SOCIAL IMPACT ASSESSMENT OF BUILT ENVIRONMENT AND STRATEGIC MEASURES OF MITIGATING SOCIAL IMPACTS: THE CASE OF STANDARD GAUGE RAILWAY LINE AT SULTAN HAMUD IN MAKUENI COUNTY, KENYA

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A Thesis Submitted in Partial Fulfilment of the Requirements for the Award of the Degree of Master of Science Environment and Natural Resource Management in the School of Science and Technology, Departments of Environment and Natural Resource Management of African Nazarene University

January 2026

DECLARATION

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DECLARATION

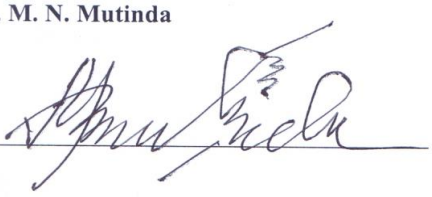
I declare that this document and the research proposal it describes are my original work and that they have not been presented in any university for academic work.

George Ochieng' Okumu
17J03DMEV003

Date: 08/06/2026

This research was conducted under our supervision and is submitted with our approval as university supervisors.

Dr. M. N. Mutinda



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Prof. A. A. Aboud

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Africa Nazarene University,

Nairobi, Kenya.

DEDICATION

The thesis is dedicated to my immediate family: My wife Jacinter for her encouragement during the period of my course work and writing of the thesis and my children Aleena, Dahlia, and Ryan for their understanding of my absence during my research and writing of the thesis.

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My special appreciation to the almighty God, for making everything possible for this thesis to be what it is today. It has taken time to complete it, but I believe the timing of the Lord is the best (as God makes everything beautiful in his time: and this is the time.

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Finally, I congratulate my research team of enumerators, contact persons and service providers for work well done and pass my sincere appreciation to the three hundred and forty-four (344) households, sixty-three (63) Key Informants and forty (40) members of Focus Group Discussions who willingly provided the data used in this study, “may the almighty God bless you for what you have done for me”.

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ABSTRACT

Built environment refers to the aspects of human made surroundings distinguished from the natural environment that provide support for human activity such as transportation, recreation, social networking, economic activities, defences from natural disasters, telecommunications among others. Built environment impacts the environment and the society positively and negatively. This study therefore was undertaken to determine the impacts of built environment on the society using the Mombasa-Nairobi standard gauge railway line (SGR) as a case study. Specifically, the study was to: (i) determine the socio-demographic characteristics of the stakeholders and households impacted by built environment (SGR), (ii) undertake a scoping exercise for Social Impact Assessment (SIA), (iii) Assessment of social impacts of the built environment (SGR) using the SIA framework and variables, (iv) identification of mitigating strategies and ranking of their effectiveness in alleviating social impacts of a built environment (SGR). A mixed method research design incorporating crossectional, descriptive, *ex post facto* and evaluative designs was used for this study. The target population was the households within ten-kilometre radius of Sultan Hamud town within the corridor of the Mombasa-Nairobi SGR. A stratified random sample of 344 households was identified and surveyed using a structured questionnaire. Key Informants Interviews (KII) of sixty-three (63) purposively selected stakeholders were undertaken to identify and rank the impact mitigating strategies. Four Focus Group Discussions (FGD) were conducted to triangulate the survey and KIIs data. The data was analysed using descriptive and inferential statistics in the Statistical Package for the Social Sciences (IBM SPSS version 27). The findings showed that the social impacts of the built environment (SGR) using the combined index of five dimensions and twenty-six (26) indicators of Social Impact Assessment (SIA) framework were rated as high (M=5.0, SD=.45) on a scale 0 no impact to 7 very high impact. The reliability of the index using Cronbach's alpha was determined as (α=.877). The stakeholders identified mitigating strategies for social impacts of the built environment (SGR) at Sultan Hamud and ranked their effectiveness in terms of their implementation. The Corporate Social Responsibility and the utilisation of the new livelihood ventures created by the Built environment (SGR) were highly ranked strategies by the stakeholders. The study recommended public involvement and participation in mitigating social impacts. The implication of the study findings to the stakeholders and the communities impacted by the Built Environment (SGR): (i) the SIA process creates an awareness to the affected community of their social responsibility as pertains to the management of the impacts of development project, (ii) the identification of the significance and magnitude of the social impacts shows the stakeholders and the impacted community of the effects of the development for them to address, (iii) as they identify the social impacts and strategies for mitigating the impacts, it allows them to mitigate or eliminate the negative impacts and enhance the positive ones to manage their economy, and (iv) the SIA procedure also identifies and brings together the project stakeholders to the table to discuss and manage the challenges arising from the building and implementation phase of the development projects.

DEFINITION OF TERMS

Built Environment This refers to the aspects of human made surroundings distinguished from the natural environment that provide support for human activity.

Social Impact Assessment (SIA). This includes the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions.

Environmental Impact Assessment (EIA) is defined as the systematic examination of the unintended consequences of a development project or program, aimed at reducing negative impacts and maximizing positive ones, while ensuring the protection of the environment and natural resources for sustainable economic development. (El Haggar, 2005).

Standard Gauge Railway refers to a railway line whose distance between the inside edges is defined as 1435mm in many different parts of the world except in the United States, where it is defined using imperial and US customary units as 4ft 8 1/2in.

Modern Technology This is the advancement of the previously applied technological methods with new additions and modifications in day to day problem solution.

Design These refers to all preliminary studies including the social impact assessment, the Environmental impact assessment, geotechnical tests, topographical survey and cost benefit analysis carried out to determine the viability of a project.

LIST OF ABBREVIATIONS AND ACRONYMS

SGR	Standard Gauge Railway
CEB	China Exim Bank
CRBC	China Road and Bridge Corporation
EAC	East African Community
CEC	County Executive Committees
PA	Provincial Administration
SID	Society for International Development
AHI	African Highlands Initiative
EIA	Environmental Impact Assessment
KSH	Kenya Shillings
GDP	Gross Domestic Product
KURH	Kenya Uganda Railways and Harbours

CHAPTER ONE

INTRODUCTION

1.1 Introduction

The research study focused on the assessment of social impacts arising from built environment using the Standard Gauge Railway (SGR) line at Sultan Hamud as the case study. The households' strategies for mitigating the impacts of the built environment (SGR) were identified and evaluated in terms of their effectiveness in mitigating the social impacts of the physical development.

Chapter one of this thesis covers; the background to the study, statement of the problem, objectives of the research, research questions, significance of the study, limitations of the study, delimitations of the study, theoretical framework and the conceptual framework of the study.

1.2 Background of the Study

Built environment refers to the aspects of human made surroundings distinguished from the natural environment that provide support for human activity such as transportation, recreation, social networking, economic activities, defences from natural disasters, and telecommunications. They range from buildings, their support infrastructure and human-made usable spaces between the buildings. Portella (2014). describes built environment as a general concept that can be related with all the structures built by man to support human activity. The term comprises everything that is physically part of a city, a town, or a village, such as buildings, roads, squares, parks, sidewalks, commercial signage and street furniture (Thompson and Kent, 2017).

In the development of built environments, the stakeholders usually intend to provide milestones in improvement of human well-being of social, economic and cultural status, the latest being improvement in the advancement of the modern technology. These milestones can however result to positive community life improvements and some to negative impact to the society. There are some cases when initially positively propagated milestones are negated thus resulting into negative effects.

Social Impact Assessment (SIA) is the process of identifying, evaluating, and addressing the effects of proposed actions, policies, and programs on the human environment and the social fabric of communities (Townsend & Steedly, 2014). SIA provides a framework for determining how policies and projects affect the social fabric of a community. The process recognizes that communities are systems, with a number of interrelated interdependent parts operating as a whole. The process is iterative and multidimensional, taking into account the effects of these actions on individuals, families, groups, and entire communities, as well as on the networks and institutions that play an essential role in a community's social cohesion (Hassan, 2018).

Social impacts are the ultimate short time and long-term interventions on human socio- economic and cultural environment arising from human caused developments and policy changes. These impacts of development interventions take range from the initially projected positive impacts, negative impacts and those that arises due to negation of positive impacts. As the benefits projected from a development flow in from different perspectives, there is need to identify and evaluate the negative impacts associated these developments. These exerted influences need to be evaluated and

assessed for mitigation in such a way that the positive impacts are enhanced and the negative impacts mitigated (Johnston and Lane, 2018).

Environmental Impact Assessment (EIA) is an analytical process that systematically examines the possible environmental consequences of the implementation of projects, programs and policies and how it affects daily life of populations whose environment is impacted. Social Impact Assessment (SIA) is a component and an aspect of Environmental Impact Assessment (NEMA, 2014)

A well planned and optimized development takes into account the social dimension of human development. The Social Impact Assessment (SIA), Environmental Impact Assessment (EIA), and Biodiversity Impact Assessments are some of the methods that are required in planning, design and implementation of development projects (Centre for good Governance, 2006).

The studies, Social Impact Assessment (SIA), Environmental Impact Assessment (EIA), and Biodiversity Impact Assessments (BIA) are implemented in the scope of preliminary designs stage, and support the integration of social and environmental aspects associated with the development of built environment into the decision-making process. They enhance positive social and environmental outcomes; and minimize social and environmental impacts as a result of either individual subprojects or their cumulative project development.

The overall resultant effects of social impacts from a development are wide in scope. Past studies have tried to group these social impacts into categories under which other minor effects fall. Juslén (1995) identified several general impact categories and grouped them as ‘standard’ social impacts psychosocial impacts anticipatory fear;

impacts of carrying out the assessment; impacts on state and private services; and impacts on mobility.

Built environment has innumerable benefits to the society where it is located. These range from social, economic, cultural and technological benefits. This equally comes with unintended detrimental social, environmental and biodiversity variations of the ecosystem. Some of the already identified impacts in the development of built environment include the positive change in demographic characteristics, improved and functioning institutional structures, management of human conflicts, improved individual and family changes, improves usage and exploration of community resources, economic growth, environmental and social sustenance of the society. The negative impacts are the direct negation of the above stated factors (Hurst and Johnston, 2018).

In Project planning for a built environment, it evaluates the cost benefit analysis, the final design for implementation bases its core on the positive values outweighing the negative values. There have been situations where expected consequences negate the positive benefits of economic development. This increases human ecological footprint due to the disturbances caused to the environment. When any built environment is created it is expected that disturbances to social, economic and cultural harmony which can either be positive and/or negative to occur. In many built environments, people tend to be exposed to multiple stressors and the effects of these are not well understood (Gatersleben & Griffin, 2017). This fact forms the basis of this study.

1.3 Statement of the Problem

Built environment, such as infrastructure, housing and other physical facilities are made to provide social and economic benefits to the community and the environment.

The Kenya Standard Gauge Railway (SGR) line (the case study for this thesis) was constructed with an aim to provide fast efficient and reliable mode of transport, reduce the cost of passenger and cargo transportation, boost Kenyan GDP, improve luxurious travel of passenger through their destinations, reduce the number of heavy trucks on the roads, and speed up industrialization and to protect the environment through reduced carbon emissions.

The Built Environments also tend to have positive and negative long- and short-term impacts to the environment and the community, the impacts to the community and environment may be known but not quantified. This provides the need for Social Impact Assessment to assess the impacts and provide a plan for mitigating the negative impacts and enhancing the positive ones. raises the problem of planning the mitigation measures for the impacts.

The Built Environment (SGR) has been shown in studies to cause environmental impacts. Nyumba et al. (2021) assessment found that there were environmental impacts associated with the Kenya SGR and concluded that construction and operation of the SGR degraded, fragmented and destroyed key ecosystems in the country including water towers, protected areas, community conservancies and wildlife dispersal areas. The Environmental and Social Impact Assessment (ESIA) for the Mombasa-Nairobi SGR project also identified ecological, social and economic impacts (AWEMAC, 2012).

The current research intended to assess the social impacts of built environment both the actual and projected using the case of the Kenya SGR project as the built environment and the mitigation measures for the purpose of social sustainability,

which can be achieved by promoting the positive benefits and mitigating the negative effects.

1.4 Purpose of the Study

The purpose of the study was to evaluate impacts of SGR to the society using households in Sultan Hamud in Kajiado and Makueni Counties, Kenya.

1.5 Objectives of the Study

The main objective of this study was to assess the social impacts arising from the construction and implementation of the standard gauge railway (SGR) line to the residents of Sultan Hamud town in Kajiado and Makueni Counties, Kenya.

1.5.1 Specific Objectives

The specific objectives of the study are:

(i). To determine the demographic characteristics of Stakeholders and households impacted by built environment (SGR) at Sultan Hamud area in Kajiado and Makueni Counties

(ii). To undertake a scooping exercise to determine the indicators of social impact assessment variables useful for evaluating impacts of SGR to the community in Sultan Hamud area in Kajiado and Makueni Counties

(iii). To assess the social impacts of a built environment (SGR) as perceived and experienced by households at Sultan Hamud area in Kajiado and Makueni Counties

(iv). To identify and appraise strategic measures for mitigating social impacts for a built environment (SGR) at Sultan Hamud area in Kajiado and Makueni Counties

1.6 Research Questions

(i). What are the demographic characteristics of households impacted by built environment (SGR) in Sultan Hamud area in Kajiado and Makueni Counties?

(ii). What are the social impact assessment indicators useful in evaluating impacts of a built environment and how do they rate using a scooping exercise in Sultan Hamud area in Kajiado and Makueni Counties?

(iii). What are the social impacts of built environment (SGR) as perceived and experienced by households at Sultan Hamud area in Kajiado and Makueni Counties?

(iv). What are the strategic measures for mitigating social impacts of a built environment at Sultan Hamud area in Kajiado and Makueni Counties?

1.7 Significance of the Study

The reason why this study is significant can he explained in five different aspects:

First, this study assesses the impact of the Standard Gauge Railway line (SGR) on the social life of the local inhabitants of Sultan Hamud, Makueni County, Kenya. Consequently, this study has value to the social life of the residents.

Second, the assessment of the impacts of the Standard Gauge Railway (SGR) on the social life of the residents of Sultan Hamud, also evaluated the course and extent of the mitigation procedures proposed in the planning of the construction of the project.

Third, it is hoped that this study may help all stakeholders, technical institutions and policy makers taking part in development of built environment on how they can improve on the reduction of negative social effects and improvement on the positive social effects in implementation of the future projects of similar kind and magnitude.

Fourth, the findings from this study will add to knowledge on the existing literature and benefit other researchers that may wish to conduct further research to help improve the knowledge and information on built environment. Issues raised in the study and recommendations that are made will be beneficial in the modification of facilities and programmes to improve on methods of dealing with social impacts of built environments.

Fifth, the study is significant academically as it provides information on built environments, mitigation measures, and household perceptions of the existing social impacts.

1.8 Scope of the Study

This study was carried out in a 10 km radius of Sultan Hamud town located along the Nairobi-Mombasa highway. The Kenya SGR and the oil pipeline passes through the town area. The town lies between two counties Kajiado and Makueni. The town lies between Latitude -2.0168394 and Longitude 37.3693579 at an altitude of 1227m.

The study focussed on the social impacts arising from the built environment (SGR) and the strategies used to mitigate them. The evaluation of the social impacts used the Social Impact Assessment (SIA) variables developed by Burdge and Vanclay (1996). These are 26 indicators divided into five (5) domains: Population characteristics of the residents, Community and Institutional Structures of the community, Conflict between local residents and new-comers of the town, Individual and family changes of the residents and Community Resources of the residents.

1.9 Delimitations of the Study

The study sample selected was composed of people and leaders who had lived in Sultan Hamud before, during and after the construction of the SGR and owned land in the area. This omitted people who were living in the area but were not resident of the area.

The study may not have been able to cover all the social groups living in the area (especially the youth and this may have missed the perceptions of the young population in the area.

1.10 Limitations of the Study

The study area covered a 10km radius of Sultan Hamud and the SGR, this area was purposively selected for this research due to its nearness to the SGR, the extent of the town and the surrounding rural land use. The conditions of the area may not be a typical representation of the whole SGR which extends from Nairobi to Mombasa. This limitation was countered by dividing the area into sections (stratum) and having samples that were proportional to the population of the strata.

Cultural and language barrier in the study area caused challenges of accessibility. This however was mitigated by the use of research assistants and the involvement of the Chief and the representative of the *Nyumba kumi initiative* from the area who were conversant with the culture, language and the conditions of the area.

1.11 Assumptions of the study

The researcher considered a number of assumptions, which included:

(i) The respondents' responses were honest, truthful and accurate,

(ii) The sample size chosen was a representation of whole population of the community impacted by the built environment (SGR) in Sultan hamud area,

(iii) The intervening variables of the study remained constant,

(iv) The Key Informants were cooperative in releasing the required information

1.12 Theoretical Framework

The study will be guided by two theories: Bibb Latane theory of social impact (Dietz, 1987) and environmental stress theory (Lazarus & Cohen, 1977. These two are discussed in section 1.12.1 and 1.12.2.

1.12.1 Social Impact Theory

Social impact theory (SIT) was developed by Bibb Latane in 1981 (Latané, 1981) is a theory meant to predict how and when sources of social influence will affect the target of influence. Latane theory suggests that we are greatly influenced by the actions of others in that we can be persuaded, inhibited, threatened, and supported by others. The Social Impact Theory (SIT) has been renamed as the Dynamic Social Impact theory, this is because the theory considers that the influence from social impact is a two-way exchange in that the target can influence the source and vice versa.

Latané's theory proposes that individuals can be the sources or targets of social influence. Social impact theory is a model that conceives of influence from other people as being the result of social forces acting on the individual. The likelihood that someone will respond to social influence is thought to increase with the strength of the source, the immediacy of the event, and the number of sources exerting the impact as depicted in Figure 1.1 and explained in Table 1.1.

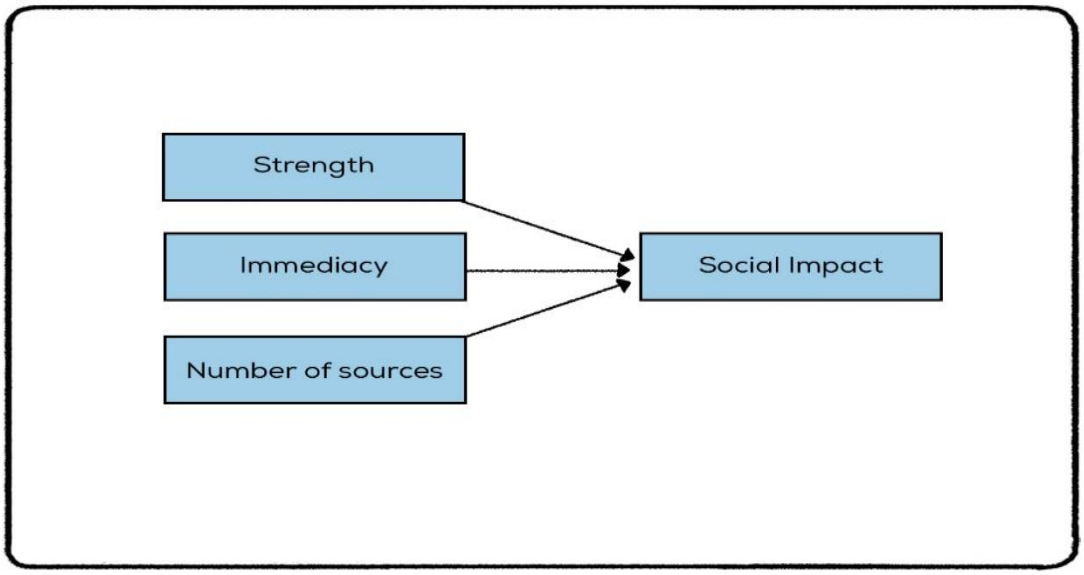

Figure 1.1: Variables/ Pillars explaining Latane's social impact theory

The SIT describes social impact in terms of social force fields that impinge upon people, pushing them to think or behave in a particular way. These social forces can be equated to physical forces that govern the transmission of light, sound, gravity, magnetism. For example, the amount of light that falls on a table top is a function of the strength of the lights that shine on the table, their distance from the table, and the number of lights that are present. In an analogous way, the social impact felt by an individual should be a function of the strength, immediacy, and number of source persons that are present. Thus, these three elements, or descriptions, of source persons should all directly affect the social force felt by a target person (Jackson, 1987).

Social impact theory, which deals with impact can be measured at three levels at the individual, family and community. Dynamic social impact theory (DSIT) looks at how this one person or group, who is influenced, may also influence a group or person as well. For example, celebrities influence the media, and media influences celebrities. The common people influence politicians and politicians influence the common people (Baumeister & Vohs, 2007).

Table 1.1: Explanation of the Components Social Impact theory

Social Force	Explanation	Illustration
Strength	Salience, importance or intensity of the influencing source. Can be related to the source itself (Transituational strength) or related to the context-specific roles that the influence and the influenced occupy (Situational strength)	Transituational Strength: age, gender, physical characteristics, and perceived intelligence, physical appearance. Situation-Specific Strength: Actor and audience, teacher and class, peer pressure and alcohol consumption.
Immediacy	The proximity of influencing source and the individual who is the target of the influence. Can be physical, temporal or social	Physical Immediacy: Geographic location, seat spacing, crowding. Temporal Immediacy: time between announcements, duration of announcement Social Immediacy: perceptions that others are "like us."
Number	The number of influencing sources directed towards the individual	Numbers in a crowd, numbers in class, numbers in an online community.

Latané built Social Impact Theory around three organizing principles: The first, the *social forces rule,* states that impact is a multiplicative function of strength, immediacy, and number. The second, the *psychosocial law,* captures the diminishing returns of adding more sources – modelled after Stevens's psychophysical law, which describes how sensory perception follows a similar curve. The third principle – *multiplication versus division of impact*– distinguishes between situations where one person is the target versus many. When multiple people share the target role, the pressure is distributed and each person feels less of it. This principle accounts for

social phenomena like social loafing, where individuals in larger groups exert less individual effort because responsibility is diffused, and the bystander effect, where the presence of multiple witnesses reduces each person's likelihood of helping someone in distress (Baumeister & Vohs (2007).

1.12.2 Environmental Stress Theory (EST)

Environmental stress theory can be explained by the concept that an environmental stimulus can cause responses within an organism. These responses occur due to a cognitive and an autonomic evaluation of the stressor in the environment as threatening or nonthreatening (Lazarus & Cohen, 1977). Stressors perceived as threatening tend to lead to stress reactions involving physiological, emotional, and behavioral elements, which in turn may elicit strategies designed to cope with and potentially adapt to the threat. This theory deals with appraising stress from threatening issues which may arise in the environment (Ding, 2022).

Environmental stress theory suggests that stressors found in the environment such as radiation, physical structure, non-ergonomic furniture, natural disasters, pollution, illnesses, and climate change significantly affect the health of individuals and social groups. For instance, a report stated that the presence of industrial chemicals has led to a global pandemic of neurodevelopmental toxicity. Also, another study concluded that those who are usually exposed to traffic noise have higher levels of stress hormones (Bilotta et al., 2018).

The physical environment affects people in many ways, how they feel, what they think and how they act. When the demands of the physical environment outweigh an individual's ability to deal with those demands, stress occurs. Environmental stress refers to a negative subjective psychological response to an environmental stimulus. It

is important to note that an environmental stimulus that is stressful for one person in a particular situation may not be stressful for another or for the same person in a different situation. As such, environmental stress is an interaction between an individual and an external stimulus (.

Environmental stress theory suggests that stressors found in the environment such as radiation, physical structure, non-ergonomic furniture, natural disasters, pollution, illnesses, and climate change significantly affect the health of individuals and social groups. For instance, a report stated that the presence of industrial chemicals has led to a global pandemic of neurodevelopmental toxicity. Also, another study concluded that those who are usually exposed to traffic noise have higher levels of stress hormones.

There are many types of stress factors associated with the environment, ranging from climate conditions to cell phone radiation to life situation stressors. Generally, they do not get a lot of attention but have a big impact on our health. Lazarus and Cohen (1977) mentioned eight types of stressors that can be identified with the way we tend to feel: (i) climate stressors, (ii) major disturbance stressors, (iii) anthropogenic stressors, (iv) ergonomic stressors, (v) energetic stressors, (vi) chemical stressors, (vii) biological stressors, (viii) physical environment stressors

Environmental Stress as a Response to Stimulus from Surroundings

Baum et al. (1985) explained that stress is a process by which environmental events threaten, harm, or challenge an organism's existence or well-being, and by which the organism responds to this threat. Subjects may be observed in the stressful environment and their behavioural responses recorded and interpreted, or performance measures can be used to assess the effects of stress on motivation or

on some ability or skill during or after exposure to a stressor. Research on life change is concerned with measuring the frequency of experience with various stressors or events that require adjustment or involve disruption of everyday life. Observational measures of behavior under stressful conditions can also provide useful information.

The Environmental Stress Theory is based on several key components (Fang, et al., 2023) they include:

(i) Stressors: These are the factors in the environment that cause stress. They can be physical (like noise or heat), social (like conflict or social pressure), or psychological (like fear or frustration).

(ii) Coping Mechanisms: These are the strategies that individuals use to deal with stress. They can be problem-focused (dealing with the stressor itself) or emotion-focused (dealing with the emotional response to the stressor).

(iii) Adaptation: This is the process by which individuals adjust to stressors. It can involve changes in behavior, cognition, or physiology.

(iv) Stress Outcomes: These are the effects of stress on an individual's health and well-being. They can be physical (like illness or fatigue), psychological (like anxiety or depression), or behavioral (like aggression or withdrawal).

Environmental Stress Theory provides a framework for understanding how environmental factors can cause stress and impact an individual's health and well-being. It highlights the importance of effective coping mechanisms and adaptation in managing stress. In a real-world situation, the environmental stress theory might work as in the example depicted in Table 1.2.

Table 1.2: A Practical Example of the Working of the Environmental Stress Theory

Step	Description
Stressor	A student is facing a high workload at university.
Coping Mechanism	The student decides to create a study schedule to manage their time effectively.
Adaptation	The student adjusts their daily routine to accommodate the study schedule.
Stress Outcome	The student experiences less stress and performs better academically.

1.13 Conceptual Framework

The conceptual framework illustrates the interaction between the dependent and the independent variables. In this study, the independent variable is the Built environment, the Standard Gauge Railway (SGR) line passing through Sultan Hamud town. This is an example of a built environment which is bound to have positive and negative environmental and social impacts on the welfare of the affected communities during construction and completion of the project.

The dependent variable, Social Impacts is assessed using the Social Impact Assessment (SIA) variables. The SIA variables are twenty-six in number and are divided into five (5) dimensions. These dimensions include: population impacts, communal/ institutional arrangements, communities in transition, individual and family level impacts and the community infrastructure needs (IOCPGSIA, 2003). The social impacts are assessed by the stakeholders using a 7-point rating scale as follows: 0=No Impact, 1=Extremely Low Impact, 2=Very Low Impact, 3=Low Impact, 4= Moderate Impact, 5=High Impact, 6= Very High Impact, 7=Extremely high Impact. The scores for the indicators are then added to give the magnitude of the impact for that variable.

The direct and indirect impacts arising from the built environment (SGR) to the communities can be mitigated by planned strategic interventions (or the mitigating variables) as depicted in Figure 1.2.

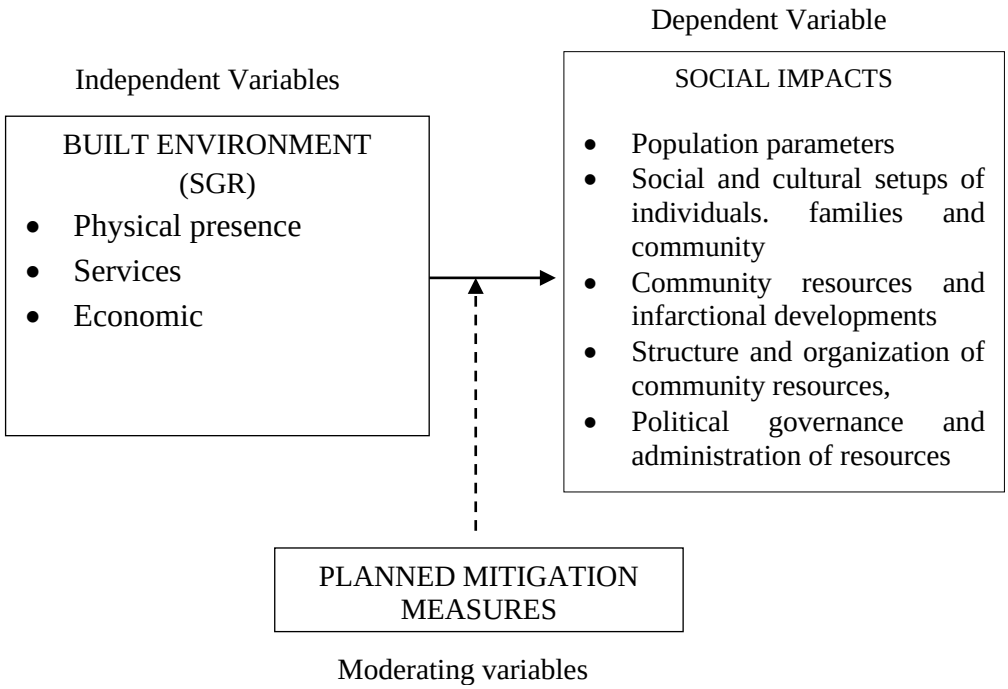

Figure 1.2: Conceptual framework depicting the relationship between changes caused by Built environment (SGR) and their influence on the social impacts of communities in Sultan hamud in Makueni and Kajiado County, Kenya

The possible changes that can be brought about by the SGR project were selected from a list of possible changes that can occur due to a mining project developed by Daniel Franks (Franks, 2011) and shown in Table 1.3.

Table 1.3: Common Change Induced by Mining that can Lead to Social Impacts

No	Variable/indicators	Description
L	**Social and Cultural Change**	
1	Population and demographics	In-migration, out-migration, workers' camps, social inclusion, growth or decline of towns, conflict and tensions between social groups
2	Social infrastructure and services	Demands on and investment in housing, skills (shortages and staff retention), childcare, health, education, and training
3	Crime and social order	Corruption, domestic violence, sexual violence, substance abuse and trafficking, prostitution, change in social norms, pace of change for vulnerable communities
4	Culture and customs	Change in traditional family roles, changing production and employment base, effect of cash economy, reduced participation in civil society, community cohesion, sense of place, community leadership, cultural heritage
5	Community health and safety	Disease, vehicle accidents, spills, alcohol and substance abuse, pollution, interruption to traditional food supply, awareness and treatment programs
6	Labour	Health and safety, working conditions, remuneration, right to assemble, representation in unions, labour force participation for women
7	Gender and vulnerable groups	Disproportionate experience of impact and marginalization of vulnerable groups (e.g., women, disabled, aged, ethnic minorities, indigenous, and young), equity in participation and employment
8	Human rights and security	Abuses by security personnel (government, contractor, company), social disorder in camps, suppression of demonstrations, targeting of activists, rights awareness programs
II	**Economic Change**	
	Distribution of benefits	Employment, flow of profits, royalties and taxes, training, local business spending, community development and social programs, compensation, managing expectations, equitable distribution across state/regional/local/ethnic/ family groups, cash economy
	Inflation/deflation	Housing (ownership and rents), food, access to social services

	Infrastructure	Demands on, and investment in, roads, rail, ports, sewerage, telecommunications, power and water supplies
III	**Socio-Environmental Change**	
	Pollution and amenity	Air (e.g., dust), water (e.g., acid and metalliferous drainage, cyanide, riverine and submarine waste disposal), noise, scenic amenity, vibration, radiation, traffic, government capacity to monitor and regulate
	Resources (access/competition)	Land, mobility, water (groundwater, river, ocean), mineral resources (artisanal and small-scale mining), cultural heritage, forest resources, human, post-mining land use
	Resettlement	Consent and consultation for resettlement, compensation, ties to land, adequacy of resettlement housing and facilities, equity, post-settlement conditions, livelihoods
	Disturbance	Disruption to economic and social activities (including by exploration), consultation for land access, frequency and timing, compensation
IV	**The Process of Change**	
	Community engagement	Consultation, communication, participation, empowerment, access to decision makers, transparency, timing, inclusiveness – particularly for vulnerable and marginalized groups – respect of customs and authority structures, reporting
	Consent	Indigenous sovereignty/title (free, prior, and informed consent), community consent
	Participation	Planning, development of programs, monitoring, selection of alternatives and technologies, operational aspects
	Remedy	Grievance and dispute resolution, acknowledgment of issues, compensation, mitigation
	Agreements	Equity, timely honouring of commitments, issues with delivery, duress, clarity of obligations, capacity and governance (including government capacity to respond to and manage change)
	Community development	Participation, adequacy, appropriateness, capacity to facilitate, consistency, prioritization

(Source: Franks, 2011)

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides an overview of previous studies that support this research on built environment and its effects to humas social and cultural environment. It introduces the conceptual framework for the case study showing the relationship and linkages between the main variables and how these variables affect the case study.

2.2 Impact Assessment (IA)

Impact Assessment (IA) is a general term that can be defined as the process of identifying the future consequences of a current or proposed action. One of the major sub-fields of impact assessment is social impact. Baker (2001) recognizes four types of impacts: environmental impacts, technology impacts, economic impacts, and social impacts.

2.2.1 Social Impacts

Social impact (SI) can be understood as the real or perceived, intended or unintended, relational and agentic consequences that emerge from organizational decisions or actions for individuals, communities, and societies. The term social impact describes the consequences, real or perceived, on a social setting, that results from an organizational decision or action. Inherent here is the recognition that social impact aligns with consequences, whether it be on individuals, communities, and societies, and that these consequences stem from organizational decisions and behaviors (Hurst & Johnston, 2021, p. 2; see also Burdge & Vanclay, 1996; Johnston & Lane, 2018b).

Social impacts are more inclusive than the specific impact assessments conducted for specific fields such as: assessment of health impacts, assessment of cultural impact,

assessment of heritage impact, assessment of aesthetic impact, assessment of gender impact among others. The social impacts are also more than the few considered during the standard environmental impact assessment (EIA) such as: demographic changes, job issues, financial security, and impacts on family life.

2.2.2 Conceptualization of Social Impacts

The work of Hurst and Johnstone (2025) on the taxonomy of social impacts, realized many professionals and academicians define social impacts in many different ways to a point that the universal meaning of social impact becomes complex and ambiguous and cannot be used in sound description or comparison of different development initiatives uniformly. To remove this ambiguity the authors, recommended the idea of operationalization of the social impacts in different contexts or defining the different aspects, attributes or themes to use in social impact definition so that the definition is clear, authentic, and accountable.

In their operationalization of social impacts concept, Johnstone and Lane (2018) emphasised the attribute of change in the way people live, experience, sustain, and function within their society due to a development, policy change or plans. The changes can be positive or negative, intended or unintended, anticipated or unanticipated. The international Association for Impact Assessment (IAIA) conceptualizes social impacts as changes to one or more of the following indicator variables:

(i) People's way of life: how they live, work, play and interact with one another on a day-to-day basis;

(ii) *Their culture:* their shared beliefs, customs, values and language or dialect;

(iii) Their community: its cohesion, stability, character, services and facilities;

(iv) Their political systems: the extent to which people are able to participate in decisions that affect their lives, the level of democratization that is taking place, and the resources provided for this purpose;

(v) Their environment: the quality of the air and water people use; the availability and quality of the food they eat; the level of hazard or risk, dust and noise they are exposed to; the adequacy of sanitation, their physical safety, and their access to and control over resources;

(vi) Their health and wellbeing: health is a state of complete physical, mental, social, and spiritual wellbeing and not merely the absence of disease or infirmity;

(vii) Their personal and property rights: particularly whether people are economically affected, or experience personal disadvantage which may include a violation of their civil liberties;

(viii) Their fears and aspirations: their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.

2.3 Social Impact Assessment (SIA)

Social Impact Assessment (SIA) is defined as the process of identifying the future consequences of a current or proposed actions, which are related to individuals, organizations and social macro-systems (Becker, 2001). Social Impact Assessment includes the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions. Its primary purpose is to bring about a more sustainable and equitable

biophysical and human environment (International Association for Impact Assessment, 2024; Vanclay, 2003).

The important features of this definition are that:

- The goal of impact assessment is to bring about a more ecologically, socio-culturally and economically sustainable and equitable environment. Impact assessment, therefore, promotes community development and empowerment, builds capacity, and develops social capital (social networks and trust).
- The focus of concern of SIA is a proactive stance to development and better development outcomes, not just the identification or amelioration of negative or unintended outcomes. Assisting communities and other stakeholders to identify development goals, and ensuring that positive outcomes are maximized, can be more important than minimizing harm from negative impacts.
- The methodology of SIA can be applied to a wide range of planned interventions, and can be undertaken on behalf of a wide range of actors, and not just within a regulatory framework.
- SIA contributes to the process of adaptive management of policies, programs, plans and projects, and therefore needs to inform the design and operation of the planned intervention.
- SIA builds on local knowledge and utilizes participatory processes to analyze the concerns of interested and affected parties. It involves stakeholders in the assessment of social impacts, the analysis of alternatives, and monitoring of the planned intervention.
- The good practice of SIA accepts that social, economic and biophysical impacts are inherently and inextricably interconnected. Change in any of these

domains will lead to changes in the other domains. SIA must, therefore, develop an understanding of the impact pathways that are created when change in one domain triggers impacts across other domains, as well as the iterative or flow-on consequences within each domain. In other words, there must be consideration of the second and higher order impacts and of cumulative impacts.

- In order for the discipline of SIA to learn and grow, there must be analysis of the impacts that occurred as a result of past activities. SIA must be reflexive and evaluative of its theoretical bases and of its practice.
- While SIA is typically applied to planned interventions, the techniques of SIA can also be used to consider the social impacts that derive from other types of events, such as disasters, demographic change and epidemics.

2.3.1 International Principles for Social Impact Assessment

Vanclay (2003) developed and IAIA (2024) endorsed specific international principles for the practice of Social Impact Assessment, they include:

- Equity considerations should be a fundamental element of impact assessment and of development planning.
- Many of the social impacts of planned interventions can be predicted.
- Planned interventions can be modified to reduce their negative social impacts and enhance their positive impacts.
- SIA should be an integral part of the development process, involved in all stages from inception to follow-up audit.
- There should be a focus on socially sustainable development, with SIA contributing to the determination of best development alternative(s) – SIA

(and EIA) have more to offer than just being an arbiter between economic benefit and social cost.

- In all planned interventions and their assessments, avenues should be developed to build the social and human capital of local communities and to strengthen democratic processes.
- In all planned interventions, but especially where there are unavoidable impacts, ways to turn impacted peoples into beneficiaries should be investigated.
- The SIA must give due consideration to the alternatives of any planned intervention, but especially in cases when there are likely to be unavoidable impacts.
- Full consideration should be given to the potential mitigation measures of social and environmental impacts, even where impacted communities may approve the planned intervention and where they may be regarded as beneficiaries.
- Local knowledge and experience and acknowledgment of different local cultural values should be incorporated in any assessment.
- There should be no use of violence, harassment, intimidation or undue force in connection with the assessment or implementation of a planned intervention.
- Developmental processes that infringe the human rights of any section of society should not be accepted.

2.3.2 Assessment of Social Impacts

The Social Impact Assessment has been described as a process composed of specific steps and activities aimed at quantifying the positive social and cultural impacts in order to enhance sustainable development and suggesting mitigation measures for the

negative impacts to improve on the ecological characteristics of the environment. The seven SIA key steps that serve to guide organizational mission, vision, and planning (Hurst et al., 2023), they are:

(1) proposing decisions, (2) understanding which stakeholders are or may be impacted by an organizational decision or behavior, (3) predicting the nature and extent of this social impact, (4) measuring the actual social impact, (5) managing the social impact, (6) reporting on the social impact, and (7) ongoing monitoring and evaluation.

In the measurement of Social Impacts, it is composed of the following activities documented by IAIA (2024):

- participates in the environmental design of the planned intervention;
- identifies interested and affected peoples;
- facilitates and coordinates the participation of stakeholders;
- documents and analyses the local historical setting of the planned intervention so as to be able to interpret responses to the intervention, and to assess cumulative impacts;
- collects baseline data (social profiling) to allow evaluation and audit of the impact assessment process and the planned intervention itself;
- gives a rich picture of the local cultural context, and develops an understanding of local community values, particularly how they relate to the planned intervention;
- identifies and describes the activities which are likely to cause impacts (scoping);
- predicts (or analyses) likely impacts and how different stakeholders are likely to respond;

- assists evaluating and selecting alternatives (including a no development option);
- assists in site selection;
- recommends mitigation measures;
- assists in the valuation process and provides suggestions about compensation (non-financial as well as financial);
- describes potential conflicts between stakeholders and advises on resolution processes;
- develops coping strategies for dealing with residual or non-mitigatable impacts;
- contributes to skill development and capacity building in the community;
- advises on appropriate institutional and coordination arrangements for all parties;
- assists in devising and implementing monitoring and management programs.

2.3.3 Social Framework for Projects

The Social Framework for Projects developed by Smyth and Vanclay (2017) is a conceptual and analytical tool in the field of social impact assessment (SIA). It is an effective framework for identifying and better understanding the social impacts that might arise from projects. (Siebert & Vanclay, 2024). The framework aims to understand, assess, plan and manage the social issues associated with big projects in a simple yet comprehensive way (Smyth and Vanclay 2017).

The Social Framework draws on existing approaches, is compatible with human rights concerns, is aligned with international standards and best practice, assists in contributing to achieving the Sustainable Development Goals, and yet is participatory, practical and simple (Smyth and Vanclay 2017).

A key advantage of the Social Framework is that it provides a process to understand how the wellbeing of host communities is impacted by large projects. The framework is structured around eight key categories: people, community, culture, livelihoods, infrastructure, housing, environment, and land (see Figure 2.1). It should be noted that the Social Framework was primarily designed to be a tool to assist in thinking about the social issues faced by a pre-existing host community rather than the issues faced by workers or by new arrivees (project-induced in-migration), but potentially it could also be used for these other purposes.

Figure 2.1: Eight Key Categories of the Social Framework that impact on the wellbeing of the host communities

The Social Framework represents a simple conceptual model for highlighting the social issues that contribute to people's well-being and that are impacted by large projects. At the core of the Framework is people's well-being. Individuals are used as the primary unit of analysis in recognition of the fact that there is considerable inequality within households and communities, and that it is important to understand

how some people are more vulnerable to project impacts than others. The Framework also acknowledges that individuals typically live within families and communities, and that there is co-dependence between these different social layers.

Wellbeing is an all-encompassing notion that includes having one's basic human needs met (e.g. adequate food and water), being in good mental and physical health, having the ability to pursue one's goals and to thrive, feeling connected to and a part of one's local community and locality, and a general feeling of being satisfied with life (OECD. 2011). Impacts to well-being can occur at local, national and even international levels. Changes to our local environment can have a very direct impact on our well-being, but changes at distant locations can also have an impact when they affect the things we care about. For example, a project that causes the loss of habitat of an endangered species, the destruction of natural or cultural heritage, or threatens highly significant ecosystems, can reduce our well-being even if they take place on the other side of the world.

2.4 Variables / Indicators Used in Assessing Social Impacts

The Social Impact Assessment (SIA) measurement uses variables and indicators (Burdge, 2002; Takyi, 2014). Five social impact dimensions or categories used in the assessment of social impacts, they include: population impacts, communal/ institutional arrangements, communities in transition, individual and family level impacts and the community infrastructure needs (Burdge and Vanclay, 1996; Franks, 2001). These dimensions are discussed in this section.

2.4.1 Population Impacts

Population impacts are diverse interventions of social, demographic, and economic features of the countries or regions demography. These impacts range from population

change, influx or outflux of temporary staff in case of a socio-economic activity, presence of seasonal residence mainly for the purposes of leisure, relocation of individuals or families emanating from the infrastructural development and dissimilarity in age, gender, racial and ethnic composition in a society.

These diverse impacts can be used to tailor the development and evaluation of policies and programs to better serve the needs of a given population at higher risk for certain conditions. Data on impacts on a population that may affect physical, social, economic and cultural, as well as general livelihood of the population in a specific region shall be useful in this study.

According to the UN census in 2012, Kenya has a population of 42.7 million people from which 992,183 is the population of Makueni County. The town of sultan Hamud on the county has population of about 100,000 dominated mainly by urban settlers from various parts of the country for socio-economic activities in the town.

2.3.2 Community/ Institutional Arrangements

The promulgation of a new Constitution on August 27th 2010, created devolution from the central government to the county governments. Unlike other countries like Uganda, Ghana, Columbia, and Argentina where the three types of decentralization occurred in leaps and sequentially (Kauzya, 2007; Falleti, 2005; Crawford, 2004), the Kenyan case is peculiar in the sense that all the three types of decentralization occurred at once.

Some of the key objectives of decentralization as spelt out in Article 174 include: “to promote democratic and accountable exercise of power; to give powers of self-governance to the people and enhance the participation of the people in the exercise of

the powers of the state in making decisions affecting them; and to facilitate the decentralization of state organs, their functions and services from the capital of Kenya" (Government of Kenya (GOK), Constitution, 2010: 113).

Administratively, to actualize self-governance, Article 179 of the 2010 Constitution requires that all county executive authority and its exercise be vested in the County Executive Committee (CEC) headed by an elected governor and his or her deputy. Functionally, County governments are empowered by Article 183: Clause 1 (a-d) to implement county legislation, manage and coordinate county administration and their departments including functions conferred to them by national legislation.

Operationally, Article 235 requires parliament to enact legislation to enable county governments to create county public service mechanisms, responsible for creating offices, recruiting, promoting and disciplining public servants within their jurisdictions (GOK, 2010). The 2010 Constitution therefore requires county governments to create their own bureaucracies to enable them to better serve their citizens. Broadly, these Articles and others seem to emphasize a downward accountability mechanism where people-elected officials run the local affairs of the devolved governments and are accountable to those who elect them.

Previously under the old constitution, coordination of central government policies and development programs at the local level was done by the provincial administration (PA). As a department within the Office of the President, the PA not only supervised other central government ministries at the province and district levels but also coordinated their programs and policies. As personal 1 Restructuring the Provincial Administration: An Insider's View SID Constitution Working Paper No. 3 representatives of the president at the local levels, the provincial administrators

exercised upward accountability as they “served at the pleasure of the President” (Akech, 2010: 27).

Currently, under the new constitution, the central power was devolved down to the counties with the Governors and Deputy Governors and the Senators in charge of the counties with the Members of the county assemblies are in-charge of the Sub-Counties. On the sane structure, the constituency levels are governed by the Members of Parliament and the Women Representatives.

The new constitution outlines duties of each of the administrative and governing members. On the other hand, the presidency has been delegated to the County Commissioners under which Chiefs and Village elders assist in the management of the devolve county as a representative of the office of the president. This aspect in general has caused formation of attitudes towards a project by the society, formation of interest group activities, alteration of the size and structure of the local government in order to suit in the administration and management of new projects, creating some presence of zoning and planning activity, industrial diversification, family living wage, enhanced economic inequities, change in employment equity of minority groups and change in the occupational opportunities for the society.

2.3.3 Communities in Transition

This is a created change between people with either supporting or opposing social, economic, and cultural resources which are needs, ideas, beliefs, values, or goals. This emanates due to the emergence and presence of an outside agencies to manage the projects and their sole control comes from outside the area of project, emergence of inter-organizational corporation, introduction of new social classes, changes in the

commercial and industrial focus of the area, and presence of vocational residents for recreation.

These transitions create new social or political groupings which can be of prosperity or dangerous if they fail to reach a consensus on the settlement of the transition source.

2.3.4 Individual and Family Level Impacts

The family is a unit which acts as a major institution for carrying out essential production, consumption, reproduction, and accumulation functions that are associated with the social and economic empowerment of individuals and societies (Zitha Makomane, 2012). The key pathways to these functions and, in turn, to social and economic empowerment include family capital and family resilience.

The concept of family capital borrows from the literature on social capital where the latter refers to “resources embedded within a person’s social network that influence decisions and outcomes by shaping a personal identity while delineating opportunities and obstacles within a person’s social world” (Belcher et al, 2011:69).To this end family capital provides enabling resources and strengthens the capacity of individual family members to function and attain their current and future goals and objectives.

Infrastructural developments creates impacts levels through disruption in daily living and movement patterns to suit in the natural cause created by the project in the society, creation of dissimilarity status in religious and cultural practices due to diversity of a project stakeholders, alteration of family structures, disruption of social networks previously existing in the community before emergence of a project in the area, different perceptions of public health and safety status in the area, and changes in leisure opportunities for the local residents

2.3.5 Community Infrastructure Needs

For sustainable development, institutions, especially at local level, are important for mobilizing resources and regulating their use with a view to maintaining a long-term base for productive activity (Uphoff n.d). In terms of natural resource management, William (1995) adds that sustainable use is conditioned by the strength of local institutions to involve the user of that resource in its rational management.

Rural communities live in well-organized set-ups that structure their activities and interactions with the environment in their quest to make a living out of available resources. Households, kin groups, hamlets and villages are the main actors through which local communities are organized (Singh 1994). Such structures are the local institutions through which diverse community aspirations are fulfilled. They are highly path-dependent (Olate 2003), dynamic and develop with society according to needs.

They may last for a long time, accomplish their objectives, fade out, or transform to capitalize on emerging opportunities. Local institutions differ based on their functions and objectives. According to Donnelly-Roark et al. (2001), they encompass many different types of indigenous organizations and functions such as village-level governance, acceptable methods of community resource mobilization, security arrangements, conflict resolution, asset management and lineage organization.

In Mozambique, traditional leaders including spiritual ones were found to be important institutions with responsibilities such as land allocation, conflict resolution and mediation with spirits (Blom 2000; Virtanen 2000; Serra 2001); the latter being important where norms have been violated. Elsewhere, in Mali, Burkina Faso and Niger, Hilhorst (2008) noted that informal local governance institutions continue to

play an important role in natural resources management including defining access and management of natural resources and in sanctioning trespassers. Ultimately, institutions encourage people to take a longer-term view by creating common expectations and a basis for cooperation that goes beyond individual interests, and to the extent institutions are regarded as legitimate, people comply without (or with fewer) inducements and sanctions (Uphoff n.d).

However, it is also recognized that local institutions have weaknesses when it comes to sustainable practices that favour sustainability. In case of emergence of a project in a given area, there are tendencies of change in community infrastructure and resources, rising cases of land acquisition and disposal and enhanced effects of known cultural, historical, sacred and archaeological resources

2.4 Built Environment

Social impacts are the ultimate short time and long-term interventions on human socio- economic and cultural environment arising from human caused developments, today majorly the built environment. These impacts of development interventions take range from the initially projected positive impacts, negative impacts and those that arises die to negation of positive impacts. While projected benefits flow in from different development actions, there is also a need to identify and evaluate the negative impacts associated with them. These impacts needs to be identified and measured and be mitigated in such a way that the positive impacts are maximized and the negative impacts are minimized.

A well planned and balanced development takes into account the socio-economical, environmental, cultural and biodiversity impacts of economic development. According to ‘A Comprehensive Guide for Social Impact Assessment, Centre for

Good Governance (2006), the Social Impact Assessment (SIA), Environmental Impact Assessment (EIA), and biodiversity impact assessments are some of the methods that have been used in planning, design and implementation of developments.

These assessments and studies are implemented as part of the preliminary designs stage, Social Impact Assessment (SIA), Environmental Impact Assessment (EIA), and biodiversity impact assessments support the integration of social and environmental aspects associated with the development of built environment into the decision making process. They enhance positive social and environmental outcomes; and minimize social and environmental impacts as a result of either individual subprojects or their cumulative effects.

The overall resultant effects of social impacts from a development are wide in scope. Past studies have tried to group these social impacts into categories under which other minor effects fall. Juslén (1995) identified several general impact categories and grouped them as ‘standard’ social impacts psychosocial impacts anticipatory fear; impacts of carrying out the assessment; impacts on state and private services; and impacts on mobility .

Built environment has innumerable benefits to its location society. This equally comes with unintended detrimental social, environmental and biodiversity effects on people and natural resources. Human activities have played a major role in the disturbance ecosystem. In order to achieve a built environment then there must be expectation to disturbance to social, economic and cultural harmony which can either be positive and/or negative.

From the fact that Project planning for a built environment evaluates the cost benefit analysis, the final design for implementation bases its core on the positive values outweighing the negative values. There have been situations where expected consequences negate the positive benefits of economic development.

2.5 Impacts of Built Environment

Built Environment especially linear infrastructure project are known to cause environmental and impacts during the construction and utilization of the structures. The impacts can be beneficial or negative to the environment and society.

2.5.1 Environmental Impacts of SGR

The most prominent environmental concerns in Kenya are water, soil and they arise from pollution from urban and industrial wastes; degradation of water quality from increased use of pesticides and fertilizers, deforestation, soil erosion and desertification Kenya has signed various international environmental agreements that are related to biodiversity protection and climate change for instance through the Kyoto Protocol,

On the other hand, there were negative impacts that were already identified in the preliminary design stages and possible mitigation procedures were put into place. The negative effects oppress the state of the free natural biodiversity and social effect risk to the inhabitants of the railway corridor.

2.5.2 Social Impacts of SGR

Already, the impact of the SGR is already being felt as at least 30 per cent of the financing cost is being spent in the country. Both individuals and SMEs benefit from the construction as demand construction materials is high and the job creation

opportunities through provision of labour force from the local communities. The service providing sector has benefited since services such as healthcare, catering security and entertainment are being provided to SGR workers creating captive market for the sector.

Kahangirwe and Vanclay (2024) based on primary and secondary data, concluded that the linear infrastructure projects were likely to provide the following short and long-term benefits:

- A safer, cleaner, and healthier living environment, with reduced dust and noise.
- Improved access to social services.
- Short-term job opportunities for subcontractors and local people.
- Supply of equipment and materials by local suppliers.
- Increased business for local retailers during construction (to workers) and beyond (to people who now have improved access to these retail outlets).
- Rental income during construction from providing land for the contractors' requirements, as well as accommodation for workers.
- Increase in property values.
- Because of perceived increased land value, local residents might be motivated to improve their houses and/or commercial premises to obtain higher returns.
- Private investors might be attracted to invest in the area, leading to improved services and facilities.
- Increased prosperity benefits town councils and districts through increased rate revenue.
- Increased income for farmers by having an expanded consumer base to buy their product.

- Increased activity in local markets, benefiting all traders.

2.6 The History of Railway Transport in Kenya

According to the historical publications of Railway transport in East Africa, The Kenya – Uganda Railway originally known as the Kenya and Uganda Railways and Harbours (KUR&H) was built by the Imperial British East Africa Company back in the 1890s. Construction of the line began at the Kilindini Harbour in Mombasa in 1895 after the Berlin Conference of 1885 when the British set to open up the interior of East Africa by connecting the Indian Ocean to Uganda using the railway to counter divisions in the African regions. This had a low design capacity of transportation of both passengers and cargo in comparison with the state today (Walmer, 2010).

In 1900, the line arrived at the present site of the city of Nairobi. For the purposes of engineering designs, railway engineers drained a vast swamp, to enable the construction of permanent buildings as subsidiary infrastructure for the operation of the railway transport and thus the existence of Nairobi City today. The construction continued and arrived at Port Florence (Kisumu) around 1901 (Ochieng and Maxon, 1992).

During this time, the British Government took over the territories of Kenya and Uganda from the Imperial British East Africa Company. In 1920, Kenya became a colony of the crown under direct administration of the Colonial Office in London.

The railway was expanded from Eldoret to Kampala. Additional branch lines were built from Nakuru to Nyahururu, from Nakuru to Rongai and from Konza to Magadi within the Kenyan territory.

Further expansion to the Central Kenya took place after the invasion of Ethiopia by Italy during the Second World War forcing the British to expand the railway from Nairobi to Nanyuki to access and service the armed forces in Nanyuki base.

After independence in the early 1960s, railway and port operations in Kenya, Uganda and Tanzania was administratively cantered: the East African Railways and Harbours. The breakup of the East African Community in 1977 marked the beginning of the end for the region's railway system. Each of the three East African countries took up running its own system. In Kenya, railway and port operations were split between two state-owned corporations: Kenya Railways and Kenya Ports Authority.

Lately, in the East African Countries, there have been a severe competition in the cargo and passenger transport modes between different types of transportation. Due to the vital social and economic roles in a country's economy, it is of great importance to plan, prepare, implement and run different modes of transport ensuring harmonious behavior and dynamic development of the transport systems.

In the late 1990s, Kenya's first meter gauge railway lines were in a deteriorated state due to lack of routine maintenance and repairs. By 2016, passenger railway trains were taking 24 hours to travel from Nairobi to Mombasa, nearly double the timetable of the early 1990s. Freight transported from the Port of Mombasa fell from 4.8 million tons in the 1980s to 1.5 million tons in 2012.

In 2014, Rift Valley Railways, the operator of railways in Kenya and Uganda, reported a loss of $1.5 million. These necessitated the government and other stakeholders to intervene as in comparison with other parts of the world, rail transport

is playing a major role in economic sustenance and creation of improved GDP for these countries

To improve on the positive gains and reduction of the negative effects of a different mode of transport, the Government if Kenya has been keen in expanding different modes of transport more so lately on the railway transport in connecting the sea port and the inland depots. The Government of Kenya through feasibility studies and bench marking from other countries intervened and thus the development of the standard gauge railway.

In 2011, Kenyan government through the Ministry of Roads and Infrastructure signed a memorandum of understanding with the China Road and Bridge Corporation (CRBC) to design, build operate and commission a standard gauge railway from Mombasa to Nairobi as part of this intervention.

2.7 The Kenya Standard Gauge Railway Line

The Standard Gauge Railway (SGR) which was set to be the intervention for an efficient transport infrastructure and universal lineation with the other economic giants through standard rail gauge was designed and implemented expected to boost economic growth, development and achievement of Kenya’s Vision 2030.

The Mombasa–Nairobi Standard Gauge Railway (SGR) is a heavy rail standard gauge railway of 485 kilometers that connects the port city of Mombasa to Kenya's capital city Nairobi at a cost of US$3.6 billion. The financing was finalized in May 2014, with the China Exim Bank (CEB) offering a loan of 90% of the project cost with Kenyan government financing the balance of 10% of the project cost. The Standard

gauge railway has replaced the parallel and colonial Uganda Railway that was originally built during the British colonial rule in the 19th century.

The project's execution evolved in distinct, chronological phases:

Phase 1 (Mombasa to Nairobi): Following a feasibility study completed in 2011, large-scale track-laying on the 472-kilometre stretch commenced in 2015. This phase was officially completed and inaugurated for passenger services (branded as the *Madaraka Express*) on May 31, 2017, followed by commercial freight operations in early 2018.

1. Phase 2A (Nairobi to Naivasha/Suswa): This 120-kilometre line extended the rail network through the Rift Valley region, opening up for active transit services in October 2019.
2. Phases 2B & 2C (Naivasha to Kisumu and Malaba): This 475-kilometre corridor routes through Narok, Bomet, and Kericho to reach the Lake Victoria basin in Kisumu before terminating at the Malaba border town to tie directly into Uganda's connecting rail network.

The SGR begins at Port Reitz, running parallel to the old meter gauge railway, but it follows a geometrically simplified alignment to allow for higher speeds. Passenger trains run between Mombasa Terminus in Miritini and Nairobi Terminus at Syokimau, near Jomo Kenyatta International Airport.

Freight services are provided between Port Reitz and an inland container depot at Embakasi in Nairobi. Because of terrain, large portions of the railway are built on viaducts for environmental protection, underpasses, about 98 bridges, embankments, and cuttings to allow for wildlife free movement where the rail passes through parks.

There are nine passenger stations from Mombasa to Nairobi architecturally designed from the inspiration of the local elements. The stations have geometrics to show a relationship with the socio- economic and cultural relationship with their corresponding communities.

Mombasa Terminus is a Concentric circle geometrically and a central tower, inspired by a ripple in the ocean. Mariakani are Porticos as in coconut trees, the core economical product in the region. The Miasenyi station is White and brown stripes, inspired by the stripes of a zebra. Voi station is V-shaped like a person with raised hands, inspired by the spirit of 'harambee'. Mtito Andei station has geometric Sloping roofs, depicting the neighboring Mount Kilimanjaro and the Chyulu Hills. Kibwezi station is based on traditional African architecture, with leaves that shade passengers from the sun while Emali station is a closed fist, representing unity. Athi River station is shaped like the region's hills with Nairobi Terminus portraying two trains with a bridge on top.

2.7.1 Economies of the Kenya SGR

The SGR when completed was planned to provide an opportunity to Kenyans to participate in the provision of railway transport services by investing in in the project through direct and/or indirect participation. The economy of the country was set to improve as transportation costs were to decrease. On its completion, Kenyans from all walks of life will benefit from considerable cost savings in the next three to five years.

The Standard Gauge Railway (SGR) was set to be the revolution to efficient transport expected to boost social, cultural, economic growth, and achievement of Kenya's Vision 2030. The Standard Gauge Railway created many positive and negative effects that were expected to open up the interior and provide access to local and

international trade of Kenyan Goods, especially in the agricultural sector. It is also set to pose some social challenges to the government and the local society, creating need for mitigation in order to keep level for the projected gains. The railway line being a common divisor to the main towns along the railway corridor in the country, urbanization has been seen to expound from current state.

The technological gains have been experienced through Technological transfer. This is because skills have and are still being equipped to those individuals working in the construction. The skills will last since even after the project is over, more people will have learnt how to go about the whole process, thus transfer the same knowledge to future generations.

The economy of the country is set to improve as transportation costs will decrease. On its completion, Kenyans from all walks of life will benefit from considerable cost savings in the next three to five years. There have also been negative results of oppressing the state of the free natural biodiversity and social effect risk to the inhabitants of the railway corridor. Bio-diversity has been affected in some areas thus resulting to socio-economic strains to the people who directly depend on the nature.

Economically, the line has moved tens of millions of passengers and generated significant logistics efficiencies. Despite these gains, its physical footprint introduces permanent local community shifts, spatial fracturing, and ecological disturbances exemplified at intermediate hubs like the Sultan Hamud station—which establishes the primary baseline for this academic inquiry.

The macroeconomic landscape of Kenya has been significantly altered by the introduction of the Standard Gauge Railway (SGR). The commercial performance of

the infrastructure network is anchored primarily on heavy-duty logistics and cargo haulage along the northern transit corridor. SGR freight traffic handled approximately 7.5 million tonnes of cargo, marking a notable 14.6% increase from the 6.5 million tonnes recorded during the preceding annual cycle (Business Daily, 2026). This progressive growth in cargo volumes is largely attributed to record throughput volumes processed at the Port of Mombasa, which has successfully positioned the rail system as an essential, high-efficiency conduit for moving containerised and conventional goods to the interior. By removing approximately 23,000 long-haul trucks from national roads monthly, the logistics system has effectively decongested highway networks and mitigated infrastructural degradation across the country.

Financially, the network has demonstrated an upward trajectory in general revenue collection despite facing substantial debt-servicing liabilities. Total SGR network revenues surged by 18.6% to reach KSh 21.4 billion, rising steadily from KSh 18.1 billion in the previous operational year (The Star, 2026). Within this commercial breakdown, freight operations remained the dominant economic engine, contributing KSh 16.6 billion to the gross earnings. Simultaneously, passenger transport services staged a resilient recovery following a 50% fare adjustment introduced by Kenya Railways. Ticket sales on the Madaraka Express generated KSh 4.8 billion from 2.7 million travellers who prioritized the rail line over competing transport modalities due to its safety and predictability (Business Daily, 2026).

However, the overarching commercial asset remains heavily burdened by its original funding mechanism, carrying an estimated KSh 646.15 billion Chinese loan portfolio that demands sustained fiscal restructuring and debt optimization from the National Treasury. To manage this significant fiscal strain and mitigate sovereign debt distress,

Kenya successfully negotiated a strategic restructuring of the on-lent SGR loan with Chinese lenders (Chatham House, 2025). The National Treasury converted the dollar-denominated credit facilities into Chinese Yuan, which effectively lowered the prevailing interest rates from 6% to 3% (Kenyans.co.ke, 2025). This currency and interest rate optimization secured approximately KSh 27.7 billion in annual savings for the exchequer and extended the national repayment amortization timeline up to the year 2040.

The broader economic integration of the region has entered a transformative phase following updates on the cross-border SGR expansion. In a bid to enhance intra-regional commerce, Kenya and Uganda officially broke ground on the KSh 502.9 billion Naivasha–Kisumu–Malaba rail extension, with full regional project completion scheduled for 2028 (Business Daily, 2026). Pressured by Uganda's rapid mobilization of a Sh62 billion (€405 million) Shariah-compliant Sukuk bond to fast-track construction on its side of the border, Kenya has leveraged alternative domestic funding avenues. Instead of taking on new external commercial credit, the government is financing its western rail stretch through the strategic securitization of the domestic Railway Development Levy.

2.7.2 Funding Mechanisms and Financial Restructuring

The initial financial architecture of the SGR relied heavily on external bilateral credit arrangements. This layout was 90% financed via dual concessional and preferential export buyer loans from the Export-Import Bank of China (Exim Bank), with the remaining 10% equity matched directly by the Government of Kenya through the Railway Development Levy.

The Phase 2B/2C extensions to Kisumu and Malaba, is financed through innovative localized funding models, utilizing the direct securitisation of existing transportation revenue streams and structured domestic budget capital injections.

2.7.3 Engineering Implementation and Operations

Engineering execution across all phases was contracted to the China Road and Bridge Corporation (CRBC) alongside its parent multinational, the China Communications Construction Company (CCCC). The line utilizes modern diesel-locomotive traction systems engineered to accommodate heavy axle loads (up to 25 tonnes) operating at up to 120 km/h for passenger services and 80 km/h for industrial freight. Operationally, CRBC initially retained comprehensive operational custody under a multi-year service management agreement.

2.8 Economic Activities in Sultan Hamud

In the pre-colonial era, Sultan Hamud was a trading centre for the Kamba and the Maasai, who would meet to exchange agricultural products and animals at an ancient open-air market. Agricultural activities of subsistence farming is also practiced in this area. The depressed rains in this area hardly sustain the major staple food production in this area. The condition has negatively affected agriculture which is the main economic activity in the county.

Local Tourism is the other economic activity undertaken at Sultan Hamud area. The main tourist attractions in the area include: the Tsavo National Parks, the Chyulu Hills National Park, Amboseli National Park, and Mount Kilimanjaro, vast and impressive landscapes of Yatta plateau and the lava stream of the baobab country around Kibwezi West. The Mbui Nzau Hills are customarily famous from the local folk tale

of a white goat that used to appear on top of the hills very early in the morning just after sunrise before the arrival of the missionaries.

There is an on-going exploration of the area and it is reported that there is presence of natural minerals in the Sultan Hamud environs such as Fluorspar. The exploitation of these minerals has begun thus forming another major economic activity in the area.

The Konza Techno city, which is an expanding business hub in the country lies 50km from Sultan Hamud on the Mombasa-Nairobi highway. This development has a great impact on the growth potential of the area.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides a description of the research methodology that was used to select the sample, develop research instruments to collect data, and analysis of the data. The chapter elaborates on the proposed research design, research site and rationale, target population, sampling procedures, sampling size, data collection procedures, research instruments, data analysis and presentation, and ethical considerations for the study.

3.2 Research Design

A mixed method research design was used for this study. The design incorporated four different research designs, that included: cross-sectional, descriptive, *ex post facto* and evaluative research design, s as shown in Table 3.1.

The cross-sectional design was used to determine the sociodemographic characteristics of the household heads at one point in time. In a cross-sectional study, the investigator measures the outcome and the exposures in the study participants at the same time (Setia, 2016), while descriptive design was used for the scoping exercise as it aims to describe and answering "what," "how," or "who" regarding a phenomenon without manipulating variables (Mugenda & Mugenda, 2003). The *ex post facto* design was used to assess the magnitude of the social impacts, this design was used as the dependent variable social impacts had already occurred without the manipulation of the researcher (Allen, 2017). The evaluative research design was used to test and assess the strategic measures for mitigating social impacts. Evaluative research designs, systematically test and assess the effectiveness, efficiency and

impact of programmes, products or policy in order to guide on the improvements or decisions (Clarke, 2011).

The data collection methods included: the use of a household survey, in-depth Key Informants Interview (KII) and Focus Group Discussions (FGD). Secondary sources of data were also used to collect data for this study, this included physical aspects of the built environment (SGR), the characteristics of the population, and the biological environment. A summary of the specific objectives, the measurable variable(s) / indicators and specific research designs for the study are shown in Table 3.1.

Table 3.1: Summary of Specific Objectives, Measurable Variable(s)/Indicators and Specific Research Designs for the Study

Specific Objectives		**Measurable Variable(s) / indicators**	**Research Design**
(i)	To determine the demographic characteristics of households impacted by built environment (SGR) in Sultan Hamud	demographic Characteristics of the impacted households	Cross-sectional household Survey
(ii)	To undertake a scooping exercise to determine the indicators of social impact assessment variables useful for evaluating impacts of SGR to the community in Sultan Hamud area.	Social impact Assessment (SIA) variables	Descriptive research designs
(iii)	To assess the social impacts of built environment (SGR) as perceived and experienced by households at Sultan Hamud area	Independent variable: built environment (SGR) Dependent variable: Social Impact Assessment	ex post facto (after the fact) research design
(iv)	To identify and appraise strategic measures for mitigating social impacts for a built environment (SGR) at Sultan Hamud area	Strategies and their effectiveness	Evaluative research design

3.3 Research Site

This study was carried out at Sultan Hamud town. A ten-kilometre radius from the town constituted the study area. The study area extends to Makueni county to the East and Kajiado county to the west. The town is located 102.6 km from Nairobi on the Nairobi to Mombasa highway. Specifically, the town lies at Latitude of -2, 0167 (21'0.012"S) and Longitude of 37, 3667 (3722'0.120"E). The area (10km radius) encompasses residential areas, local farms, small settlements near the highway, and key road infrastructure connecting to the Loitoktok junction. The Standard Gauge Railway line (SGR) passes through the town as shown in Figure 3.1 and Figure 3.2.

Source: Google Map 2017

Figure 3.1: Satellite Imagery: showing the location of SGR and Sultan Hamud Township

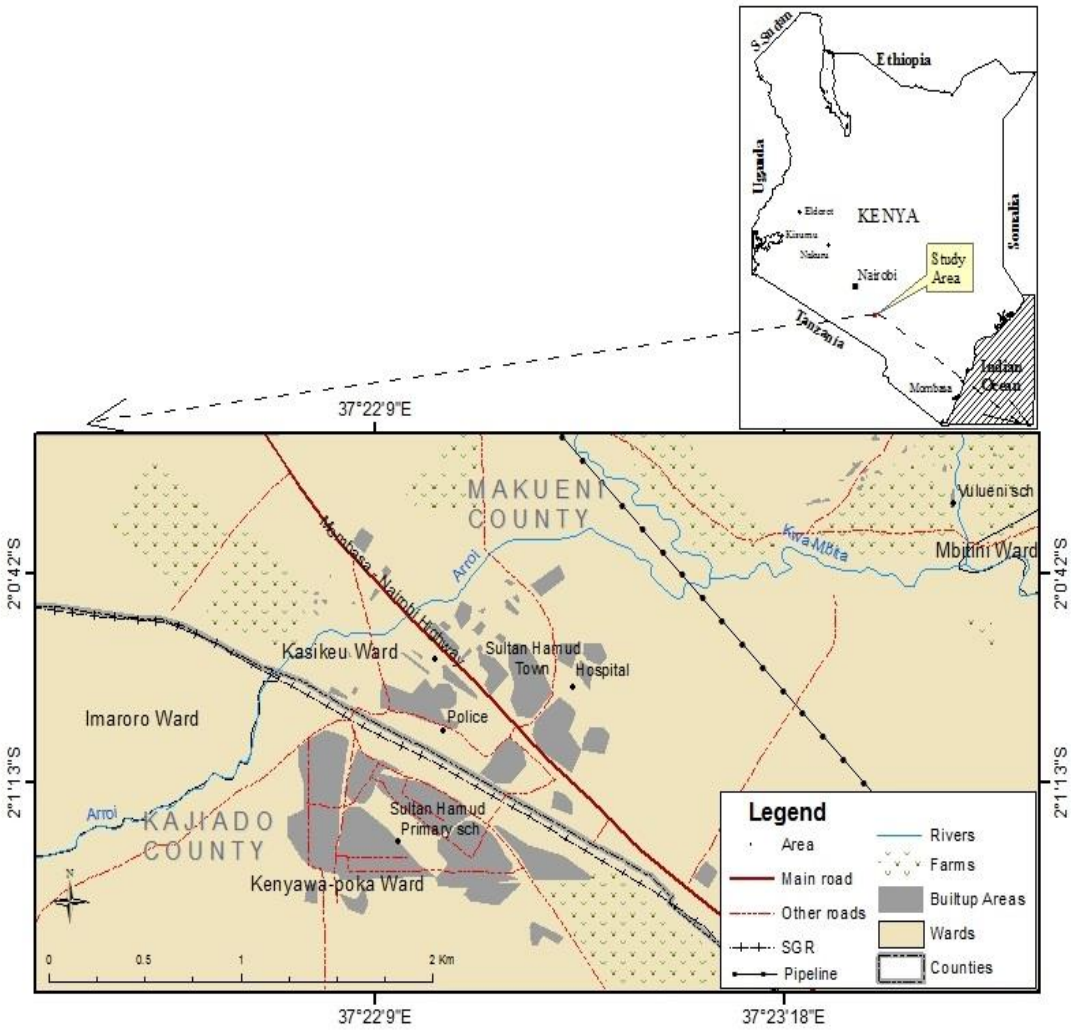

Figure 3.2 Map of the study area: showing location on Kenya map, SGR, Sultan Hamud town, and the surrounding rural area

The area lies at an altitude of 1246m having an arid and semi-arid climate and is usually prone to frequent droughts. The lower side which is very dry receives little rainfall ranging from 300mm to 400mm.

Sultan Hamud town got its name from Sultan Ali Hamud who ruled Zanzibar Sultanate from 1902 to 1911. When construction of the railway reached present-day Sultan Hamud, the Zanzibar ruler visited to see progress and camped there for some days. That visit gave the town its name.

3.4 Target Population

Target population is the entire group of people or objects to which the researcher wishes to generalise the research findings. The group must meet the criterion set by the researcher (Mishra & Alok, 2017). The target population for this study was the permanent residents of Sultan Hamud area, that included the town, and the surrounding rural area. This included all the people who resided in the town from either their birth and/or at least latest the year 2000 to the time of completion of Phase 1 of the project, the year 2016.

A population of 18,398 was found in the study area living in 5,017 households (KNBS, 2019). The population was composed of farmers, pastoralists, the skilled, non-skilled, professionals, community workers, religious leaders, government officials, youth, women people with disabilities and those in the private sector. In order to maintain uniformity in the composition of the households, the background of the households was used to obtain a sampling frame of 3,280 households from data maintained by the *Nyumba kumi* imitative. The *Nyumba kumi* is an initiative by the Kenya government for anchoring community policing at household level.

3.5 Study Sample

A sample is defined as a smaller set of data that a researcher chooses or selects from a larger population by using a pre-defined selection method. These elements are known as sample points, sampling units, or observations. Creating a sample is an efficient method of conducting research. In most cases, it is impossible or costly and time-consuming to research the whole population. Hence, examining the sample provides insights that the researcher can apply to the entire population (Mishra & Alok, 2017). According to Ogula (2005), sampling is a procedure, process, or technique of

selecting a subgroup from a population to participate in a study. That is, it is the process of choosing a number of individuals for a study in such a way that the individuals chosen represent the larger group from which they were selected.

3.5.1 Study Sample Size

Sample size represents the total number of respondents retrieved from the study population that the researcher intends to study (Mugenda & Mugenda, 2012). The study used the households that were found within the designated study area. The study sample size was calculated using the formula of Krejcie and Morgan (1970), which is based on the number of households in the study area. The study area was divided into four areas (north, south, west and east) with a total of 3,280 households (KNBS, 2019). The study sample was estimated as follows using the formula described by Krejcie and Morgan (1970) equation 1:

$$n = \frac{\chi^2 * N * P(1-P)}{(ME^2 * (N-1)) + (\chi^2 * P(1-P))}$$

Where:

n = The required sample size, given by the following:

χ^2 = The table value of chi square for one degree of freedom relative to the desired level of confidence which was 0.95. [The chi-square value used was 3.841].

N = The population within the study area [3,280] households]

P = The population proportion [assumed to be 0.50], as this magnitude yields the maximum possible sample size required.

ME = desired margin of error (expressed as a proportion). This is the degree of accuracy as reflected by the amount of error that can be tolerated in the fluctuation of a sample proportion about the population **P**. The value of d was taken as 0.05, which is equal to plus or minus 1.96σp. $\boldsymbol{ME^2}$= [0.05^2 =0.0025]

n = 344

The study sample size based on this calculation was 344 households.

3.5.2 Sampling Procedure

The stratified random sampling technique was used in selecting the households to be included in this study. The study used stratified random sampling technique to select the study sample. Stratified random sampling provides a sample that is highly representative of the population being studied (Laerd, 2012). The four areas (north, south, east and west) formed the strata. In each stratum the households were selected proportionally based on the population of the stratum. Random sampling was used to select the individual households.

A simple random sample is a randomly selected subset of a population (Gravetter & Franzano, 2011; Thomas, 2020). In this sampling method, each member of the population had an exactly equal chance of being selected. The names of the household heads were obtained from the *Nyumba kumi initiative* and then listed to form a sampling frame and using a Table of random numbers, the households were selected. The proportional allocation method was used to distribute the samples within the different sub locations as shown in Table 3.2.

Table 3.2: Proportional Allocation of the Study Samples to the Four Strata

Four Strata	Households	Proportional allocation	Sample
Area to the north	1,279	1,279/3,280*344	134
Area to the south	528	528/3,280*344	55
Area to the east	751	751/3,280*344	79
Area to the west	722	722/3,280*344	76
Total	**3,280**		**344**

The summary of the sampling methods, and sample sizes used in this study is given in Table 3.3.

Table 3.3 Summary of Sampling Methods and Sample Size for the Study

Study Population Units	Sampling Methods	Sample size
Surveyed Households	Stratified random sampling	344
Key Informant Interviews: Agricultural and environmental officers, County and ward officers, Natural resources, NGOs, SGR workers,	Purposive	63
Focus Group Discussions	Quota	40 members 4 FGD each having 10 members

The Table 3.3 shows that there were three hundred and sforty-four (344) households selected using stratified random sampling, with the four areas acting as the strata. They were interviewed using a structured questionnaire.

There were also, sixty-three (63) Key Informants used in this study. The Key Informants who participated in the study were selected using the purposeful sampling method. Tongco (2007) observes that purposeful sampling, also known as judgement sampling, is the intentional choice of a respondent based on their attributes. In this study, the key respondents, or "informants", at the county level were purposely selected due to their wealth of knowledge and experience in the community and environmental impacts. They included agricultural and environmental officers, county and ward officers, natural resource management and NGOs dealing with environmental issues in the study area. The composition and frequency of the Key informants is shown in Table 4.9 of this Thesis. They were selected using the purposive sampling method and were interviewed using a structured interview schedule (Appendix C).

The Focus Group Discussion (FGD) participant were selected using the purposive sampling method. The group participants were selected from communities in the study area, each group consisted of ten (10) participants. There were four (4) groups, one from each of the four (4) strata forming the study area.

3.6 Data Collection

This section explains the process that was used to collect data from the household heads. This is a systematic process of gathering, making observations or measurements on the qualitative and quantitative information of the study variables. During the process care was taken to collect good data that was clean, consistent and reliable to enable the evaluation of the outcome (Tan, 2018).

3.6.1 Data Collection Instruments

Primary Data

Primary data for this study was collected using four different types of instruments: an observation check list, a household questionnaire, a Key Informants Interview schedule, and a Focus Group Discussion guide. The summary of the data collection instruments is given in Table 3.4.

Table 3.4: Summary of Data Collection Instruments Used

Study Population Unit	Sampling Method	Size (n)	Data Collection Instrument	Appendix Number
Surveyed households	Stratified random sampling	344	questionnaire	B
Key Informants Interview	Purposive	63	Interview Schedule	C
FGD	Quota	40	FGD guide	D
Observation check list	Purposive	1	Observation checklist	A

The data collection instruments in Table 3.4, include an observation check list, which was used to collect information on environmental attributes of the study area, built environment and the community. The observation check list is outlined in Appendix A. The observation check list was used to collect information on the type, quantity and quality of the existing natural resources of the study area.

A researcher-administered structured questionnaire (Tan, 2018) was used to collect information from the surveyed households in Sultan Hamud area. The questionnaire is shown in Appendix B. The researcher administered questionnaire for the households, consisted of six sections, as follows: the biodata of the participants, the household rating of the impacts. The information was collected using a seven-point rating scale (0 to 7 points) as follows:

0=No Impact, 1=Extremely Low Impact, 2=Very Low Impact, 3=Low Impact, 4= Moderate Impact, 5=High Impact, 6= Very High Impact, 7=Extremely high Impact. The scores for the indicators are then added to give the magnitude of the impact for that variable.

A Key Informants Interview (KII) interview schedule for agricultural extension officers, county officials dealing with environment and natural resources and NGOs dealing with natural resource management was used to collect information on the level of use of natural resources and strategies used in climate change. The Key Informants interview guide (Appendix C) was used to collect information on the different types of strategies and the natural resources that were available in the study area, their condition, their use by the pastoralists, strategies for effective use of the resources.

A Focus Group Discussion (FGD) guide used for the community is given in Appendix G, was used to triangulate the KII and the information from the households. The Focus Group Discussion guide (Appendix D) was used to guide the discussions conducted with the communities in the study area.

Secondary Data

Secondary information was sourced from published and unpublished sources for use in content analysis. The specific sources of information included: Kenya Metrological reports, journal publications, technical institutions reports, textbooks, stakeholder's reports, teaching manuals and progress reports from all the stakeholders. Specific information sought from these documents included: environmental data, SGR, developments, climate data, natural resources, agriculture policies, institutions dealing with climate change. Secondary data obtained from the review of relevant and related studies were used to complement primary information gathered from the study respondents on the use and management of environment in Sultan Hamud.

3.6.2 Pilot Testing of Research Instruments

Pilot-testing involves trying out a questionnaire on a small group of individuals (preferably 10 % of the sample size) to get an idea of how they react to it before the final version is created. The pilot testing enables the researcher to fine-tune the questionnaire for objectivity and efficiency of the process (Creswell, 2014).

A pilot-test was conducted on 30 households in the adjoining Kajiado central sub-county. The results of the pilot test assisted in fine tuning of the research instrument for objectivity and efficiency of the data collection.

3.6.3 Instrument Reliability

The study established the reliability of structured questionnaire by use of Cronbach's alpha coefficient (Cronbach, 1951). Lee Cronbach in 1951, factors in scale size in reliability estimation, calculated using the following formula:

Equation 2: Reliability estimation alpha coefficient by Lee Cronbach (1951)

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{I=1}^{K} O^2 yi}{O^2 x}\right) \text{ ……,,,,,,, equation 2}$$

Where:

K is the number of items in the measure,

$O^2 x$ is the variance (square of standard deviation) of the observed total scores,

$O^2 yi$ is the observed variance for item *i.*

A reliability coefficient alpha of above 0.7 will be acceptable.

3.6.4 Instrument Validity

Validity is the accuracy and meaningfulness of inference and the degree to which the results obtained from the analysis of the data actually represents the phenomenon and investigation (Murithi et al., 2016). Outcomes of the pilot testing phase were used to improve the initial drafted questionnaire to enable it to capture appropriate, useful and dependable data whose finding and inferences presented a true reflection of the study population.

3.6.5 Data Collection Procedures

A letter of clearance was sought from the Board of Post Graduate Studies at Africa Nazarene University, to enable the researcher seek research permit from National Council of Science, Technology and Innovation (NACOSTI) and the Makueni County Government and the *Nyumba kumi initiative* in Sultan Hamud.

The sampling frame was then developed from the *Nyumba kumi initiative* data of the households in the study area. The sample households were then randomly selected using a table of random numbers. The enumerators were then trained and allocated households to cover in their survey. Data collection involved face to face interview with the ranchers. The filled questionnaires were collected after one week. The FGDs were then conducted in each of the four ranches forming the strata.

3.7 Data Analysis

Data collected in this study was mainly quantitative data. The method of analysis involved systematically arranging and organizing interview questionnaire forms, field notes, data and other materials obtained from the field into summary tables (Creswell, 2011). Quantitative data analysis was done by the application of a computer software Statistical Package for Social Sciences (SPSS) version 27 (IBM Corp, Armonk, NY, USA), which is a comprehensive, integrated collection of computer programs for managing, analyzing and displaying data. Data summary and classification was done using descriptive statistics; frequency distributions, mean, median, mode, standard deviation, and variance. Descriptive statistics were also used to determine the sociodemographic characteristics of the study sample. Inferential statistics were used to determine the existing relationships between the variables. The critical value for significance p was set at 0.05. The data was then displayed and presented using graphs, charts and tables as summarized in Table 3.5.

Table 3.5: Summary of Data Analysis

Objectives		Independent variable	Dependent variable	Statistics
(i).	To determine the demographic characteristics of households impacted by Built Environment (SGR) in Sultan Hamud area in Kajiado and Makueni Counties	demographic characteristics	Social impacts of the households	Descriptive, t-test, Chi-square
(ii).	To undertake a scooping exercise to determine the indicators of social impact assessment variables useful for evaluating impacts of Built Environment (SGR) to the community in Sultan Hamud area in Kajiado and Makueni Counties	Socio-demographic characteristics	Social impacts of the households	Descriptive statistics
(iii).	To assess the social impacts of Built Environment (SGR) as perceived and experienced by households at Sultan Hamud area in Kajiado and Makueni Counties	Built environment	Social impacts of the households	Descriptive analysis
(iv).	To identify and appraise strategic impact mitigation measures for a Built Environment (SGR) to enhance community resilience at Sultan Hamud area in Kajiado and Makueni Counties	Social impacts	Mitigation measures	Descriptive statistics

3.8 Legal and Ethical Consideration

The ultimate goal of ethics in research is to ensure that no one is harmed or suffers adverse consequences from research activities. To safeguard against these, O´Sullivan and Rassel (1999) put forward the following guidelines which include: Respect for the individual (encompassing respect for autonomy and protection of vulnerable affected persons, non-maleficence (minimizing harm to affected persons), beneficence Explaining study benefits to the respondents, explaining respondents' rights and protections and finally obtaining informed consent which was observed in accordance with the Africa Nazarene University (ANU) ethics requirements for certification and NACOSTI conditions for research in Kenya.

In line with ethic requirements, privacy which is a cornerstone of research were observed. Consent at all stages to carry out the study was sought, this included NACOSTI permit (Appendix F), letter to the participants (Appendix A), and letter to the Key Informants (Appendix C). Confidentiality and anonymity, was observed: respondent numbers were used instead of names and no particular information was linked to any of the respondent directly. Ethical issues were observed during the collection and analysis of data. The researcher endeavoured to be as objective as possible by collecting full, correct data without subjective selectivity. The research process was followed and all care was taken to avoid compromising the integrity of the study.

An application for a research permit was first made to the National Commission for Science, Technology and Innovation (NACOSTI) by the researcher through the Board of Post-graduate studies at ANU. Permission to access the households was then sought from the County Government at the county level and the *Nyumba kumi*

initiative. A list of the Maasai pastoral households found in Magadi division was then made. A random sample was then drawn from this list for interview. The selected household heads were then contacted with the help of the enumerators in the different localities of the study area. The participants were then explained by the researcher on the purpose of the study and their consent was sought and they were assured of confidentiality before they were interviewed using the questionnaire by the enumerators. Data collection period lasted one month (the month of April, 2022).

The four (4) Focus Group Discussions (FGD) were conducted to triangulate the information received from the Key Informants Interview and the household questionnaire. Each of the FGD had ten members who were used to identify the different strategies and rank them in terms of their usefulness.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.1 Introduction

Chapter four of this thesis deals with the analysis of data, results, interpretation of the results and findings of the study. The chapter is divided into the following sections: (i) introduction, (ii) demographic characteristics of the households impacted by the built environment (SGR), (iii) results of the scooping exercise, (iv) Social Impact Assessment (SIA) of a built environment, (v) mitigation measures undertaken by the community to combat negative impacts.

4.2 Demographic Characteristics of the Households Impacted by Built Environment (SGR) Participants

This section (section 4.2) of the thesis presents results, interpretation of results and findings arising from the analysis of objective number one of this study, which was stated as:

"To Determine the demographic characteristics of the households impacted by the built environment (SGR) at Sultan Hamud"

The characteristics of the households covered by the survey in this study are presented in the following sub-sections: gender of respondents, age of respondents, level of formal education attained, and household number.

4.2.1 Gender of the Respondents

Social impacts tend to vary with the gender of the respondents making it a vital variable. The respondents' sex was noted during the interview and the information was summarised and is presented in Table 4.1.

Table 4.1 Gender of the Surveyed Household Heads

Sex of Respondents	Frequency	Percent
Male	212	61.6
Female	132	38.4
Total	**344**	**100.0**

The majority (61.6 %) of the households were male led, while the women led households were 38.4 %. The chi-square test was performed on the gender distribution to determine the equality of the categories and the results are given in Table 4.2.

Table 4.2: Chi-square Test for Equality of the Categories for Gender of Household Heads in Sultan Hamud

Gender	Observed N	Expected N	Residual	Chi-Square
Male headed households	212	172.0	40.0	χ^2=18.605
Female headed households	132	172.0	-40.0	*df*=1
Total	**344**			*p*=.001

The chi-square test (Table 4.2) shows that the male headed households were more than the female households. This difference in the male and female headed households was found to be statistically (χ^2 =18.605, *df* =1, *p* =.001) significantly different from each other, meaning that the differences in the two categories were true differences and did not occur by chance.

4.2.2 Age Distribution of the Respondents

Respondents were asked to indicate their year of birth, and the information was then used to calculate the exact age of the participant. The descriptive statistics and frequency distribution were calculated and are represented in the Table 4.3.

Table 4.3: Age Distribution of the Household Heads Impacted by the Built Environment (SGR) at Sultan Hamud

Age Categories (years)	Frequency	Percent
20-30	35	10.2
31-40	24	7.0
41-50	151	43.9
51-60	67	19.5
61-70	49	14.2
Above 71	18	5.2
Total	**344**	**100.0**

Mean 49±.66, Median 47, Mode 44, Std. dev. 12.27, Minimum 27, Maximum 77

The majority (61.1 %) of the respondents were below 50 years old, while 38.9 % were above 51 years old. The average age for the respondents was (M=49.0, SD=12.27), while the minimum age was 27 and the maximum age was 77 years old. The chi-square test was performed on the age distribution to determine the equality of the categories and the results are given in Table 4.4.

Table 4.4: Chi-square Test for Equality of the Categories for the Age of Household Heads

Age Categories	Observed N	Expected N	Residual	Statistics
20-30	35	57.3	-22.3	χ2=210.93
31-40	24	57.3	-33.3	df=5
41-50	151	57.3	93.7	p=.001
51-60	67	57.3	9.7	
61-70	49	57.3	-8.3	
Above 71	18	57.3	-39.3	
Total	**344**			

The chi-square test (Table 4.4) indicates that the majority of the household heads' ages that were between 41 and 50 years old, which had the highest residual value. The chi-square test returned a highly statistically significant value (χ^2=210.93, df=5, p<

.001), meaning that the differences between the categories were true differences and they did not occur by chance.

4.2.3 Level of Formal Education Attained by the Participants

The household heads were asked to state the highest level of formal education they had attained. The information was then analysed and the results are presented in Table 4.5.

Table 4.5: Level of Formal Education Attained by the Household Heads

Level of Formal Education	Frequency	Percent
No Formal Education	62	18.0
Primary Class 1-8	109	31.7
Secondary Form 1-4	84	24.4
College	35	10.2
Bachelors	42	12.2
Masters	8	2.3
PhD	4	1.2
Total	**344**	**100.0**

The percent of the household heads who had not attended formal schooling was 18 %, while the majority (60.3 %) had attained the secondary school level (form 1-4) and above.

4.2.4 Household Size

The respondents were asked to state the number of people living in their households. The information was analysed and the descriptive statistics are shown in frequency distribution Table 4.6. The average number of people living in the households was five (M=5, SD=1.88), and ranged between 1 and 12. The majority of households (61.3 %) had between 1 and 5 people.

Table 4.6: Number of People Living in the Surveyed Household

Number of Individuals	Frequency	Percent
2.00	30	8.7
3.00	44	12.8
4.00	63	18.3
5.00	74	21.5
6.00	58	16.9
7.00	38	11.0
8.00	31	9.0
Above 9.00	6	1.8
Total	**344**	**100.0**

Mean 5±.10, Median 5, Mode 5, Std. dev. 1.88, Minimum 2, Maximum 12

4.2.7 Homestead Distance from the SGR

The distance of the surveyed households from the built environment (SGR) was estimated and the information was analysed using descriptive statistics and the results are presented in Table 4.7.

Table 4.7: Distance of Households from the Built Environment

Distance in Km	Frequency	Percent
1-3	40	11.6
4-6	83	24.1
7-9	169	49.1
10-12	42	12.2
Above 13	10	2.9
Total	**344**	**100.0**

Mean 7.13±.15, median 7, mode 7, Std. dev 2.78, minimum 1, maximum 14

The majority (84.8 %) of the households were located within 9Km radius from Sultan Hamud town and only 15.1 % were above 10Km.

The chi-square test was performed on the distance to the households from Sultan Hamud to determine the equality of the categories and the results are given in Table 4.8.

Table 4.8: Chi-square Test for Equality of the Distance of Households to the SGR line

Distance in Km	Observed N	Expected N	Residual	Statistics
1-3	40	68.8	-28.8	χ2=221.61
4-6	83	68.8	14.2	df=4
7-9	169	68.8	100.2	p=.001
10-12	42	68.8	-26.8	
Above 13	10	68.8	-58.8	
Total	**344**			

The chi-square test (Table 4.8) indicates that the majority of the households were located between 7 and 9 Km from the town of Sultan Hamud. This category of between 7 and 9 had the highest residual value. The chi-square test returned a highly statistically significant value (χ^2=221.61, *df*=4, *p*< .001), meaning that the differences between the categories were true differences and they did not occur by chance.

4.3 Demographic Characteristics of the Project Stakeholders

This section (section 4.3) of the thesis presents results, interpretation of results and findings arising from the analysis of objective number one of this study, which was to determine the demographic characteristics of the Stakeholders of the Built Environment (SGR) project.

The characteristics of the stakeholders covered by the survey in this study are presented in the following sub-sections: age, gender, highest level of formal education, and number of years lived in Sultan Hamud.

4.3.1 List of Stakeholders for the Built Environment (SGR) Project

The sixty-three (63) stakeholders that were selected to represent the community impacted by the Built Environment (SGR) at Sultan Hamud as Key Informants are

listed in Table 4.9. They represent twenty-one different groups that are represented in the community. Three stakeholders were selected form each group.

Table 4.9: Composition and Frequency Distribution of the Stakeholders and Impacted Community used for the Key Informants Interview

	Stakeholders Identity	Frequency	Percent
1	Local resident	3	4.8
2	SGR staff	3	4.8
3	Business community	3	4.8
4	Migrant workers	3	4.8
5	Transport	3	4.8
6	Vendors in street	3	4.8
7	Politicians	3	4.8
8	State employees	3	4.8
9	County ward workers	3	4.8
10	Women market vendors	3	4.8
11	Religious leaders	3	4.8
12	Pastoralist	3	4.8
13	*Nyumba Kumi Initiatives*	3	4.8
14	Chief / Administration	3	4.8
15	Police /security	3	4.8
16	Environmental profession	3	4.8
17	Natural resources (conservancies)	3	4.8
18	Engineers	3	4.8
19	Farmers	3	4.8
20	Local transport	3	4.8
21	Educators	3	4.8
	Total	**63**	**100.0**

4.3.2 Gender of the Stakeholders

The gender of the stakeholders was noted during the interviews and the frequency distributions were determined and reported in Table 4.10.

Table 4.10: Gender of the Respondents

Gender	Frequency	Percent
Male	51	81.0
Female	12	19.0
Total	**63**	**100.0**

The male stakeholders were the majority (81 %).in the sample.

4.3.3 Age Distribution of Stakeholders for the Built Environment (SGR)

Stakeholders were asked to indicate their year of birth, and the information was then used to calculate the exact age of the stakeholders. The descriptive statistics and frequency distribution were calculated and are represented in the Table 4.11.

Table 4.11: Stakeholders' Age Distribution

Age Categories (years)	Frequency	Percent
20-30	7	11.1
31-40	7	11.1
41-50	25	39.7
51-60	18	28.6
Above 61	6	9.5
Total	**63**	**100.0**

Mean 46.41.4, median 46, mode 44, Std Dev. 10.8, minimum 23, maximum 67

The majority (61.9 %) of the respondents were below 50 years old, while 38.1 % were above 51 years old. The average age for the respondents was (M=46.4, SD=10.8), while the minimum age was 23 and the maximum age was 67 years old. The chi-square test was performed on the age distribution to determine the equality of the categories and the results are given in Table 4.12.

Table 4.12: Chi-square Test for Equality of the Categories for the Age Distribution of the Stakeholders

Age Categories	Observed N	Expected N	Residual	Statistics
20-30	7	12.6	-5.6	$\chi 2$=22.95
31-40	7	12.6	-5.6	df=4
41-50	25	12.6	12.4	p=.001
51-60	18	12.6	5.4	
Above 61	6	12.6	-6.6	
Total	**63**			

The chi-square test (Table 4.12) indicates that the stakeholders' ages that were in the category of between 41 and 50 years old were the majority, as they had the highest residual value. The chi-square test returned a highly statistically significant value (χ^2=22.95, *df*=4, *p*< .001), meaning that the differences between the age categories were true differences and they did not occur by chance.

4.3.4 Highest Level of Formal Education Attained by the Stakeholders

The stakeholders were asked to state the highest level of formal education they had attained and the information was analyzed and the results are presented in Table 4.13.

Table 4.13: Highest Level of Formal Education Attained by Stakeholders

Highest level of Formal Education	**Frequency**	**Percent**
Primary school	19	30.2
Secondary	21	33.3
College	12	19.0
University	11	17.5
Total	**63**	**100.0**

The majority (33.3 %) of the stakeholders had attained the secondary level, while 17.5% had attained the University level. The primary and college levels were attained by 30.2% and 19% respectively.

4.3.5 Number of Years Stakeholders had Lived in the Study Area

The stakeholders were asked to state the time they arrived in Sultan Hamud; this information was used to calculate the length of the period the stakeholder had lived in the study area. The results are presented in the Table 4.14. The minimum period stayed by the stakeholders was 7 and the maximum was 67. The time period of between 11 and 20 was highly (34.9 %) represented in the sample.

Table 4.14: Number of Years the Stakeholders had Lived in Sultan Hamud

Time in the Study Area in Years	Frequency	Percent
1-10	14	22.2
11-20	22	34.9
21-30	5	7.9
31-40	3	4.8
41-50	11	17.5
51-60	5	7.9
Above 61	3	4.8
Total	**63**	**100.0**

Mean 25±2.3, median 15, mode 11, Std Dev 18, minimum 7 maximum 67

4.4 Scooping Exercise for the Social Impact Assessment of the Built Environment (SGR) at Sultan Hamud

This section (section 4.4) of the thesis presents results, interpretation of results and findings arising from the analysis of objective number two of this study, which was stated as:

"To undertake a scooping exercise to determine the indicators of social impact assessment variables useful for evaluating impacts of the Built Environment (SGR) to the community in Sultan Hamud area in Kajiado and Makueni Counties"

The scooping exercise for the Social Impact Assessment (SIA) of the Built Environment (SGR) was undertaken in two stages:

(i) Analysis of project stakeholders and affected community members

(ii) Identification and vetting of the indicators to use for the Social Impact Assessment (SIA).

4.4.1 Analysis of Project Stakeholders and Affected Community Members of the Built Environment (SGR) at Sultan Hamud

Stakeholder analysis was undertaken by the Key Informants and was validated during the Focus Group Discussion. A list of the project stakeholders and members of the affected community was created and their involvement to the project was evaluated, the results are summarised in Table 4.15.

Table 4.15: List of Project Stakeholders and Affected Community Showing their involvement in the Built Environment (SGR) at Sultan Hamud

	Stakeholder	Involvement in the SGR project
1	Local resident	Social impacts
2	SGR staff	Corporate Social Responsibility (CSR)
3	Business community	Increased business
4	Migrant workers	Need housing resources
5	Transport	Customers for products
6	Vendors in street	Increased need for transport
7	Politicians	Increased need for services
8	State employees	Governance problems
9	County ward workers	Cess collection and services
10	Women market vendors	Market economy
11	Religious leaders	Increased need for services
12	Pastoralist	Increase in demand for products
13	*Nyumba Kumi Initiatives*	Christian and Muslim leaders
14	Chief / Administration	Pastoral communities in the conservancies
15	Police /security	Management of community
16	Environmental profession	Provision of law and order
17	Natural resources (conservancies)	Management of the conservation areas
18	Engineers	Maintain conditions of infrastructure
19	Farmers	Sale products to the community
20	Local transport	Move people and goods in the area
21	Educators /teachers	Provide education

The project stakeholders and the affected communities were then rated in terms of their influence and interest to the Built Environment (SGR) project. The rating in terms of the influence and interest was done based on 0 to 3 scale, as follows:

0= No influence or interest, 1= low influence or interest, 2=medium influence or interest and 3= High influence of interest.

Table 4.16: Stakeholder Ranking in terms of their Influence and Interest to the Built Environment (SGR) Project

		Rating		
	List of Stakeholder	**Influence**	**Interest**	**Total**
1	Local resident	2.1	2	4.1
2	SGR staff	2.7	2.0	4.7
3	Business community	2.5	2.6	5.1
4	Migrant workers	1.9	2.1	4.0
5	Transport	1.1	1.0	2.1
6	Vendors in street	2.6	2.8	5.4
7	Politicians	2.1	2.5	4.6
8	State employees	2.8	1.0	3.8
9	County ward workers	2.5	2.5	5
10	Women market vendors	2.0	2.0	4
11	Religious leaders	2.5	2.5	5
12	Pastoralist	1.1	2.9	4
13	*Nyumba Kumi Initiatives*	2.0	2.0	4
14	Chief / Administration	2.6	2.5	5.1
15	Police /security	2.0	2.5	4.5
16	Environmental profession	1.5	2.6	4.1
17	Natural resources (conservancies)	2.8	2.7	5.5
18	Engineers	2.7	2.5	5.2
19	Farmers	2.2	2.5	4.7
20	Local transport	2.0	2.2	4.2
21	Educators	2.2	2.6	4.8

The rating of stakeholders and the affected community members is shown (Table 4.16). Any of the categories / subjects with a total score of 3 and above was considered significant for inclusion or representation in the assessment of the Built Environment (SGR) project. A total score of 6, indicated a candidate who was highly

influential and with high interest in the project. All the 13 categories were found to be important for inclusion.

4.4.2 Identification and Vetting Social Impact Assessment Indicators for the Purpose of Impact Assessment

The vetting of the indicator for use in the SIA procedure was done using a 1 to 5 rating scale, where:

1= very low, 2=low, 3=medium, 4=high and 5=very high,

The scores for each indicator were added together and averaged to give the final rating. The variables scoring above 2.5 were selected for use in the Social Impact Assessment (SIA) of the Built Environment (SGR). The Table 4.17 shows the SIA indicators and their scores.

Table 4.17: Rating of the Social Impact Assessment Variables for Use in Assessing the Impacts of Built Environment (SGR) at Sultan Hamud

	Social Impact Assessment of indicators	Mean	SD
	Population Impacts		
1	Level of impact due to change in population	3.0	.30
2	Level of impact due to influx of temporary workers	2.6	.34
3	Level of impact to households due to individual relocation	2.8	.42
4	Level of impact of family's relocation on the household	4.1	1.2
5	Level of impact of dissimilarities in age (Number of young people compared to the old ones)	2.8	.68
6	Level of impact of dissimilarities due to gender (Number of males has increased more than the females)	3.0	.85
7	Level of impact of dissimilarities in ethnic diversities (Increase in foreigners than the local ethnic communities)	3.2	.78
	Individual and Family Changes		
8	Level of impact of change in attitude towards SGR project	3.4	1.0
9	Level of impact of change in perception towards the SGR project	4.0	1.1
10	Level of impact in family characteristics due to the SGR project	4.4	.05
11	Level of impact in harmful effects to health and safety due to SGR project	4.6	0.8
12	Level of impact of change in perception of risk	4.4	1.2
13	Level of impact of change in conveniences due to SGR project	3.0	1.2
	Community and Institutional Structure		
14	Level of impact in industrial diversification due the SGR project (impact from industrial diversification)	3.2	1.0
15	Level of impact in organization of local government due to SGR project	4.1	,98
16	Level of impact in activities of Non-governmental Organization (NGO) due to the SGR project	3.1	.88

17	Level of impact in religious organization due to the SGR project	2.5	.88
18	Level of impact in political structure due to SGR project	2.4	
19	Level of impact in community organization as relates to each other due to SGR project	4.7	1.3
	Community resources		
20	Rate the level of impact in availability of housing	3.6	1.0
21	Rate the level of impact in availability of community services	2.9	.85
22	Rate the level of impact in police services	4.8	.81
23	Rate the level of impact in fire brigade services	2.6	.75
24	Rate the level of impact in sanitation services	3.2	.09
25	Rate the level of impact in health services	3.2	1.1
	Political and Social Structure		
26	Level of impact in power and authority in the study area	4.1	.92
27	Level of impact in leadership capability	3.1	.78
28	Level of impact in leadership capacity	3.1	.12
29	impact in relationship between power authorities and people	2.8	.82

4.5 Assessment of Social Impacts Caused by Built Environment (SGR) at Sultan Hamud Area

This section (section 4.5) of the thesis presents results, interpretation of results and findings arising from the analysis of objective number thee of this study, which was stated as:

"To assess the social impacts of built environment (SGR) as perceived and experienced by households at Sultan Hamud area in Kajiado and Makueni Counties"

The social impacts of built environment (SGR) were assessed using the 26 Social Impact Assessment variables. The variables were operationalized as an index that combined five domains and twenty-six indicators. The five domains included: population impacts, individual and family changes, community and institutional structure, community resources and political and social resources the indicators were rated using a 7-point rating scale. The participants were asked to rate the level of impacts as follows:

0=No Impact, 1=Extremely Low Impact, 2=Very Low Impact, 3=Low Impact, 4= Moderate Impact, 5=High Impact, 6= Very High Impact, 7=Extremely high Impact

The scores for all the participants were then summed up and the descriptive statistics are presented.

4.5.1 Assessment of Social Impacts of the Built Environment (SGR) on the Population Indicators of Sultan Hamud Community

The descriptive statistics for the indicators of population impacts of built environment (SGR) at Sultan Hamud are presented in Table 4.18. Five of the indicators' impacts were rated as very high (above 5), while one was found to be low (below 3). The indicators rated highly were candidates for mitigation.

Table 4.18: Participants Rating of the Social Impacts Arising from Population impacts Caused by SGR Project

No	Indicator Description Statement	Mean	SD
1	Level of impact due to change in population	5.9	.73
2	Level of impact due to influx of temporary workers	6.0	.89
3	Level of impact to households due to individual relocation	2.3	.94
4	Level of impact of family's relocation on the household	5.4	1.2
5	Level of impact of dissimilarities in age (Number of young people compared to the old ones)	6.2	.68
6	Level of impact of dissimilarities due to gender (Number of males has increased more than the females)	5.7	.85
7	Level of impact of dissimilarities in ethnic diversities (Increase in foreigners than the local ethnic communities)	6.2	.78
	Level of Population Impacts	**5.3**	**.45**

*Scores above 3.5 were considered to be significant, while scores above 5 were taken to be high enough to warrant mitigation

4.5.2 Assessment of Social Impacts of Built Environment (SGR) on the Indicators for Individual and Family Changes at Sultan Hamud

The descriptive statistics for the impacts of Built Environment (SGR) on the indicators of individual and family changes are presented in Table 4.19. Four of the indicators were rated as High (above 5) and required to be addressed.

Table 4.19: Participants Rating of Individual and Family Impacts due to SGR Project

No	Indicator Description Statement	Mean	SD
1	Level of impact of change in attitude towards SGR project	5.4	1.0
2	Level of impact of change in perception towards the SGR project	6.0	1.1
4	Level of impact in family characteristics due to the SGR project	4.4	.05
5	Level of impact in harmful effects to health and safety due to SGR project	4.6	0.8
6	Level of impact of change in perception of risk	4.4	1.2
7	Level of impact of change in conveniences due to SGR project	5.0	
	Individual and Family Changes	**5.4**	**.45**

4.5.3 Assessment of Social Impacts of Built Environment (SGR) on the Indicators for Community and Institutional Structures at Sultan Hamud

The descriptive statistics for the impacts of Built Environment (SGR) on the indicators of community and institutional structures are presented in Table 4.20.

Table 4.20: Participants Rating on the Level of Community and Institutional Structure Impacts due to SGR Project

No	Indicator Description Statement	Mean	SD
1	Level of impact in industrial diversification due the SGR project (impact from industrial diversification)	6.2	.65
2	Level of impact in organization of local government due to SGR project	5.1	.95
3	Level of impact in activities of Non-governmental Organization (NGO) due to the SGR project	6.1	1.2
4	Level of impact in religious organization due to the SGR project	2.5	.66
5	Level of impact in political structure due to SGR project	2.4	.81
6	Level of impact in community organization as relates to each other due to SGR project	4.7	.44
	Community and Institutional Structure	**5.0**	**.46**

*Scores above 3.5 were considered to be significant, while scores above 5 were taken to be high enough to warrant mitigation

The results of the impact rating (Table 4.20) are presented. Three of the indicators were rated as high (above 5) and were candidate for mitigation.

4.5.4 Assessment of Social Impacts of Built Environment (SGR) on the Community Resources at Sultan Hamud

The descriptive statistics for the impacts of Built Environment (SGR) on the indicators of community resources are presented in Table 4.21. Seven of the indicators' impacts on the society were rated as high (above 5.0).

Table 4.21: Participants Rating of Social Impacts of Built Environment (SGR) on the Community Resources at Sultan Hamud

No	Indicator Description Statement	Mean	SD
1	Rate the level of impact in availability of housing	5.6	1.0
2	Rate the level of impact in availability of community services	5.9	.85
3	Rate the level of impact in police services	5.8	.81
4	Rate the level of impact in fire brigade services	2.6	.75
5	Rate the level of impact in sanitation services	5.2	.09
6	Rate the level of impact in health services	6.2	1.1
7	Rate the level of impact in natural resources	5.4	.90
8	Rate the level impact in land use due to the construction	5.6	.75
	Level of impact on community resources	**5.2**	**3.5**

*Scores above 3.5 were considered to be significant, while scores above 5 were taken to be high enough to warrant mitigation

4.5.5 Rating of Social Impacts of Built Environment (SGR) on the Political and Social Resources at Sultan Hamud

The descriptive statistics for the participants rating on the impacts of Built Environment (SGR) on the indicators of political and social resources are presented in Table 4.22. The political and social structure dimension had only one indicator that was rated highly by the participants.

Table 4.22: Participants Rating of the Social Impacts for the Political and Social Structure

No	Indicator Description Statement	Mean	SD
1	Level of impact in power and authority in the study area	5.1	.92
2	Level of impact in leadership capability	3.1	.78
3	Level of impact in leadership capacity	3.1	.12
4	Level of impact in relationship between power authorities and people	2.8	.82
	Political and Social Structure	**3.5**	**.51**

*Scores above 3.5 were considered to be significant, while scores above 5 were taken to be high enough to warrant mitigation

4.5.6 The Combined Social Impacts of Built Environment (SGR) as Assed by the Participants at Sultan Hamud

The overall rating of the social impacts of the Built Environment (SGR) by participants were determined and the descriptive statistics are presented in Table 4.23.

Table 4.23: Social Impact Assessment for a Built Environment (SGR)

No	Five Dimensions of the Social Impact Assessment	Mean	SD
1	Level of impacts for population indicators	5.3	.10
2	Level of impacts for the individual and family changes	5.4	.11
3	Level of impact for the community and institutional structures	5.0	.09
4	Level of impacts for community resources	5.2	.12
5	Level of impact for the political and social structure	3.5	.12
	Social Impact Assessment	**5.0**	**.45**

Mean 5.02±.02, Median 5, mode 5.25, SD .45, minimum 3.88, maximum 6.23

The participants rated the social impacts of the Built Environment (SGR) as high *(M=5.0, SD=.45*) on a scale of 0 to 7. The reliability of the index using Cronbach alpha was found to be (α=.877). The scale was divided into four categories and the frequency

distributions are as shown in Table 4.24. The category was the highest rating was the 4.01-5 group.

Table 4.24: Categories and Frequency Distributions for the Social Impact Assessment of Built Environment (SGR) at Sultan Hamud

Categories of SI Index	Frequency	Percent
3.01-4	3	.9
4.01-5	199	57.8
5.01-6	138	40.1
6.01-7	4	1.2
Total	**344**	**100.0**

The chi-square test for the equality of categories for the index on SIA was performed and the results are given in Table 4.25.

Table 4.25: Chi-square Test for the Equality of Categories for the Index of SIA of Built Environment (SGR) at Sultan Hamud

SI Index Categories	Description	Observed *N*	Expected *N*	Residual	Statistics
3.01-4	Low	3	86.0	-83.0	$\chi 2$=338.20
4.01-5	Medium	199	86.0	113.0	*df*=3
5.01-6	High	138	86.0	52.0	*p*=.001
6.01-7	Very High	4	86.0	-82.0	
Total		**344**			

The chi-square test (Table 4.25) revealed a highly statistically (*p*=.001) significant differences among the different categories of the index of SIA of Bult Environment (SGR). The category of medium (4.01-5) of the index was statistically significantly (χ^2=338.20, *df*=3, *p*= .001) higher than the other categories, indicating the majority of the participants rated the SIA of the Built Environment (SGR) at medium level.

4.5.7 Gender Differences in the Rating of SIA of Built Environment (SGR) at Sultan Hamud

The SIA of the Built Environment (SGR) scores were compared using gender. The gender differences in the rating of the level of social impacts was determined by the use of the *t*-test. The means for male and female rating of the SIA are shown in Table 4.26.

Table 4.26: Mean Comparison among the Male and Female Participants

Gender	N	Mean	Std. Deviation	Std. Error Mean
Male	212	4.9808	.45486	.03124
Female	132	5.0973	.45869	.03992

The mean of level of social impacts for the male participants was 4.9, while for the females participants was 5.09. The differences in the two means were tested using the *t*-test for the equality of means and the results are given in Table 4.27.

Table 4.27: *t*-test for Equality of Means

Gender	*N*	Means	Mean Difference	*t*	*df*	*p*
Male	212	4.98				
Female	132	5.09	-.11653	-2.303	342	.022

The mean differences for the SIA of Built Environment (SGR) for the male and female participants were statistically significantly (t = -2.303, df =342, p =.022) different form each other, meaning that females rated the SIA higher than the male participants.

4.6 Strategic Mitigation Measures and their Effectiveness in Combating Social Impacts of Built Environment (SGR)

This section (section 4.6) of the thesis presents results, interpretation of results and findings arising from the analysis of objective number four of this study, which was stated as:

> "To identify and appraise the effectiveness of strategic impact mitigation measures for a built environment (SGR) at Sultan Hamud area"

This section presents the analysis, results, and interpretation of results of the strategies that can be used to combat social impacts of built environment (SGR) and their effectiveness. The section is divided into two parts: type of mitigation measure and the effectiveness of the measure.

4.6.1 Type of Strategies for Mitigating Social Impacts of Built Environment (SGR) at Sultan Hamud

The participants for the Key Informants Interview and FGD were asked to identify different strategies that can be used to combat social impacts of built environment (SGR). The frequency of occurrence was then determined and the percentage was calculated. A list of strategies was then created showing the strategy and the and frequency of mention by the Key Informants (%) is given in Table 4.28.

The participants identified twelve (12) strategies (Table 4.28) that can be used to mitigate the social impacts of built environment (SGR) by the communities living in Sultan Hamud. All the strategies listed had a frequency of occurrence of more than 50 %, which was the cut-off point. The strategy that was selected by many respondents was

Table 4.28: List of Identified strategies for Combating Social Impacts of Built Environment (SGR) and the Frequency of Mention by the KII in %

No	Mitigating Measures	%
1	Enhance Social Corporate Responsibility (SCR) form the built environment (SGR)	97
2	Provision of credit sources for households to take opportunity of the new businesses arising from the built environment (SGR)	97
3	Development of collective action groups to aid in solving problems brought about by the built environment (SGR)	95
4	Training of household heads on all aspects of changes brought about by the built environment (SGR)	93
5	Creation of system of leadership / authority to represent the impacted community in dealing with the SGR entity	87
6	Development of Infrastructure to cater for the enhanced population	84
7	Embrace the new and alternative livelihood sources created by the built environment (SGR)	80
8	Provision of counselling services to aid with new habits and behaviors	67
9	Improving sanitation services	67
10	Provision of religious institution intervention in advising people on social behaviours	63
11	Revamp security services	57
12	Develop new and enhance the existing social amenities (housing, toilets)	54

n=63

4.6.2 Effectiveness of Strategies for Mitigating Social Impacts of Built Environment (SGR) at Sultan Hamud

The participants for the Key Informants Interview and FGD were asked to rank the effectiveness of the identified strategies (Table 4.29) in mitigating the social impacts of built environment (SGR). The effectiveness of the strategies were ranked based on a 5-point rating scale as follows:

1=Very Low effect, 2=Low effect, 3= Moderate effect,
4=High effect, and 5=Very High effect.

Table 4.29: Descriptive Statistics and Ranking of the Strategies' Effectiveness in Combating Social Impacts of Built Environment (SGR)

No	Strategies for Mitigating Impacts of Built Environment (SGR)	Effectiveness of Strategy	
		Total	Mean
1	Embrace the new and alternative livelihood sources created by the built environment (SGR)	218	3.46
2	Enhance Social Corporate Responsibility (SCR) form the built environment (SGR)	212	3.36
3	Provision of credit sources for households to take opportunity of the new businesses arising from the built environment (SGR)	212	3.36
4	Improving sanitation services (garbage, public toilets)	212	3.36
5	Provision of religious institution intervention in advising people on social behaviours	207	3.28
6	Creation of system of leadership / authority to represent the impacted community in dealing with the SGR entity	205	3.25
7	Develop new and enhance the existing social amenities (housing, public toilets	203	3.22
8	Development of collective action groups to aid in solving problems brought about by the built environment (SGR)	198	3.14
9	Training of household heads on all aspects of changes brought about by the built environment	191	3.03
10	Provision of counselling services to aid with new habits and behaviors	189	3.00
11	Revamp security services	187	2.96
12	Development of Infrastructure to cater for the enhanced population	106	1.68

** cut-off point at 2.50. Accepted strategic measures to mitigate the social impacts of the built environment (SGR)*
n=63

The results of the strategy identification, assessment of effectiveness and descriptive statistics of the ranking by the participants are summarised in Table 4.29.

The participants ranked the twelve (12) identified strategies in terms of their effectiveness in mitigating social impacts of built environment (SGR) at Sultan Hamud.

The highly raked effective strategy was to “embrace the new and alternative livelihood sources created by the built environment (SGR)” whose effectiveness was rated at (*M*=3.46) and the strategy that was lowly rated was “to revamp security services”, whose effectiveness was rated at (*M*=1.68).

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This section of the thesis presents the summary of the study, discussion of the results, conclusions of the study and the recommendations made.

5.2 Summary of the Study

This study aimed at assessing the social impacts of a built environment (SGR) at Sultan Hamud in Makueni County and identifying strategies that can be adopted to mitigate the social impacts arising from this development. The study specifically examined: (i) the demographic characteristics of the impacted households, (ii) the scoping exercise for Social Impact Assessment (SIA), (iii) Assessment of the social impacts of the built environment (SGR) using the SIA variables, (iv) identification of mitigating strategies and ranking of their effectiveness in alleviating social impacts of a built environment (SGR).

In achieving the study objectives, the study used primary data of a household survey, which was collected using a structured questionnaire that was organized according to the key thematic areas corresponding to specific objectives of the study. Key Informants Interview (KII) and Focus Group Discussions (FGDs) were conducted to triangulate the household survey data. The study then utilized descriptive and inferential statistics to analyse the collected data.

The results showed that social impacts of the built environment (SGR) were experienced by the households in Sultan Hamud in Makueni county. Effective strategies were available for use in mitigating the social impacts of the built environment (SGR) at Sultan Hamud in Makueni County.

5.3 Discussion

The findings for this study are discussed in this section based on the specific objectives of the study as stated in section 1.4 of this thesis.

5.3.1 Demographic Characteristics of Households Impacted by Built Environment (SGR)

Demographic characteristics have been shown to influence perceptions of household heads when evaluating a built environment for social impacts. The demographic characteristics of the study sample selected were different when compared to the county population data. The 2019 population census of the county found that the number of females was slightly more when compared to the males. The population of the females was 8,718 (52 %), while the males were 4,535 (48 %) (KNBS, 2019). The demographic characteristics (age and education) were found to be comparable to other studies conducted in the area. The highest age group category in the sample (41-50 years) and the majority of the population having formal education level of secondary and above was comparable to study by Makumbe et al. (2024).

The higher education level of the community impacted by the Built Environment (SGR), as was the case for this study is an added advantage as the community is able to undertake meaningful public participation when participating in Social Impact Assessment process of the Built Environment (SGR) and suggesting mitigating strategies to be undertaken (Vanclay, 2003).

In Built Environments especially infrastructure such as the SGR or roads, that tends to traverse different geographical areas in a linear manner (corridor) the impacts they cause tend to vary with the demographic characteristics of the communities living in the areas the project traverses (Lesutis, 2021). Studies have shown that demographic

characteristics such as: different ethnic communities, class structure caused by different income levels, geographical locations such as urban or rural, affect the magnitude and type of impact that is caused by the development (Edwards & Hall, 2000; Huang, 2022; Huang & Lesutis, 2023: Zhu et al., 2020; Zhu, 2023).

5.3.2 Scoping Exercise for Social Impact Assessment of the Built Environment (SGR) at Sultan Hamud

The Scoping in Social Impact Assessment (SIA) is the critical initial phase that identifies key community sensitivities, establishes project boundaries, and defines the Terms of Reference (ToR) to ensure all social, cultural, and economic impacts are properly addressed prior to project development (Notuku et al., 2025). The scoping exercise conducted for the Built Environment (SGR) identified twenty-seven (27) SIA indicators and twenty-one (21) groups of stakeholders for use for the assessment of the social impacts arising from the SGR project. The indicators identified are similar to the ones identified by Burdge and Vanclay (1996)

The stakeholder categories used for this study was slightly more, when compared to the list recommended by Notuku et al. (2025). The list recommended, included: the government (national and county), parastatals, community, traditional authority, vulnerable groups, indigenous people, civil society, non-governmental organizations (NGOs), community-based organizations (CBOs), and business organizations.

5.3.3 Social Impact Assessment (SIA) of Built Environment (SGR) Project

The findings of this study indicate that the magnitude of social impacts of the Built Environment (SGR) on the affected community were high especially on the population indicators. The female participants were found to significantly rate the social impacts highly when compared to the men. The mean scores of the magnitude

of the impacts were comparable to the ones found by Zhu et al. (2023). The study found the magnitude for the different indicators of social impact to range between 3.45 and 4.58 on a scale of 1 to 5. The positive impacts identified by the study were similar as the ones mentioned in the previous Environmental and Social Impact Assessment (ESIA) report on the project, that was conducted before the commissioning of the project (AWEMAC, 2012).

The assessment of the significance of the social impacts of the SGR in this current study did not find impacts highlighted during the building phase of the project and in other areas along the SGR line, such as: compensation and livelihood disruption (Ngare et al., 2015), positive socio-economic impacts (Oluoch, 2018), involuntary displacement and dispossession (Mkutu et al., 2025) and the impact of in-migration along the line but without increase in crime and population (Githaiga, 2025).

A study on the impacts of the Kenya SGR by Bachle (2025), termed the project as an infrastructure mega project due to the impact it had on the Kenyan population and classified the positive and negative environmental impacts arising from the SGR into three based on the key actors of the project (Kenya and Chinese governments, the public and conservationists): ecological, political and economic and all these have a direct and indirect bearing on the societys' wellbeing. The Kenya government advocated that the project was a national development of economic importance, while the Chinese government leveraged on compliance with legal regulation while downplaying dissent. The conservationists were more concerned with the wildlife and biodiversity destruction.

The political angle impacting on the SGR project mentioned by Bachle (2025) was emphasized by Lesutis

One of the challenges in the evaluation of environmental impacts (EI) and social impact (SI) is to evaluate the combination of their individual effects and multiple actions over time, termed as cumulative impacts (Edwards & Hall, 2000). It is possible to assess the impact of in-migration of project workers and residents into the project area, but also when the increase in population occurs, it also causes the problem of shortage of resources especially housing, in this study this element was minimised by creating an index (Babbie, 2021) of social impacts to show the combined effects of the impacts.

5.3.4 Types and Effectiveness of Strategies for Mitigating the Social Impacts of Built Environment (SGR)

The study identified twelve (12) different strategies for mitigating the impacts of the Built Environment (SGR) and from the stakeholder's assessment and the rating of the significance of the strategies, it was found that the identified strategies were also effective in mitigating the social impacts they were supposed to address. The strategies can be categorised into economic needing financial input from the government or project implementors, cultural needing a behavioural change of the affected community, or social requiring the mobilization of the whole community to mitigate the impacts.

The majority of the social impacts of the SGR project can be mitigated or eliminated, though some are difficult to mitigate, such as: increased national debt due to the construction of the mega-infrastructure (Huang and Lesutis, 2023), Barrier effect of the railway corridor to wildlife (Ambani and Mulaku, 2021), techno-politics of differentiation (Lesutis, 2021), wildlife behaviour (Okita-Ouma et al., 2021) and restoration plans for affected livelihoods especially when the environment is involved (Mchome and Nzoya (2023).

In order to improve efficiency, transparency and long-term sustainability of major infrastructure projects (such as the Kenya SGR), Guantai and Nafula (2025) recommend structured public participation to be undertaken in order to: strengthen awareness campaigns, enhance inclusivity, maintain continuous stakeholder engagement, and institutionalizing responsive feedback systems.

The absence of prevention, mitigation, and preparation measures, contributes to the magnitude of the impacts on society caused by built environments. There is therefore need for plans to enhance the reduction of this risk. Mchome and Nzoya (2023) recommended for Livelihood Restoration Plans (LRPs) for livelihood restoration of project affected persons.

In development planning for Built Environment such as the SGR project there is need to integrate the transport with land use planning around the stations and along the SGR corridor in order to enhance economic sustainability of the project (Mchome and Nzoya, 2023). This will avoid the cessation of the businesses and increase value of the land along the railway corridor and around the stations. The study found that most of the businesses created during the time the contractor was building the railway line and the demand for housing for the workers had reduced as the people engaged in the building work were laid off.

5.4 Conclusions

The following conclusions were made from the study:

(i) The stakeholders and communities impacted by the Built Environment (SGR) were found to be varied and included residents from the two counties affected

(ii) The assessed level of social impacts of built environment (SGR) using the SIA variables was found to be high for the households in Sultan Hamud area.

(iii) The community identified strategies for mitigating the social impacts of built environment (SGR) were found to be effective in alleviating the impacts to the households.

(iv) The community in Sultan Hamud were found to have not taken advantage of the benefits arising from the built environment (SGR).

5.5 Recommendations

Based on the study findings, the following recommendations were made:

(i) The community at Sultan Hamud needs to be more organised in order to take advantage of the of the benefits arising from the built environment (SGR) by doing the following: forming action groups, creating proactive leadership that is capable of guiding them in harnessing the benefits of the project, and being more willing to embrace the new changes brought about by the development.

(ii) Provision of credit to the households and residents to enable them to take advantage of the new businesses created by the built environment.

(iii) The community to diversify its livelihood sources to include the new ones arising from the Built Environment (SGR)

(iv) Provision of training to the households to enable them to take advantage of the new ventures arising from the Built Environment (SGR)

(v) The county government to provide the required social amenities, infrastructure, and health services to cater for the increased population.

(vi) Public participation to be done to: strengthen awareness campaigns, enhance inclusivity, maintaining continuous stakeholder engagement, and institutionalizing responsive feedback systems in order to improve efficiency, transparency and long-term sustainability of the SGR project.

5.6 Recommendations for Further Research

The following are recommended to be done for further research:

(a). The study covered Sultan Hamud community and used SGR as the built environment. There is therefore need to cover other communities and different types of built environment in other areas of Kenya in order to get a clearer picture of the situation in the country.

(b). To determine the social impacts of multiple built environments to a given community in arid and semi-arid areas (ASAL).

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APPENDICES

Appendix A: Letter to Respondents

Dear Participant,

RE: PARTICIPATION IN RESEARCH

I am George Ochieng' Okumu, a student of Master of Science Environment and Natural Resource in the School of Environment and Natural Resources. I am conducting my academic research in Sultan Hamud area of Makueni and Kajiado County.

You are among the residents of Sultan Hamud township who have been selected for this study. The purpose of this study is to assess the social impacts of the SGR project to the community. The title of the research is *"**Social Impact Assessment of Built Environment and Strategic Measures of Mitigating Social Impacts in Makueni County, Kenya"***

Your participation in this study is highly appreciated and all your responses will be confidential and will not be disclosed to anyone.

Sincerely

George Ochieng' Okumu

Researcher

Appendix B: Household Questionnaire

Section One: Demographic Characteristics of the Respondents

Demographic

Location _____

Distance from the SGR _____

Gender (Male / Female)

Age of the respondent in Years or year born _____

Level of formal Education

Education level	tick
No formal education	
Primary 1-8	
Secondary form 1-4	
College	
Bachelor's Degree	
Master's Degree	
PhD	

Household number _____

Income per month _____

Income per year _____

Section Two: Socioeconomic

1. Size of land unit owned by the respondent _____
2. Sources of income / Livelihood options (you can tick more than one depending on options)

Livelihood option	
Farming	
Livestock keeping	
Business (mention type of business)	
Employed (mention type of job)	
Doing part time jobs on farms	
Doing part time jobs as maids	
Teacher	

Section Three: Changes Caused by Built environment (SGR) to the Community

1. Changes in the Population Parameters due to SGR

Rate the level of change caused by the SGR project undertaken in your area on a 7-point rating scale as follows:
0=No Change, 1=Extremely Low Change, 2=Very Low Change, 3=Low Change, 4= Moderate Change, 5=High Change, 6= Very High Change, 7=Extremely high Change

	Statement	1	2	3	4	5	6	7
1	Rate the level of change in population due to SGR project							
2	Rate the level of change due to influx of temporary workers due to SGR project							
3	Rate the level of change of individual relocation due to SGR project							
4	Rate the level of change of family's relocation due to SGR project							
5	Rate level of change in dissimilarities in age due to SGR project (number of young people compared to the old ones)							
6	Rate the level of change in dissimilarities due to gender (number of males has increased more than the females due to the SGR project)							
7	Rate level of change in dissimilarities in ethnic diversities (there is an increase in foreigners than the local ethnic communities)							

2. Changes in the social and cultural set up of individuals, families and communities due to SGR

Rate the level of change in your household caused by the SGR project undertaken in your area on a 7-point rating scale as follows:
0=No Change, 1=Extremely Low Change, 2=Very Low Change, 3=Low Change, 4= Moderate Change, 5=High Change, 6= Very High Change, 7=Extremely high Change

	Statement	1	2	3	4	5	6	7
1	Rate the level of change in your attitude towards the SGR project							
2	Rate the level of change in your perception due to SGR project							
3	Rate the level of change of your perception towards SGR							
4	Rate the level change in family characteristics due to the SGR project							
5	Rate level of change in culture and values due to SGR project							
6	Rate the level of change in perception of risk due to SGR project							
7	Rate level of change in conveniences due to SGR project							

3. Changes in the structure and organization of Community Institutions and developments due to SGR

Rate the level of change in your household caused by the SGR project undertaken in your area on a 7-point rating scale as follows:
0=No Change, 1=Extremely Low Change, 2=Very Low Change, 3=Low Change, 4= Moderate Change, 5=High Change, 6= Very High Change, 7=Extremely high Change

	Statement	1	2	3	4	5	6	7
1	Rate the level of change in industrial diversification due the SGR project (has there been change in industrial diversification)							
2	Rate the level of change in organization of local government due to SGR project							
3	Rate the level of change in activities of Non-governmental Organization (NGO) due to the SGR project							
4	Rate the level change in religious organization due to the SGR project							
5	Rate level of change in political structure due to SGR project							
6	Rate the level of change in community organization as relates to each other due to SGR project							

4. Changes in access of Community Resources and Infrastructural developments due to SGR

Rate the level of change in your household caused by the SGR project undertaken in your area on a 7-point rating scale as follows:
0=No Change, 1=Extremely Low Change, 2=Very Low Change, 3=Low Change, 4= Moderate Change, 5=High Change, 6= Very High Change, 7=Extremely high Change

	Statement	1	2	3	4	5	6	7
1	Rate the level of change in availability of housing due to SGR project							
2	Rate the level of change in availability of community services due to SGR project							
3	Rate the level of change in police services due to SGR project							
4	Rate the level of change in fire brigade services due to SGR project							
5	Rate the level of change in sanitation services due to SGR project							
6	Rate the level of change in health services due to SGR project							
7	Rate the level of change in natural resources due to the construction of SGR project							
8	Rate the level change in labour availability/employment due to the construction SGR project							

5. Changes in Political, Governance and administration of Social Resources due to SGR

Rate the level of change in your household caused by the SGR project undertaken in your area on a 7-point rating scale as follows:
0=No Change, 1=Extremely Low Change, 2=Very Low Change, 3=Low Change, 4= Moderate Change, 5=High Change, 6= Very High Change, 7=Extremely high Change

	Statement	1	2	3	4	5	6	7
1	Rate the level of change in power and authority in the study area due to SGR project							
2	Rate the level of change in leadership capability due to SGR project							
3	Rate the level of change in leadership capacity due to SGR project							
4	Rate the level of change in relationship between power authorities and people due to SGR project							

Appendix C: Key Informants Interview (KII)

Section One: Demographic Characteristics of the Respondents

Location _____

Distance from the SGR _____

Years lived in Sultan Hamud _____

Gender (Male / Female)

Age of the respondent in Years or year born _____

Level of formal Education

Education level	tick
No formal education	
Primary 1-8	
Secondary form 1-4	
College	
Bachelor's Degree	
Master's Degree	
PhD	

Household number _____

Income per month _____

Income per year _____

Section Two: Stakeholder Analysis

1. List of Stakeholders and impacted community for the Built Environment

(i) Identify the stakeholders and community impacted by the SGR at Sultan Hamud by ticking either Yes or No next to stakeholder.
(ii) State the stakeholder involvement in the SGR project
(iii) Add to the list in case one has been omitted.

	Stakeholder	**Yes**	**No**	**Involvement in the SGR project**
1	Local resident			
2	SGR staff			
3	Business community			
4	Migrant workers			
5	Transport			
6	Vendors in street			

7	Politicians			
8	State employees			
9	County ward workers			
10	Women market vendors			
11	Religious leaders			
12	Pastoralist			
13	*Nyumba Kumi Initiatives*			
14	Chief / Administration			
15	Police /security			
16	Environmental profession			
17	Natural resources (conservancies)			
18	Engineers			
19	Farmers			
20	Local transport			
21	Educators			

2. Rating of the Stakeholders and affected communities in terms of their influence and interest to the SGR project.

(a) Rate the stakeholders in terms of their influence to the SGR project

(b) Rate the stakeholders in terns of their interest to the SGR project

(c) The rating in terms of the influence and interest was done based on 0 to 3 scale, as follows:

0= No influence or interest, 1= low influence or interest, 2=medium influence or interest and 3= High influence of interest.

		Rating		
	List of Stakeholder	**Influence**	**Interest**	**Total**
1	Local resident			
2	SGR staff			
3	Business community			
4	Migrant workers			
5	Transport			
6	Vendors in street			
7	Politicians			
8	State employees			
9	County ward workers			
10	Women market vendors			
11	Religious leaders			
12	Pastoralist			
13	*Nyumba Kumi Initiatives*			

14	Chief / Administration			
15	Police /security			
16	Environmental profession			
17	Natural resources (conservancies)			
18	Engineers			
19	Farmers			
20	Local transport			
21	Educators			

3. Identification and Vetting Social Impact Assessment Indicators for the Purpose of Impact Assessment

(i) Vet the indicators in terms of their usefulness in impact assessment of the SGR project
(ii) use a 1 to 5 rating scale, where:

1= very low, 2=low, 3=medium, 4=high and 5=very high,

	Population Impacts	**Score**
1	Level of impact due to change in population	
2	Level of impact due to influx of temporary workers	
3	Level of impact to households due to individual relocation	
4	Level of impact of family's relocation on the household	
5	Level of impact of dissimilarities in age (Number of young people compared to the old ones)	
6	Level of impact of dissimilarities due to gender (Number of males has increased more than the females)	
7	Level of impact of dissimilarities in ethnic diversities (Increase in foreigners than the local ethnic communities)	
	Individual and Family Changes	
8	Level of impact of change in attitude towards SGR project	
9	Level of impact of change in perception towards the SGR project	
10	Level of impact in family characteristics due to the SGR project	
11	Level of impact in harmful effects to health and safety due to SGR project	
12	Level of impact of change in perception of risk	
13	Level of impact of change in conveniences due to SGR project	
	Community and Institutional Structure	
14	Level of impact in industrial diversification due the SGR project (impact from industrial diversification)	
15	Level of impact in organization of local government due to SGR project	
16	Level of impact in activities of Non-governmental Organization (NGO) due to the SGR project	
17	Level of impact in religious organization due to the SGR project	
18	Level of impact in political structure due to SGR project	

19	Level of impact in community organization as relates to each other due to SGR project	
	Community resources	
20	Rate the level of impact in availability of housing	
21	Rate the level of impact in availability of community services	
22	Rate the level of impact in police services	
23	Rate the level of impact in fire brigade services	
24	Rate the level of impact in sanitation services	
25	Rate the level of impact in health services	
	Political and Social Structure	
26	Level of impact in power and authority in the study area	
27	Level of impact in leadership capability	
28	Level of impact in leadership capacity	
29	impact in relationship between power authorities and people	

4. Identify strategies for mitigating impacts arising from the SGR project
(a) suggest strategies for the different social impacts

	Population Impacts	**Tick**
	Individual and Family Changes	
	Community and Institutional Structure	
	Community resources	
	Political and Social Structure	

5. Effectiveness of Strategies for Mitigating Social Impacts of Built Environment (SGR) at Sultan Hamud

Assess the effectiveness of the strategies using a 5-point rating scale as follows:
1=Very Low effect, 2=Low effect, 3= Moderate effect,
4=High effect, and 5=Very High effect.

No	Strategies for Mitigating Impacts of Built Environment (SGR)	Effectiveness score
1	Provision of counselling services to aid with new habits and behaviors	
2	Enhance Social Corporate Responsibility (SCR) form the built environment (SGR)	
3	Provision of religious institution intervention in advising people on social behaviours	
4	Training of household heads on all aspects of changes brought about by the built environment	
5	Embrace the new and alternative livelihood sources created by the built environment (SGR)	
6	Development of Infrastructure to cater for the enhanced population	
7	Provision of credit sources for households to take opportunity of the new businesses arising from the built environment (SGR)	
8	Develop new and enhance the existing social amenities (housing, public toilets	
9	Development of collective action groups to aid in solving problems brought about by the built environment (SGR)	
10	Revamp security services	
11	Creation of system of leadership, authority to act as a representation in dealing with the SGR entity	
12	Improving sanitation services (garbage, public toilets)	

Appendix D: Focus Group Discussion Guide

1. identify the different stakeholders for the SGR

2. Rank the stakeholders in terms of their importance

3 list the different strategies to mitigate social impacts

4. How effective are the strategies

5. identify the different indicators and rate them in terms of their importance

Appendix E: Photos from the field

Plate 1: SGR locomotive and the countryside

Plate 2: The SGR pylons at the Tsavo River

Plate 3: SGR locomotive

Plate 4: SGR passenger train

Appendix F: Letter of Approval from ANU

AFRICA NAZARENE
UNIVERSITY

12th June, 2018

RE: TO WHOM IT MAY CONCERN

George Ochieng Okumu 17JO3DMEV003 is a bonafide student at Africa Nazarene University. He/She has finished his/her course work and has defended his/her thesis proposal ***entitled "Assessment of the influence of built environment on the socio-economic wellbeing of households impacted by the standard gauge railway line in sultan Hamud, Makueni county, Kenya***

Any assistance accorded to him/her to facilitate data collection and finish his/her thesis is highly welcomed.

Prof. Rodney Reed
Deputy Vice Chancellor, Academic Affairs

Appendix G: NACOSTI Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Ref No: **614213**

Date of Issue: **03/June/2026**

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