Financial viability of developing 35MW of geothermal power at Menengai Field, Kenya," UNU-GTP Report No. 19. Reykjavik, Iceland: United Nations University.

KenGen. 2012. Geothermal Development in Kenya. a presentation by the CEO at the Geothermal Resources Council (GRC) Annual Meeting, Reno, Nevada, USA, October 1st, 2012. Retrieved in July 2020 at http://www.geothermal.org/PDFs/Geothermal_Development_in_Kenya.pdf

Kenya Energy Generation Company (KenGen). Annual Report and Financial Statement 2015 & 2018.

Kenya Human Rights Commission (KHRC). 2012. “Wilting Bloom: The irony of women labor rights in the cut-flower sector in Kenya.”

Kenya Power & Lighting Company Limited (KPLC). Annual Report and Financial Statement 2018.

Kenya Wildlife Services (KWS). Annual Report and Financial Statement 2017.

KFC Profile (2020). In Kenya Flower Council. Retrieved from: http://www.kenyaflowercouncil.org/

KWS. 2010. Hell’s Gate-Mt. Longonot Ecosystem Management Plan, 2010-2015.

LANDac. 2016. Flowers for food? Scoping study on Dutch flower farms, land governance and local food security in Eastern Africa. Retrieved from http://www.landgovernance.org/assets/20160210-LANDac_Flower-Report-WEB.pdf

Mwiti, Kirera. “Billions-Shilling Worth Road, a Shame to Naivasha, Nation.” *People Daily*. December 3, 2019, Online edition. https://www.pd.co.ke/news/national/billions-shilling-worth-road-a-shame-to-naivasha-nation-15639/

Pindyck, Robert S. & Daniel Rubinfeld. 2009. Microeconomics, 7th edition. New Jersey, USA: Pearson Prentise Hall Press.

Riungu, Catherine. “Oserian Two Lakes Industrial Park Signs up Maxim Agri.” *Horticultural News*, September 6, 2019. https://www.hortinews.co.ke/2019/09/06/oserian-two-lakes-industrial-park-signs-up-maxim-agri/.

Riungu, Catherine. “Oserian: From a FIower Farm to an Industrial Park.” *Horticultural News*, June 17, 2019. https://www.hortinews.co.ke/2019/06/17/from-a-fiower-farm-to-an-industrial-park/

The Dutch Ministry of Economic Affairs, Agriculture & Innovation. 2012. “A study on the Kenya-Dutch Horticultural Supply chain.” A report prepared by Hortiwise.

The Standard, July 14th 2015. “Flower farmers agree to pay cess.” Available at http://www.standardmedia.co.ke/article/2000169133/flower-farmers-agree-to-pay-cess

The Standard, March 30th 2020. “Coronavirus: KEPSA launches campaign for Kenya’s worst hit flower industry.” http://www.standardmedia.co.ke/article/2001366236/kepsa-launches-campaign-for-the-flower-industry

Uche & A. Kazimierczuk. 2017. Dutch Companies and Productive Employment in the Flower Sector in Kenya, INCLUDE POLICY BRIEF. http://includeplatform.net/wp-content/uploads/2019/07/Uche_kazimierczuk_policy_brief_flower_sector_2017-1.pdf

World Bank. 2010. “Road projects cost benefit analysis: Scenario analysis of the effect of varying inputs.” Washington, D.C.: World Bank.

WWF. 2011. Shared risk and opportunity in water resources: Seeking a sustainable future for Lake Naivasha. Report prepared by Pegasys.

9.0 APPENDICES

Appendix 1: Methodology

To accomplish the assignment, a detailed industry analysis will be conducted to shed light on the political, economic, social, technological, environmental, and legal issues around the road. OGIVES will use this together with Industry Competitive Analysis Framework (ICAF) to identify the strengths and weaknesses internal to the selected sectors and the opportunities and threats external to it. Such an evaluation will allow the determination of the competitive position of the sectors against national and international competition, and how upgrading the MSLR would improve opportunities and mitigate against any threats. The focus will be on the following sectors:

1. Horticulture: the road is the main transportation artery for some of the largest flower and vegetable production and exporting companies, which account for about 40% of Kenya's horticulture exports.
2. Hospitality and tourism: it is the key link to major tourist hotels around Lakes Naivasha and Oloiden and the gateway to Hell's Gate and Lake Naivasha National Parks.
3. National government sectors, such as energy generation: it is the shortest access route to major geothermal resources and plants in Ol Karia.
4. Fisheries: the road provides the main evacuation route for the growing L. Naivasha fisheries with markets in Naivasha town, across Nakuru County, and beyond.

Economic Base Analysis

We performed economic base analysis (EBA) to develop a profile of the local economy and compare it to Kenya. By assumption, we believe that the horticulture, hospitality/tourism and energy sectors are the economic base of the South Lakes region of Naivasha, if not the entire Naivasha sub-county. To conduct the EBA of the local economy, two sets of calculations using employment, income, output, population or a variety of other economic factors are undertaken to identify the basic sectors, namely:

1. **Location Quotient Analysis (LQA)**, which measures the relative concentration of each industry or sector in the region compared to the reference area.

2. **Shift/Share Analysis (SSA),** which measures the growth or decline of each industry over a certain period, relative to the overall performance of that industry across the reference area. It decomposes changes into three components: national share, industrial mix, and regional share.

For purposes of this study, and because of time and resource constraints and potential data issues in measuring industrial mix and change, the LQA was preferred in estimating the potential economic impact of developing the MSLR. The LQ compares sector's share of local employment or income with its share of national employment, and is formulated as follows:

$$\mathbf{LQ} = \left(\frac{Eir}{Er}\right) \Big/ \left(\frac{Ein}{En}\right)$$

where, E_{ir} and E_{in} represent the employment or income of sector i of local region and the country, respectively, while E_r and E_n are the total employment or income of the local region and the country, respectively.

The LQ can be equal to, less than or greater than 1 to imply that the industry's share is the same, less than or greater than the national share. If the latter, the industry produces more goods and services than are consumed locally, which are exported to other regions of the country or to foreign markets. This simple calculation will also help us examine changes in the LQ over time – whether declining or increasing, and from what size.

The specific objective of conducting the EBA is to calculate base (employment) multipliers – a method for estimating the impact of the basic sector upon the local economy. It was calculated as the ratio of the total to basic sector employment or income in year *t*, thus:

BM = $\frac{Ert}{BErt}$

where, E_{rt} and BE_{rt} are the total employment or income in the region and the basic sector at time *t*, respectively.

Estimation of Local Employment and Income

The LQ and BM metrics were derived from production, employment and income data, both national and local. They were derived using several assumptions drawn from the literature, as follows:

Horticulture: From national export volumes and values, we assumed that the following:

- Naivasha area contributed 65-70% of cut flowers and 20% of fresh vegetables since 2010; of these, the area around the road was estimated to contribute about 85-90% and 75-80%, respectively. These are averaged from reports of industry groups, such as KFC, FPEAK, and the Lake Naivasha Growers Group (LNGG), unpublished reports, and WWF (2011).
- Approximately 45% of the total earnings are retained in the local economy (WWF, 2011).
- Employment is calculated from estimates of employee productivity (tons per employee) was calculated to be 3.6-3.8 and 2.9 for cut flowers and vegetables, respectively. The estimates were compared to those found in KHRC (2012).
- Estimates of direct and indirect employment outside and in Naivasha are calculated by assuming that for each employee on the farm there is one more at the pack house and another indirectly employed locally (this is derived from WWF, 2011).
- Agricultural investment was calculated using information from horticulture industry sources. We assumed an average greenhouse costs approximately $600,000 and $200,000 per hectare for flowers and fresh vegetables, respectively.

Tourism and hospitality: The estimates of number of hotels in Naivasha and their capacities are derived from registration details by the Kenya Tourism Regulatory Authority (TRA). The KWS and KNBS statistical publications – Statistical Abstracts and Economic Surveys provided data for tourism – number of visitors, bed availability and occupancy, employment and earnings. Naivasha numbers are calculated as follows:

- Nature tourism: The number of visitors to Hell's Gate and Mt. Longonot National Parks annually. We did not adjust the KWS data for the many private ranches and wildlife sanctuaries in the area. The data on total revenues was used to calculate the revenue per visitor and its historical growth, which was then used to extrapolate the revenue estimates for subsequent years. Since revenue data stopped in 2012, we applied the compounded annual growth rate (CAGR) of unit earnings between 2004 and 2012 (9% p.a.) to tabulate the 2013-2019 unit and total revenues. The resultant unit revenues were then used to extended the series over the appraisal period. To forecast the growth over the 20 years, we projected the number of visitors by assuming 4% annual growth; the resultant number was multiplied by the average of estimated revenue per visitor.
- Hospitality: The number of hotels, lodges and campsites extracted from the TRA and online was 50. Of these, 40 had data on bed capacity. Data for calculating bed occupancy rates, tourist visits, employment and seasonality was derived from an interview with one of the major hotels in the area and three tours and travel companies. The results were applied uniformly to all the hotels to generate bed occupancy rates – low and high seasons, total bed nights per month and annually, average number of visitors, number of employees, and revenue. The unit revenues used in the estimation were derived from the KNBS publications and extrapolated over the 20 years.

- Hotel investment: This was derived from the results of projections of growth in bed nights and occupancy rates. These were applied to average hotel capacity calculated from the hotels data to generate the number and capacity of hotels needed to meet projected demand. The investment cost was calculated from the estimated average size of a hotel room and unit construction cost in Kenya ($1200 per hotel room in 2019).

Cost-Benefit Analysis

We developed a case to provide robust evidence that the investment provides value for money (cost/benefit analysis), is financially affordable and deliverable, and is valuable to society. This includes the 'strategic case', the 'economic case', the 'financial case' and the 'value case' for the road. The strategic and economic case for the project are key to securing the support for the Business Case. The CBA was conducted using the Highway Development and Management Model (HDM-4) Version 501 of 2018, which applies multiple road and traffic characteristics and cost parameters to calculate the effects of road/traffic development on road user costs (RUC).

Appraisal Period

The cost and benefits of a road project or policy typically occur over a long time period. While the initial capital expenditure may occur in the first couple of years, maintenance and renewal costs and impacts on key factors are long-lasting. To compare the costs/benefits, therefore, the appraisal period should cover the period of usefulness of the assets under consideration. Typically, roads once built must be maintained and/or renewed when required; therefore, the asset life will be indefinite, or as long as it is maintained or renewed. We adopted the standard practice in Kenya of 25 years. The model was run for 20 years, leaving 20% as the residual cost value (RCV), which was converted to its NPV and subtracted from the investment cost.

Road User Cost

To identify the impacts of upgrading the road on value and risk under different economic and investment scenarios, RUC was calculated. The economic costs consist of (i) the capital investment costs; (ii) the routine and periodic maintenance expenses; and, iii) capital investment for major restoration works. The benefits consist of savings in vehicle operating costs and travel time for passengers and cargo. The benefit-cost ratio (BCR), the net present value (NPV), the economic internal rate of return (EIRR), and the NPV per kilometer (NPV/km) were calculated to evaluate the financial and economic value of the project. The BCR assesses the value for money (VfM) and includes the 'near certain' and 'more than likely' direct user benefits and budget and tax implications. The VfM helps in assessing the magnitude of impacts of the road on commuting users, other users, and businesses. The EIRR and the NPV/km help evaluate the financial affordability of the project. All the cost and benefit values were converted to economic values using an SCF of 0.8 (World Bank, 2010; African Development Fund (ADF), 2010 & 2013) and real values using forecasted inflation rates.

Discount Rate

To calculate the economic return to the road investment, there is need to convert the future cost and benefit flows into their present value. The present time was taken to be 2019 and the discount rate estimated at 14%, which is in line with recent Kenya infrastructure project valuations (KenGen Annual Report 2018; Kachumo, 2016; World Bank, 2010; African Development Fund (ADF), 2010 & 2013). This rate was used in calculating the nominal NPV of RUC. However, since the rest of the analysis uses real prices, the discount rate must also be converted to real rate. According to Pindyck & Rubinfeld (2009), this conversion is done by netting out the inflation rate. We used the Central Bank of Kenya annual inflation rates statistics between 2011 and 2020 to calculate the 10-year rate at 2%; this was assumed to be representative of the long run inflation for the appraisal period. The resultant 12% was adopted as the real discount rate for the CBA.

The Economic Case

The impacts considered in the 'economic case' include those directly impacting on the measured economy or sector and those which can be monetized; they can include all the additional economic, social and environmental impacts that can be attributed to the investment. The cost-benefit analysis (CBA) was used to make the economic case. The CBA used the benefit-cost ratio (BCR), the net present value (NPV), and NPV/km metrics to identify impacts of upgrading the road on value and risk under different economic and investment scenarios. The BCR is estimated using the following formula:

BCR = $\frac{Present\ Value\ of\ Benefits\ (PVB)}{Present\ Value\ of\ Costs\ (PVC)}$

The BCR is the measure for value for money (VfM), which forecasts two futures - one with the project (upgraded road) and one without (current project), and the difference between the two. We adjusted the BCR to include wider economic benefits, such as induced economic and investment impacts or reliability benefits, as well as qualitative and non-monetary factors. The magnitude of impacts of the road are the net impacts on commuting users, other users, and businesses – a product of usage (e.g. number of trips or vehicle mileage) and per unit use (e.g. time or cost saved per trip). The BCR is based on either the factor-cost or market-price unit of account, but the results expressed in the latter; all values are expressed in real prices and discounted.

The initial VfM assessment was categorized as follows:

- Poor VfM if the BCR is less than 1.0
- Low VfM if the BCR is between 1.0 and 1.5
- Medium VfM if the BCR is between 1.5 and 2.0
- High VfM if the BCR is between 2.0 and 4.0
- Very high VfM if the BCR is greater than 4.0

Data Collection

The study relied primarily on secondary data from published and unpublished sources. The consultant sought to save time and cost by first utilizing information that is readily and reliably available before conducting further research and data collection. The consultant first reviewed published literature and relevant reports to extract critical information, implement alternative analysis, identify gaps, and design survey instruments. This documentation included:

- Relevant FPEAK and partner documents and data
- Documentation on the relevant programs and profiles
- Development of data collection tools in collaboration with the client and stakeholders
- Data collection, data analysis
- Report writing, dissemination, incorporation of stakeholders' feedback

Information gathered during this stage assisted in refining tools to be used for key informants' interviews, as well as interpretations of the primary data. We consulted widely with project implementers to design and conduct surveys and interviews to validate and update existing information specific to the target sectors. The available data was scrutinized for credibility, including alternative analysis and interpretation.

Because statistical inference is not required and the population of the various actors is small and known, a non-probability sampling was used, with the main guiding factors being getting respondents with a high diversity of opinions, knowledge of (or linkages with) the sectors and markets, and accessibility to researchers. However, because the study was conducted during the ongoing COVID-19 pandemic, response from stakeholders contacted was extremely low – most companies were closed and key employees either sent on leave or dismissed. The key respondents did not have access to the information required. The consultant therefore relied

on the few responses received – one tourist hotel and three travel agencies, to conduct the analysis and then extrapolate. Because of the lack of primary data mining, estimation, extrapolation and interpretive analysis were the most important techniques used. A lot of this drew from the consultant's knowledge of the area and the various sectors of interest.

The Table below outlines the data collection matrix.

Key issue(s) / Questions	Proposed Method(s) / Data source	Possible questions / themes
Economic factors: Local population Local industry mix Employment (incl. indirect) Output / inputs / supplies Tourist visits Income / revenues HH total & per capita income	Secondary sources: KNBS Statistical Abstracts, Economic Surveys, KIHBS 2006/2016 Reports, KHPC 2009/2019 Reports, County GCP Reports 2019 & Inequality Report 2013; KTB / Kenya Hotel Keepers Association (KHKA) reports, FPEAK / KFC reports; KenGen / GDC / MoE / KeNHA/KERRA / KWS reports; Nakuru CIDPs. Primary sources – Interviews with: FPEAK, KenGen / MoE, KeNHA / KERRA, Naivasha Subcounty / Commissioner offices, KTB, KHKA	1. Leading economic sectors 2. Numbers employed – total & sectoral 3. HH incomes – average & per capita 4. Total output & Naivasha share 5. Inputs used & their sources 6. Annual & seasonal tourism traffic 7. Total industry income / revenue & Naivasha share
Business/government cost: Travel time Number of trips Vehicle operating costs Transport provider revenues and operating costs Costs to the broad transport infrastructure budget Changes in indirect taxation	Primary sources – Interviews with: Horticulture & tourist/hospitality companies, FPEAK/KFC, KTB, KHKA, travel agents, KenGen/GDC, Naivasha Sub-county gov't, KWS, KeNHA/KERRA	1. Average time taken to/from Nairobi-Nakuru Highway 2. Cost of operating transport vehicles – fuel, servicing, charges 3. Frequency of vehicle repairs 4. Operating cost & revenues of transport provider 5. Cost of public transport 6. Bed nights – annual & seasonal 7. Vehicular traffic – annual / seasonal 8. Cost of road building & maintenance 9. Local transport levies / cess

Appendix 2: Results Tables

A2.1. ECONOMIC STATISTICS

Table 17: Kenya employment, 2014-2019

Year	Kenya total wage employment	Kenya AFS employment	of which… hotels/lodges	of which… rest./food service	Hotels share	National electricity employment %	National AFS employment %	National hotels employment %
2014	2,370,184	73,165	53,375	19,790	73%	0.64%	3.09%	2.25%
2015	2,598,500	76,105	55,279	20,826	73%	0.65%	2.93%	2.13%
2016	2,683,100	77,363	55,851	21,512	72%	0.65%	2.88%	2.08%
2017	2,792,500	79,780	57,269	22,511	72%	0.68%	2.86%	2.05%
2018	2,859,900	81,553	58,164	23,389	71%	0.67%	2.85%	2.03%
2019	2,928,300	82,900	59,124	23,775	71%	0.67%	2.83%	2.02%

Source: KNBS

Table 18: Kenya agriculture employment, 2014-2019

	Mixed farming	Postharvest activities	Crop prod. support	Coffee	Tea	Sugar	Fiber	Total crop	Total AFF	Crop share	Mixed farming %	Mixed farming adj. total
2014	43,737	8,608	17,526	70,109	84,096	31,906	14,586	270,568	333,281	81.2%	16.2%	47,962
2015	43,636	8,912	17,728	72,486	83,934	32,462	14,797	273,955	336,979	81.3%	15.9%	47,879
2016	42,355	9,007	17,745	72,798	83,868	32,815	14,752	273,340	336,746	81.2%	15.5%	46,500
2017	41,676	8,946	17,600	71,739	81,958	32,614	14,551	269,084	332,105	81.0%	15.5%	45,787
2018	42,346	9,062	17,855	72,959	83,329	32,622	14,842	273,015	336,607	81.1%	15.5%	46,521
2019								296,700	338,600	87.6%	16.0%	50,439

Source: KNBS & Author's calculations

Table 19: Naivasha employment estimates

Year	Kenya population share		Kenya consumption share		Naivasha share of Nakuru County		Naivasha		
	Nakuru County	Naivasha Sub-county	Nakuru County	Naivasha Sub-county	Pop.	Consumption	Pop. (000)	Employed	Employed For Pay
2009	0.04200	0.00600	0.04800	0.0085	14.3%	17.7%	253	91,720	55,289
2016	0.04477	0.00700	0.06600	0.0129	15.6%	19.6%	317	133,544	81,624
2017	0.04512	0.00715	0.06900	0.0137	15.8%	19.9%		140,907	86,295
2018	0.04695	0.00731	0.07263	0.0146	15.6%	20.1%	339	148,677	91,233
2019	0.04546	0.00747	0.07593	0.0155	16.4%	20.4%	355	156,874	96,454
2020	0.0458	0.0076	0.0795	0.0164	16.4%	20.4%	368		

Table 20: Flower and fresh vegetable sector exports and employment

Year	Kenya exports (MT)		Naivasha (MT)		Farm mix (%) - flowers	Farm size (# flori employees	Farm size (# vegi employees)	Naivasha total employees
	flowers	fresh veges	flowers	fresh veges				
2012	108,300	66,400	74,727	13,280	68%	20,758	4,579	25,337
2013	105,600	77,200	71,808	15,440	68%	19,947	5,324	25,271
2014	114,800	70,300	76,916	14,060	68%	21,366	4,848	26,214
2015	122,825	69,700	79,836	13,940	68%	22,177	4,807	26,984
2016	133,658	78,800	86,878	15,760	73%	22,863	5,434	28,297
2017	159,961	87,200	103,975	17,440	73%	27,362	6,014	33,376
2018	161,227	85,819	104,798	17,164	73%	27,578	5,919	33,497
2019	173,721	72,735	112,919	14,547	73%	29,715	5,016	34,732
Mean (2017-19)	**64,970**	**81,918**	**107,230**	**16,384**				**33,868**

Table 21: Kenya tourism

	Earnings (mil. KSh)	No. of arrivals	Mil. KSh per arrival	Total Beds Occupants (000)
2012	96,000	1,610,000	0.060	6,861
2013	93,900	1,430,000	0.066	6,597
2014	87,100	1,350,000	0.065	6,282
2015	84,600	1,459,500	0.058	5,879
2016	99,700	1,666,000	0.060	6,449
2017	119,900	1,778,400	0.067	7,174
2018	157,400	2,027,700	0.078	8,618
2019	163,600	2,035,400	0.080	9,161
Mean (2017-19)	146,967	1,947,167	0.08	8,318

Source: KNBS

Table 22: Naivasha nature tourist visits and estimated revenue, 2004-2019

Year	Hell's Gate	Longonot	Total	Total Revenue (Kshs)
2004	37,586	12,653	50,239	13,936,876
2005	46,521	16,578	63,099	14,067,489
2006	62,197	20,889	83,086	21,807,835
2007	95,816	25,252	121,068	40,464,488
2008	82,103	29,872	111,975	28,982,432
2009	93,336	28,373	121,709	60,286,783
2012	95,417	32,453	127,870	71,124,868
2013	88,960	43,628	132,588	80,449,782
2014	114,086	50,671	164,757	109,051,282
2015	121,835	53,300	175,135	126,452,113
2016	154,385	64,500	218,885	172,399,257
2017	206,485	88,000	294,485	253,016,481
2018	165,817	60,100	225,917	196,408,926
2019	165,600	60,100	225,700	198,550,298
2015-19 CAGR	8%	3%	7%	12%

Source: KNBS & Author's own calculations

Table 23: Energy sector statistics

Year	Installed capacity (MW)	Power total (GWh)	Electricity sales (GWh)	KenGen sales (GWh)	Kengen Geo (GWh)	KenGen %	Geo %	Olkaria employment	Naivasha employment
2014	2,195.30	9,139	8,347	6,084	1,297	73%	16%	2,407	2,674
2015	2,333.70	9,515	8,714	7,027	3,104	81%	36%	2,779	3,088
2016	2,327.00	10,057	9,234	7,819	3,542	85%	38%	3,093	3,436
2017	2,339.90	10,360	9,633	7,556	3,282	78%	34%	2,989	3,321
2018	2,711.70	11,183	10,124	7,989	3,868	79%	38%	3,160	3,511
2019		10,431	8,873	7,002	3,632	79%	41%	3,341	3,713

Source: KNBS & Author calculations

Table 24: Hotels, lodges and campsites identified in Naivasha South Lake area

Name	Number of Beds	Total Bed nights	Bed occupancy rate (BOR) - high seas.	BOR - low seas.	Total bed occupancy	BOR
Panaroma Park Hotel	57	20,805	0.83	0.40	12,830	0.62
Aloe Park Hotel	10	3,650	0.83	0.40	2,251	0.62
Naivasha Kongoni Lodge	29	10,585	0.83	0.40	6,527	0.62
Eseriani Limited	22	8,030	0.83	0.40	4,952	0.62
Eseriani Resort	20	7,300	0.83	0.40	4,502	0.62
Kijiko Holdings	15	5,475	0.83	0.40	3,376	0.62
Carnelleys Camp	68	24,820	0.83	0.40	15,306	0.62
Genesis Guesthouse	20	7,300	0.83	0.40	4,502	0.62
Fish Eagle Inn	100	36,500	0.83	0.40	22,508	0.62
Masada Hotel	46	16,790	0.83	0.40	10,354	0.62
Lake Naivasha Resort	128	46,720	0.83	0.40	28,811	0.62
Sweet Lake Resort	135	49,275	0.83	0.40	30,386	0.62
Club Heritage Naivasha	103	37,595	0.83	0.40	23,184	0.62
Chui Lodge	20	7,300	0.83	0.40	4,502	0.62
Kiangazi House	14	5,110	0.83	0.40	3,151	0.62
Oloiden Campsite	14	5,110	0.83	0.35	3,023	0.59
Wileli Guest House	14	5,110	0.83	0.40	3,151	0.62
Chambai Safari Hotel	44	16,060	0.83	0.40	9,904	0.62
Miles & Miles Of Africa	6	2,190	0.83	0.40	1,351	0.62
Olerai House	10	3,650	0.83	0.37	2,190	0.60
Lake Naivasha Crescent Camp	20	7,300	0.83	0.37	4,380	0.60
Fisherman Camp	38	13,870	0.83	0.37	8,322	0.60
Club Heritage Naivasha	40	14,600	0.83	0.37	8,760	0.60
Twinspot Guest House	43	15,695	0.83	0.37	9,417	0.60
Summer Lodge	34	12,410	0.83	0.37	7,446	0.60
Malewa Garden Hotel	32	11,680	0.83	0.37	7,008	0.60
Ol- Makau Hotel	12	4,380	0.83	0.40	2,701	0.62
Aberdare Guest House	26	9,490	0.83	0.40	5,852	0.62
Lake Naivasha Sawela	150	54,750	0.83	0.43	34,675	0.63
Petda Guest House	24	8,760	0.83	0.33	5,110	0.58
Wambuku Hotel	33	12,045	0.77	0.37	6,826	0.57
Astorian Grand Hotel	38	13,870	0.82	0.37	8,206	0.59
Crater Lake Camp	25	9,125	0.85	0.43	5,855	0.64
Lake Naivasha Sopa Resort	164	59,860	0.87	0.40	37,911	0.63
Great Rift Valley Lodge	325	118,625	0.87	0.43	77,106	0.65
Loldia Lodge	18	6,570	0.87	0.47	4,380	0.67
Lake Naivasha Simba Lodge	180	65,700	0.87	0.40	41,610	0.63
Enashipai Resort And Spa	215	78,475	0.83	0.43	49,701	0.63
Kiboko Luxury Camp	16	5,840	0.87	0.53	4,088	0.70
Elsamere Lodge	15	5,475	0.83	0.33	3,194	0.58
Total	2,323	847,895	-	-	522,026	0.62
Average	58	21,197	0.84	0.40	13,233	0.62
Median	31	11,133	0.83	0.40	6,676	0.62
About ten Others	305	111,325	0.83	0.40	68,650	0.62
GRAND TOTAL	**2,628**	**959,220**	**400,874**	**190,045**	**590,676**	**0.62**
Kenya Hotels/Lodges Total		26,501,000			9,160,800	0.35
% Naivasha		4%			6.4%	

A2.2. ECONOMIC BASE ANALYSIS RESULTS

Table 25: EBA of the combined base economy

Year	Total Base Economy GDP (million KES, constant 2019)			Location Quotient	Base Multiplier
	Kenya	Naivasha	MSLR		
2014	344,270	78,147	35,166	21.9	2.5
2015	359,650	90,003	40,501	22.6	2.4
2016	418,616	101,462	45,658	19.9	2.5
2017	422,033	102,475	46,114	19.3	2.7
2018	503,207	123,201	55,441	19.6	2.3
2019	482,332	118,993	53,547	20.0	2.5

Source: Author's calculations

A2.3. COST BENEFIT ANALYSIS RESULTS

Table 26: Summary Bills of Quantities, in KES

DESCRIPTION	***PRO1*** ***7m, 50mm AC, no shoulders***	***PRO2*** ***7m, 50mm AC, 0.5m shoulder both sides***	***PRO3*** ***7m, 50mm AC, and 0.5m shoulder & 1.5m 35mm AC NMT both sides***	***PRO4*** ***7m, 50mm AC , and 0.5m shoulder & 3m 35mm AC NMT***
Length (km)	27	27	27	27
Sub-total 1 (core construction cost)	1,245,321,240	1,414,965,774	1,878,041,805	2,341,117,837
Sub-total 2 (incl. 2.5% contingency & 5% variation)	1,338,720,333	1,521,088,207	2,018,894,941	2,516,701,674
TOTAL (incl. 14% VAT)	**1,526,141,179**	**1,734,040,556**	**2,301,540,232**	**2,869,039,909**
TOTAL PER KM	**56,523,747**	**64,223,724**	**85,242,231**	**106,260,737**
TOTAL (US$)	**14,962,168**	**17,000,398**	**22,564,120**	**28,127,842**

Source: Author's analysis of the Engineer's BOQS

Estimating Daily Traffic Flows

Export horticulture: From the export volumes during the 2015-2019 period, it is estimated that about 60 (5-ton equivalent) trucks make daily return journeys to/from the area to transport flowers and vegetables to various markets and the JKIA. These clock approximately 3000 vehicle-kilometers (vkm) daily on the MSLR. In addition, trucks pick produce for other markets or deliver supplies to the farms, including inputs, materials and services. We assume that 40% of the 50 horticultural farms receive two deliveries daily and 0.5% of the staff use small trucks – total 270 trucks. In addition to the trucks, the farms use buses, vans and private cars to ferry the more than 30,000 employees to/from residential areas around Naivasha daily, each estimated to make about three return trips daily. We also assume that about 10% of the staff use private cars and 65% live off the farms, i.e., approximately 2000 cars. Of the remaining workers, about 70% live around Naivasha town and commute daily using approximately 560 (35-seater equivalent) vans and buses, each doing at least four trips daily. The total number of horticulture-related vehicles using the road daily is about 2800, plus about 780 motorcycles.

Energy: The demand for transport from the energy and related companies is equally enormous. For example, KenGen estimates its total fleet stationed at Olkaria at 176 medium-to-heavy trucks, which cumulatively cover between 145,000 and 170,000 kilometers per month (1.9 million vkm annually). Assuming KenGen fleet is 75% of the trucks in the sector, the total number of trucks is 251. In addition, it is estimated that 1000 KenGen employees use personal cars to commute between Naivasha town and the Olkaria fields daily. If another 30% of the

remaining employees in the energy sector use private cars, the total number of daily car traffic is over 1600. The remaining employees are transported on about 51 (40-seater) company or hired vans and buses daily – each making at least four trips. The road carries an estimated 1960 vehicles daily associated with the energy sector.

Tourism and hospitality: The T&HS traffic is difficult to estimate precisely. However, from tourist visitors and bed night numbers, we estimate that the traffic consists of over 600 private cars, 120 vans/buses used by employees and tourists, and 120 delivery vans/trucks.

Fisheries: The over 3,000 tons of fish harvested annually by 700+ fishermen and over 3000 other actors require daily transportation to and from the various fish landing sites and markets. Daily traffic into the area comprises of fishermen, fish mongers and traders, and fish transporters; a majority of whom uses motorcycles, vans and trucks. Approximately 600 motorcycles, 50 small buses, and five trucks ply the road daily ferrying people and fish. This traffic will most likely increase with the upcoming fish market.

In summary, the following traffic flows and fleet characteristics are estimated for the road.

Table 27: Road Traffic and Vehicle Fleet Characteristics

Vehicle Description	Average Annual Daily Traffic (AADT)	Vehicle Fleet Characteristics	
		Annual km Driven	Annual Working Hours
Motorcycle	200	15,000	600
Car Small	300	18,000	600
Car Medium	500	18,000	600
Delivery Vehicle	200	25,000	1,000
Four-Wheel Drive	200	20,000	600
Truck Light	100	20,000	1,100
Truck Medium	150	20,000	1,200
Truck Heavy	60	15,000	1,200
Truck Articulated	20	10,000	400
Bus Light	160	80,000	2,000
Bus Medium	80	80,000	2,000
Bus Heavy	40	21,000	800
Total	2,010		

Table 28: Average Annual Daily Traffic (AADT)

Year	Motor cycle	Small Car	Medium Car	Delivery Vehicle	Four-Wheel Drive	Light Truck	Medium Truck	Heavy Truck	Articulated Truck	Small Bus	Medium Bus	Large Bus	Total
1	200	300	500	200	200	100	150	60	20	160	80	40	2010
2	206	309	515	206	206	103	155	62	21	165	82	41	2070
3	212	318	530	212	212	106	159	64	21	170	85	42	2132
4	219	328	546	219	219	109	164	66	22	175	87	44	2196
5	225	338	563	225	225	113	169	68	23	180	90	45	2262
6	232	348	580	232	232	116	174	70	23	185	93	46	2330
7	239	358	597	239	239	119	179	72	24	191	96	48	2400
8	246	369	615	246	246	123	184	74	25	197	98	49	2472
9	253	380	633	253	253	127	190	76	25	203	101	51	2546
10	261	391	652	261	261	130	196	78	26	209	104	52	2623
11	269	403	672	269	269	134	202	81	27	215	108	54	2701
12	277	415	692	277	277	138	208	83	28	221	111	55	2782
13	285	428	713	285	285	143	214	86	29	228	114	57	2866
14	294	441	734	294	294	147	220	88	29	235	117	59	2952
15	303	454	756	303	303	151	227	91	30	242	121	61	3040
16	312	467	779	312	312	156	234	93	31	249	125	62	3132
17	321	481	802	321	321	160	241	96	32	257	128	64	3225
18	331	496	826	331	331	165	248	99	33	264	132	66	3322
19	340	511	851	340	340	170	255	102	34	272	136	68	3422
20	351	526	877	351	351	175	263	105	35	281	140	70	3525

Road User Costs Data

Table 29: Road Characteristics for Project versus alternative

Road Condition			Road Geometry				
Road Roughness (IRI, m/km)	Carriage way Width (m)	Surface (1-Paved 2-Unpaved)	Rise & Fall (m/km)	Number of Rise & Fall per km (#)	Horizontal Curvature (degrees/km)	Super elevation (%)	Altitude (m)
3.0	7.0	1	1	1	3	2.0	1800
5.3	6.0	1	10	3	15	3.0	1800

Project	Speed Adjustment Factors				Rolling Resistance Factors	
	Speed Limit (km/hour)	Speed Limit Enforcement (#)	Roadside Friction (#)	Non-Motorized Traffic Friction (#)	Percent Time Driven on Water (%)	Paved Roads Texture Depth (mm)
Current	100	1.10	0.50	0.50	20	0.35
Proposed	100	1.10	0.82	0.76	20	0.69

Cost Benefit Analysis Results

Table 30: Without Project Alternative

Year	Road Work Costs (M$)			Road User Costs (M$)	Total Society Costs (M$)	CO2 Emissions (tons)
	Capital Costs	Recurrent Costs	Total Costs			
1	1.528	0.000	1.528	14.058	15.587	7,971
2	1.365	0.000	1.365	14.501	15.865	8,215
3	0.000	0.000	0.000	12.738	12.738	7,277
4	0.000	0.000	0.000	13.141	13.141	7,501
5	0.000	0.000	0.000	14.731	14.731	8,424
6	0.000	0.034	0.034	15.650	15.683	9,066
7	0.000	0.000	0.000	14.436	14.436	8,219
8	0.000	0.000	0.000	15.654	15.654	8,962
9	0.000	0.000	0.000	17.127	17.127	9,914
10	0.000	0.580	0.580	17.805	18.385	10,254
11	0.000	0.000	0.000	16.150	16.150	9,225
12	0.000	0.000	0.000	16.747	16.747	9,532
13	0.000	0.000	0.000	19.218	19.218	11,143
14	0.000	0.012	0.012	20.009	20.021	11,533
15	0.000	0.000	0.000	18.315	18.315	10,425
16	0.000	0.000	0.000	20.483	20.483	11,692
17	0.000	0.000	0.000	21.730	21.730	12,567
18	0.000	0.007	0.007	22.555	22.563	12,990
19	0.000	0.000	0.000	20.706	20.706	11,761
20	0.000	0.000	0.000	23.362	23.362	8,215
Total	2.893	0.633	3.526	349.116	352.642	194,888
PV	2.747	0.232	2.979	131.745	134.724	

Table 31: Project Alternative

Year	Road Work Costs (M$)			Road User Costs (M$)	Total Society Costs (M$)	CO2 Emissions (tons)
	Capital Costs	Recurrent Costs	Total Costs			
1	5.946	0.000	5.946	14.058	20.004	7,971
2	5.309	0.000	5.309	14.501	19.809	8,215
3	0.000	0.000	0.000	8.352	8.352	5,924
4	0.000	0.000	0.000	8.441	8.441	6,318
5	0.000	0.042	0.042	8.705	8.748	6,513
6	0.000	0.037	0.037	8.982	9.019	6,712
7	0.000	0.032	0.032	9.284	9.316	6,925
8	0.000	0.028	0.028	9.580	9.608	7,137
9	0.000	0.024	0.024	9.885	9.909	7,355
10	0.000	0.021	0.021	10.200	10.221	7,580
11	0.000	0.018	0.018	10.545	10.564	7,816
12	0.000	0.660	0.660	10.861	11.521	8,046
13	0.000	0.000	0.000	11.030	11.030	8,236
14	0.000	0.000	0.000	11.380	11.380	8,487
15	0.000	0.012	0.012	11.742	11.754	8,745
16	0.000	0.010	0.010	12.138	12.149	9,020
17	0.000	0.009	0.009	12.526	12.535	9,296
18	0.000	0.008	0.008	12.925	12.934	9,577
19	0.000	0.007	0.007	13.339	13.346	9,868
20	0.000	0.007	0.007	13.765	13.771	10,167
Total	11.254	0.917	12.171	222.239	234.409	159,907
PV	10.686	0.299	10.984	90.843	101.827	

Table 32: Comparison between Project Alternative and Without Project Alternative

Year	Road Work Costs Decrease (M$)			Road User Costs Decrease (M$)	Total Society Costs Decrease (M$)	CO2 Emissions Decrease (tons)
	Capital Costs	Recurrent Costs	Total Costs			
1	-4.417	0.000	-4.417	0.000	-4.417	0.0
2	-3.944	0.000	-3.944	0.000	-3.944	0.0
3	0.000	0.000	0.000	4.386	4.386	1353.0
4	0.000	0.000	0.000	4.700	4.700	1182.3
5	0.000	-0.042	-0.042	6.026	5.983	1911.2
6	0.000	-0.003	-0.003	6.668	6.664	2353.3
7	0.000	-0.032	-0.032	5.151	5.119	1294.2
8	0.000	-0.028	-0.028	6.074	6.046	1824.8
9	0.000	-0.024	-0.024	7.243	7.218	2559.2
10	0.000	0.559	0.559	7.605	8.164	2674.5
11	0.000	-0.018	-0.018	5.605	5.587	1408.9
12	0.000	-0.660	-0.660	5.886	5.226	1486.4
13	0.000	0.000	0.000	8.188	8.188	2907.7
14	0.000	0.012	0.012	8.629	8.641	3046.2
15	0.000	-0.012	-0.012	6.573	6.562	1679.8
16	0.000	-0.010	-0.010	8.345	8.334	2672.8
17	0.000	-0.009	-0.009	9.204	9.195	3271.6
18	0.000	-0.001	-0.001	9.630	9.629	3413.1
19	0.000	-0.007	-0.007	7.367	7.360	1892.6
20	0.000	-0.007	-0.007	9.597	9.590	-1951.2
Net Present Value (M$) at			12%		32.897	
Internal Rate of Return (%)					50.0%	
Emissions Decrease (tons)						34980.3

A2.4. INDUCED ECONOMIC BENEFITS

To fully demonstrate the full impact of the road investment, we estimate its potential impact on output, earnings, investment, employment, and tax revenue in the three leading sectors. These estimates are summarized in Table 13 and briefly discussed here.

Tourism and hospitality: We estimate that upgrading the road would attract more tourists into the area and thereby Increase bed occupancy rate by 28%. The number of bed nights is expected to increase by about 542,600 during the appraisal period and bed occupancy will nearly double, at an annual growth of 3.5%. The annual demand for hotel beds at the end of the appraisal period is estimated to be 1.13 million. The equivalent number of new visitors is expected to be approximately 212,900. At the expected 79% bed occupancy rate, a total of 1.44 million bed nights will be required –which would require nearly 4000 beds (50% more than current establishment) – i.e., about 1400 new beds. At the estimated average number of bed nights, this is equivalent to 30 new hotels (up to 55 at the median hotel size) with slightly over 600 new rooms. Constructing the hotels will require $30 million at current real prices.

In the alternative case with the current repairs project, bed occupancy increase only 34% - growing at 2% p.a. The current bed capacity will be adequate to absorb the additional demand – only bed occupancy will increase by 34%, to 82%. Therefore, additional hotel investment will not be necessary. The real earnings from the upgrading project is expected to be 86% higher than the current – growing at 3.3% p.a. (compared to only 22% and 1.1% growth rate). In total, the expansion induced by the road upgrade would generate approximately $558 million in net additional earnings and approximately 2800 direct (3700 total) new local jobs. The economic benefit directly attributable to the local area will be $234 million, which would inject a total of $1.83 billion into the local economy; these are equivalent to NPV of $57.3 million and $447 million, respectively. In addition, the new hotel investment will inject $32.2 million into the local economy.

Horticulture: The new road is expected to increase horticulture production and exports by 35%, aided by higher productivity and 30% new investment in flower and vegetable farms. The additional investment is expected to be in the form of an additional 1200 ha (half each of flowers and vegetables) at a cost of about $378 million. We estimate that exports will grow at 7.8% annually and earn about $4.32 billion net. Naivasha is expected to retain approximately $1.95 billion (NPV = $448 million) of this, which will inject $7.2 billion (NPV = $1.7 billion) into the local economy. The growth will create about 19,000 direct jobs and induce a total of about 53,000 jobs in the locality. If about 35% of the new investment remains in the local economy, it would generate an equivalent of about $47 million in additional income, injecting $173 million total.

Energy: We estimate that geothermal energy generation and sales will continue to increase over the appraisal period, significantly so with the upgraded road. This will be aided by new investment in steam wells, increased share of geothermal electricity on the national grid, and rapid adoption of steam heating and electricity by local horticulture, dairy, hospitality and other new industries. In Kenya's Least Cost Power Development Plan 2010-2030, geothermal energy was projected to contribute 30% of the total energy consumption by 2030 (17,750 MW) – about 5000 MW. The Naivasha region currently produces nearly all the geothermal energy and is expected to dominate for the next 20 years – approximately 70% by end of the appraisal period. Its geothermal potential is estimated at 1200MW and current generation is around 900MW (KenGen, 2020). We project that the potential will be attained during the appraisal period – a growth of 33%. The energy sector's real earnings are expected to grow at 7.7% and 5.1% per year for 20 years with and without the project, respectively; the largest growth area will be the sale of steam and water – projected to grow by 9.6% per year with the project (c.f. 4.7% without). The expansion is expected to create about 1,800 direct and 10,300 indirect new jobs.

Appendix 3: Terms of Reference

Background

Fresh Produce Exporters Association of Kenya (FPEAK) has received financial support from Trade Mark East Africa (TMEA) to implement the **Kenya Horticulture Market Access Programme** which is being implemented from February 2020 to February 2022. The project aims to improve competitiveness and enhance market access for Kenya's horticultural produce. The Project will be implemented jointly with the Kenya Flower Council (KFC) and Fresh Produce Consortium of Kenya (FPC Kenya). The programme's main objectives are:

(i) Improve Market information systems
(ii) Improve Horticulture sector export strategies through
  (a) Development of market entry strategies
  (b) Trade and investment promotion for Horticulture
  (c) Capacity building and market linkages
  (d) Institutional capacity development of horticulture institutions and trade support bodies.
(iii) Develop and maintain a comprehensive M&E system

About the Assignment

Moi South lake road is not only the back bone of the horticulture sector in Naivasha, but also an important road for tourism, geothermal generation, fishing, and the hospitality industry within Naivasha. Despite the fact that the road is a major vein serving key economic installations and businesses, because of its history, it has seen several years of disrepair and under maintenance. In September 2019, the horticulture and industry sector representatives brought the status of this road to the attention of the national government. Consequently, the government promised to send a contractor to do repairs. The said contractor went to site in late October. However, the contractor's works seem to be below par. In the last two weeks, the road has been impassable because of flooding, occasioned by the technical flaws of the contractor on site as well as historical developments along the road. This has caused serious problems for the users of this road.

Purpose of the assignment

The purpose of this assignment is to carry out an economic study to assess and document the economic importance and viability of this important artery to the economy of Kenya and possible consequences to Kenya's horticultural exports and other sectors if the road is left in disrepair. Data will be collected on investments- number of flower and vegetable farms, hotels and tourist sites, number of jobs supported, amount of foreign and national revenue generated among others. The following investments will be considered among others;

a) Horticulture – About 40 flower and vegetable farms are situated on this road. These farms have a combined labor force of upwards of 50,000 people working at different levels and each employee supports at least four dependents.
b) Hospitality – Over two hundred hotels are found along Moi South lake road.
c) Geothermal – Africa's largest geothermal plants lead by Kengen and Orpower are found along this road.
d) Fishing – There is a booming fishing industry that employs so many youths on both lake Naivasha and Oloiden.
e) Tourism – The road serves some spectacular tourist sites like the Hells gate national park, Lake Naivasha and Mount Longonot.

Methodology

The consultant will be required to develop a detailed methodology in consultation with the project implementation team and the Programme steering committee. Baseline survey will be proposed to apply both quantitative and qualitative data collection methods. The consultant will be expected to develop data collection tools including both structured and semi structured questionnaires, checklists and guides in consultation with programme implementation team.

Desk review of secondary data. The consultant will be required review all available relevant documents relating to the study area. This will include reports from government agencies, development partners and various sector industry stakeholders among others.

O**utputs/Deliverables**

The following deliverables are expected from the consultant:

- Inception Report**:** The consultant shall submit an inception report within 3 days after signing of the agreement detailing;
  - The survey methods, tools
  - Final study proposal which includes introduction, literature review and methodology including sample coverage/ locations;
  - Detailed schedule for field work
  - Structure of the study report
- Draft report and Final report

The consultant shall submit a final report in both hard copies and electronic copies along with all survey data. The draft report is expected from the consultant for comments before the final report. The draft and final reports will be written in English language and must be comprehensive. The final report should incorporate all comments and corrections provided for the draft report. Completed checklists, questionnaires, quotes, photos have to be submitted together with the final report.

Appendix 4: List of Respondents

- Regulators and Government Institutions
  - Kenya Tourist Authority (TRA)
  - KenGen
  - KURA
  - AFA HCD
- Industry Associations and Companies
  - Kenya Hotel Keepers Association (KHKA)
  - Hosea Machuki, CEO FPEAK
  - Horticulture & tourist/hospitality companies
    - Fish Eagle Inn & Spa
  - Tour, Travel & Car Hire Companies
    - Go Trip Africa Ltd, Nairobi
    - Bright Steps Car Hire Services Ltd, Nairobi
    - Wild Streamer Tours and Travel Safaris, Nairobi