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The KENYA INSTITUTE for PUBLIC POLICY RESEARCH and ANALYSIS

Enhancing Spatial Equity in Location Planning for Affordable Housing: The Case of Nairobi City County

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DP/249/2020

THE KENYA INSTITUTE FOR PUBLIC POLICY RESEARCH AND ANALYSIS (KIPPRA)

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Kenya Institute for Public Policy
Research and Analysis

KIPPRA Discussion Paper No. 249
2020

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Published 2020

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ISBN 978 9966 817 59 4

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Abstract

The affordable housing programme is being implemented by the Government of Kenya to address housing adequacy challenges in the country. Access to affordable and decent housing is imperative to improving the quality of life of Kenyans and ensuring human dignity. The choice of location for the construction of housing can either enhance or reduce equity in access to housing and services. The study sought to analyse spatial equality in housing and infrastructure provision using the City of Nairobi as a case example. Key concepts of spatial welfare, spatial equity, spatial justice and sustainable development framed the study. Using spatial analysis methods, the study first identified suitable locations (sites) for providing affordable housing. The identified sites were then evaluated for prioritization and decision-making using the spatial multi-criteria evaluation method. Criteria for analysis were identified from the literature and prioritized using a participatory approach; that is, Analytic Hierarchy Process (AHP). The study finds that prioritization of criteria and the consequent determination of weights or relative importance differs based on the background of stakeholders. For instance, what local citizens define as a priority may not be given the same weight by professionals or Government project officials. This highlights the nature of the 'decision problem' in planning and providing affordable housing units. There is observed spatial inequality concerning access or coverage of physical and social infrastructure. Locations have been identified that are less equity enhancing and would further adversely affect the lives and well-being of targeted beneficiaries, barring any affirmative infrastructure interventions. The findings are instrumental in planning and budgeting and prioritization in the allocation of resources for housing and infrastructure development.

Abbreviations and Acronyms

AHP	Analytic Hierarchy Process
ANP	Analytic Network Process
GAHP	Group Analytic Hierarchy Process
GIS	Geographic Information Systems
GoK	Government of Kenya
KES	Kenya Shillings
KNBS	Kenya National Bureau of Statistics
MCDA	Multi-criteria Decision Analysis
MCDM	Multi-Criteria Decision Making
NUA	New Urban Agenda
RS	Remote Sensing
SDGs	Sustainable Development Goals
SHI	Social Housing Index
SLLI	Strategically Located Land Index
SMCE	Spatial Multi-Criteria Evaluation
US$	United States Dollar

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1. Introduction

1.1 Background

Provision of affordable housing is one of the Government's "Big Four" agenda, where it targets to provide at least 500, 000 housing units by 2022. The programme is anchored on the principle that every Kenyan should own property, comprising decent housing built to modern standards, at a cost equivalent to the rental cost. The implementation is segmented with a focus on three levels of housing types, namely: social housing; low-income housing; and the mortgage gap (Government of Kenya, 2018). This is informed by the fact that the housing market in Kenya, has mainly provided for the middle and high-income households, to the detriment of the low-income category. A report by Nairobi City County Government (2018) shows that 50 per cent to 60 per cent of the population in Nairobi City lives in informal settlements, a trend attributable to the low level of income. On average, the monthly per adult equivalent total consumption expenditure in Nairobi was Ksh 13,691.4, while the monthly per adult equivalent rent consumption expenditure in Nairobi was Ksh 1,996.4. This was against the absolute poverty line of Ksh 5,995. 9 (Kenya National Bureau of Statistics - KNBS, 2018). In Nairobi, approximately 745,000 people live in overall poverty1, while 26,000 people experienced hardcore/extreme poverty[2] in the City (KNBS, 2018). Data shows that the cheapest home formally built by a developer in 2012 cost more than US$ 15,000, which is more than 10 times the average annual income of US$ 1,340 and only 2 per cent of formally constructed houses were targeted to the lower-income segments of the market, which account for the largest share of demand[3].

This study identifies locations suitable for the development of social housing and evaluates them based on economic, social, and environmental criteria. The study explores how principles of sustainable development and equity can be infused in the planning and provision of social housing programmes to the benefit of the urban poor. The framework applied in this study can be developed further to inform the Development Framework Guidelines[4] for the Affordable Housing Programme under the "Big Four" agenda of the Government of Kenya. Housing is a basic human need with implications for household functionality, productivity, and social harmony. The Constitution of Kenya (Bill of Rights), the Kenya Vision 2030, Sustainable Development Goals (SDG's) - Goal 11 among other policy

1 Overall poverty: households and individuals whose monthly adult equivalent total consumption expenditure per person is less than 5,995 in core-urban areas.

2 Hardcore/extreme poverty: households and individuals whose monthly adult equivalent total consumption expenditure per person is less than Ksh 2,551 in core-urban areas.

3 https://bomayangu.go.ke/downloads/20190401_Affordable_Housing_Program_-_Delivery_Framework_Draft_v02.pdf.

4 https://www.housingandurban.go.ke/wp-content/uploads/2018/11/Development-Framework-Guidelines-Release-Version.pdf.

documents, recognize the important role of housing in human development and well-being. Article 43 Section (1) clause (b) of the Constitution of Kenya states that "Every person has the right to accessible and adequate housing and reasonable standards of sanitation". The National Land Policy also provides for the removal of squatters from unsuitable land and their resettlement. A focus on social housing provision would therefore ensure that all citizens (especially low-income income) will access a decent quality of life. The study is useful in supporting implementation of the social housing programme by providing a mechanism for estimating the responsiveness of selected project sites to the needs of the targeted communities. This is important in ensuring acceptability and overall uptake of the housing product. In the long-term, socially responsive housing provision will have the intended impact of improved living standards and prosperity for all.

1.2 Problem Statement

Provision of social housing necessitates strategic urban planning to ensure that the homes respond to the economic, social and environmental needs of targeted households. In this regard, it will be necessary to select locations that respond to the need for access to jobs, schools, markets, hospitals, recreational spaces and basic services (water, electricity and transport), among others. Studies have shown that housing conditions influence an individual's outcome in health, education, socio-political participation, labour participation, among other aspects of life. As an economic good, housing has both consumption (demand for housing services) and investment (demand for housing stock) purposes. This presents a challenge in the selection of sites for the development of affordable housing due to competing and conflicting site requirements. No particular site will meet the economic, social and environmental needs of the targeted beneficiaries. A decision problem, therefore, arises with regard to identifying the suitability of sites for social housing. This is compounded in trying to identify criteria that make one site more suitable than others, and in building consensus among various stakeholders on the perceived importance of one criterion over another. Further, the Affordable Housing Development Framework Guidelines (2018) provide a mechanism to identify and evaluate sites for the development of housing. The Affordable Housing Programme is informed by multiple objectives - economic, social and environmental, as identified in the Kenya Vision 2030 and the "Big Four" Agenda. While the achievement of each of these objectives is desired, in reality, some level of prioritization and compromise may be necessary for implementation. The decision problem lies in selecting what to and what not to prioritize or compromise. It arises out of the need to provide adequate and decent

housing for all, yet different alternatives exist. The impact and trade-offs of each alternative are also a priori uncertain.

1.3 Objectives

The overall objective of this study is to examine the housing location needs of low-income households and develop a framework for identifying and delineating suitable locations for social housing development.

The specific objectives are to:

(i) To examine the housing location needs for low-income households in urban areas in Kenya

(ii) To identify and evaluate suitable locations for social housing that enhance sustainable development and spatial equity.

The key questions explored in this paper are: what are the housing needs and preferences of low-income households? how can these needs be applied in defining criteria for the selection of suitable locations for social housing provision? do the locations selected for affordable housing embrace sustainable development principles and enhance equity in housing and service delivery? which locations should be prioritized for development of social housing under the Affordable Housing Programme?

1.4 Justification of the Study

Housing is a basic human need with implications on household functionality, productivity and social harmony. The Constitution of Kenya (Bill of Rights), the Kenya Vision 2030, The National Housing Policy, and the SDG's (Goal 11), among other policy documents, recognize the important role of housing in human development and well-being. A focus on social housing provision would therefore ensure that all citizens (especially low-income income) will access a decent quality of life. The National Land Policy also provides for the removal of squatters from unsuitable land and their resettlement, while the quality of life for all and human dignity is a key principle, which is also in the National Housing Policy 2004. The study is useful in supporting the implementation of the social housing programme by providing a mechanism for estimating the responsiveness of selected project sites to the needs of the targeted communities. This is important in ensuring acceptability and overall uptake of the housing product. In the long-term, socially responsive housing provision will have the intended impact of improved living standards and prosperity for all.

2. Theory on Residential Location Planning

The theory of urban land markets as advanced by Alonso (1960) is applicable in understanding the location choice for affordable housing. In the theory, Alonso considered purchase of land as a purchase of two goods, land and location, with a one-off payment for both. He also noted another negative good (distance) in the transaction with a positive cost of commuting or a positive good (accessibility) with negative costs (savings in commuting). By applying the concept of the bid rent curve, Alonso determined that land uses determine land values through competitive bidding and that land values distribute land uses according to their ability to pay. Alonso (1960) finds that for residential land uses, satisfaction is the relevant criterion for optimal location rather than profits, as in the case of business and agricultural land uses. Consumers of residential land will seek to balance between the costs and inconvenience of commuting against the advantages of cheaper land away from the city and larger space for living. The theory argues that the poor will bid to leave closer to the "city centre" on expensive land compared to the wealthier because their bid-rent curve is steeper, and changes in land price is less important than the costs and inconvenience of commuting to them. These theories can be applied in explaining location preferences for low-income households in social housing programmes.

There are also a number of descriptive and analytical models of urban land use that have been developed over time, which explain the spatial organization of land uses. These models are instructive in planning of social housing programmes. Von Thunen's regional land use model (based on Rodrigue, 2020) was among the first to be advanced to explain the spatial organization of land uses; it is based on a central place, the market town, and its concentric impacts on surrounding land use. Using the concept of economic rent, it explained how land uses compete for location creating a pattern of concentric circles around a market and driven by transport costs. In 1925, Burgess advanced the concentric model by applying it in urban land. It investigated the spatial patterns of social classes in urban areas and recognized that these patterns were influenced by transportation and mobility. The commuting distance from the central business district formed the concentric circles which represented different socio-economic backgrounds.

In the 1930s sector (Hoyt, 1939) and multiple nuclei (Harris and Ullman, 1945) land-use models were put forth to address the weaknesses of the concentric models. The models chiefly took into account a transport axis (sector model) and multiple nuclei effect on land use organization and growth. The sector model observed that land use would organize around transport corridors/axis. The multiple nuclei held that land use and urban growth would spring from multiple different centres as opposed to one single central business district (CBD). The

literature further provides examples of hybrid models as in Isard (1956). These models though theoretical, offer one avenue of exploring the spatial organization of urban areas in Kenya. Some similarities emerge with regard to the impact of transport networks, where ribbon development is observed.

Literature also provides theories that specifically explain residential location choice and how location influences housing demand and supply. These include the Tiebout model; filtering down model; bid rent relationship; the trade-off model; and the cultural agglomeration models as explained in (Jordaan et.al, 2004) and related theoretical underpinnings mentioned in (McFadden, 1978; Whitehead 1999). One premise of these theories holds that a rational consumer will choose a residential location by weighing the attribute, such as accessibility, quality of public services, neighbourhood and dwelling characteristics, of each available alternative and by selecting the alternative that maximizes utility, with the assumption of independence on alternatives.

Theories have also been advanced to address the problems associated with the distribution of public resources in geographic space such as the spatial welfare theory (Smith, 1977), spatial equity and spatial justice (see Amer, 2007). These concepts look into "who gets what, where and when". The theories address principles of sustainable urban development by including equity to economic viability considerations, and with further consideration on heterogeneous nature in the distribution of quality of life.

This paper follows the seminal theories by Alonso (1960) and infuses principles of spatial welfare and spatial equity theories to inform the analysis.

3. Empirical Literature on Location Planning for Housing

The location where households choose to reside is influenced by five broad location-based factors, including physical characteristics of the neighbourhood; socio-economic characteristics; public services; environmental qualities; and accessibility (Rouwendal and Meijer, 2001; Segal, 1979; and Jordaan et al., 2004). These factors determine the level of sustainability of human settlements. Land that is suitably located for housing in terms of accessibility and proximity to social and physical infrastructure is a prerequisite for sustainable human settlements (Huchzermeyer, 2003).

The identification and delineation of suitable locations for housing development constitutes a multi-criteria decision problem (MCDP). It is defined by a set of alternative solutions and one or more objectives that a solution to the problem should achieve (Zucca et al., 2008). How much each alternative addresses the objectives can be measured by a set of criteria. In a non-spatial multi-criteria decision problem, the performance of one alternative for a certain criterion can be measured by one value. In a spatial multi-criteria decision problem, the criteria and the alternatives can have a spatial dimension (Sharifi and Rodrigues, 2002; Sahrifi, 2007; Zucca et.al., 2008).

In addressing the decision problem of identification and delineation of suitable locations for social housing provision, the model by Sharifi and Rodrigues (2002) for planning and decision-making is applicable. The model has a flow of three systematic activities beginning with intelligence, followed by design and then choice. Briefly, the intelligence phase entails identifying the problem and involves describing the system, understanding the system behaviour, assessing the current situation and formulation of objectives. The design phase entails developing and analyzing possible courses of action. It involves formulating planning models and generating alternatives. The choice phase then follows by evaluating the alternative options and selection of the most appealing action. It involves assessing impact, evaluating and decision-making and dissemination of the decision. The paper outlines how the planning and decision-making model makes use of spatial multi-criteria evaluation (SMCE) in all its three activities. It is also mentioned how the model is implemented within the framework of spatial decision support systems (SPDSS) within the Geographic Information System (GIS) environment. The key message is that SPDSSs are most effective when GIS and SMCE approaches are combined, as also mentioned in Musakwa et al. (2017).

Literature provides empirically tested approaches towards identification and delineation of locations for sustainable human settlements using the multi-

criteria evaluation approach. Musakwa et al. (2017) and Adero (2018) using a participatory planning approach, which applied Multi-criteria Decision Analysis (MCDA), proposed a Strategically Located Land Index (SLLI) to identify land that is smart for human settlements land reform in South Africa. Applying the Group Analytical Hierarchy Process (GAHP), the paper identified and evaluated environmental, land and proximity-based criteria. It was found that the SLLI enabled streamlining and better decision making based on a scientific basis. It is concluded that the SLLI can assist through the acquisition of appropriate land, which enables the creation of smart cities. In terms of methods chosen, it is noted that the AHP Multi-Criteria Decision-Making (MCDM) method is a quantitative and qualitative technique that reduces complex decisions to synthesized pairwise comparisons. Siqueira et al. (2018) developed the Social Housing Index (SHI) for integrating and quantifying urban spatial socio-environmental information to support social housing plans. The SHI is applicable in identifying suitable locations for social housing. Another utility is that it can be used to evaluate already existing or chosen sites. The research found that accessibility is a major factor differentiating the scores for evaluated sites. Jobs and cultural facilities are important for prioritization. The SHI is able to make different demands for housing development compatible.

Sierra et al. (2018), applying content analysis, reviewed the current state of multi-criteria infrastructure assessment studies that include social aspects. Social aspects form one of the goals of multi-criteria assessment, besides economic, and environmental goals. The results identified 23 social criteria with the most common being mobility and accessibility, safety, identity and cohesion, and local development. The paper concludes that multi-criteria assessment methods must guarantee the improvement of the representation of the social context and facilitate the evaluation in the absence of information. It also calls for representative participation, as also mentioned in Musakwa et al. (2017) and cyclic learning processes. Manupati et al. (2018) make use of a multi-criteria decision-making approach to advance an urban renewal framework for cities in India. A Decision-Making Trial and Evaluation Laboratory (DEMATEL) model-based Analytic Network Process (ANP) was developed. This methodology is found to take into account the interdependencies of the identified criteria and sub-criteria while calculating global weights. The methodology allows for the establishment of the cause and effect relationships among the criteria and sub-criteria. It also eliminates bias occasioned by decision-makers. However, the authors note that the approach relies on expert opinion, which may be subjective.

Jeong and Ramírez (2018) develop a Multi-Criteria-Spatial Decision Support System for sustainable planning and construction of rural housing. The objective of the research was to optimally eco-design rural housings under (mass)-tourism

in reservoir areas for sensitivity and effect. The model, Fuzzy-DEcision-MAking Trial and Evaluation Laboratory/Multi-Criteria-Spatial Decision Support System (F-DEMATEL/MC-SDSS, represents a spatial methodology integrating rural housing with the environment. It allows for suitability analysis of rural housing using criteria and enables verification of sustainability requirements. It is also identified as a useful tool for communication and collaboration with decision-makers in the planning process.

4. Methods and Data

4.1 Analytical Framework

4.1.1 Intelligence: Assessing the policy context and formulation of objectives and criteria

As applied in the work of Sharifi and Rodrigues (2002), cited in the literature, the analysis begins with the intelligence phase. This phase reviews the prevailing national development goals that address housing and urban development.

The objectives driving the analysis are premised on Kenya's long-term development blueprint, the Kenya Vision 2030, which aims to create "a globally competitive and prosperous country with a high quality of life by 2030". Three key pillars, economic, social and political anchor the Vision. It is further informed by the "Big Four" agenda, which translates the Governments focus on implementation of Vision 2030 for the period 2018-2022. Specifically, the analysis is aligned with the Affordable Housing Programme under the "Big Four" agenda. The National Spatial Plan for Kenya adopts the principles of sustainable development in prescribing spatial development in Kenya. It, *inter alia*, provides for the undertaking of an inventory of all the existing informal settlements in urban areas to establish the insufficient services and infrastructure for purposes of upgrading them to more habitable dwelling areas. It also prescribes that the government needs to establish a land bank for public housing through purchase or compulsory acquisition of land that is not fully optimized for future developments (Government of Kenya, 2016a). Further Sessional Paper No. 1 of 2017 on the National Land Use Policy identifies the need to strike a balance between satisfying the human livelihood needs and sustainable use of resources for posterity. It for instance identifies the challenge of urban settlements encroaching on arable land for agriculture and threat to water catchment areas due to human settlement. It seeks to balance concerns such as food security, human settlements, environmental protection and climate change, and other economic pursuits (Government of Kenya, 2017). The National Urban Development Policy - NUD) of 2016 also prescribes for sustainable urban areas and cities, and advocates for delivery of accessible quality and efficient infrastructure and services (Government of Kenya - GoK, 2016b).

The analysis also makes reference to the New Urban Agenda (NUA) advanced by the United Nations Human Settlement Programme (UN-Habitat), and the Sustainable Development Goals (SDGs). The NUA calls for an urban paradigm shift grounded in the integrated dimensions of sustainable development, namely: social, economic and environmental. Reading from the government development programmes and the global development agenda, three broad goals - economic, social and environmental, are identified for analysis and are explained as follows:

a) Social objective

Social cohesion, equality and inclusion are important goals in urban development and housing provision (Government of Kenya - GoK, 2008). These can be promoted through spatial organization, accessibility and design of urban space, and infrastructure and basic service provision. In addition, eradicating poverty in all its forms and dimensions is identified as one of the great global challenges for sustainable development (UN-Habitat, 2017). Provision of housing options that are safe, affordable and accessible for members of different income groups of society is therefore important. The social pillar of the Kenya Vision 2030 places importance on the building of a just and cohesive society that enjoys equitable social development in a clean and secure environment. It aims to, among other things, provide the country's population with adequate and decent housing in a sustainable environment.

Housing provision should consider socio-economic and cultural integration of marginalized communities. Effort should put to providing equitable and affordable access to sustainable basic physical and social infrastructure and services. These services should be responsive to the rights and needs of women, men, children and youth, older persons, among others, in vulnerable situations. Social housing is housing targeted at meeting the housing needs of low-income earners (classified as those earning Ksh 0-15,000). The "Big Four" agenda being implemented by the Government of Kenya seeks to ensure access to affordable and adequate housing by availing 500,000 housing units by 2022. The location of the social housing projects will have implications on affordability and adequacy of housing provided for the low-income members of society. Provision of safe, inclusive, accessible, green and quality public spaces is also identified as an important development objective (UN-Habitat, 2017; United Nations, 2015; Government of Kenya 2008; 2018). The criteria identified under this objective include access to social services and infrastructure.

b) Economic objective

Inclusive and sustained economic growth with full and productive employment and decent work for all is a key element of sustainable urban development (UN-Habitat, 2017; Government of Kenya, 2008). Urban areas should be developed to deliver vibrant, sustainable and inclusive urban economies that foster an enabling environment for businesses and innovation, and livelihoods. Provision of affordable housing and housing finance is identified as a factor in economic development (Government of Kenya, 2008; 2018). It stimulates productivity in other economic sectors and enhances capital formation, income, employment generation, savings and inclusive economic transformation. Economic productivity can be increased by providing the labour force with access to income-earning opportunities,

knowledge, skills and educational facilities (Government of Kenya, 2013). The criteria identified under this objective include proximity to economic centres.

c) Environmental objective

Cities face environmental challenges that undermine efforts to end poverty and to achieve sustainable development. These challenges include droughts, floods, climate change and its related risks, pollution, loss of diversity as well as unsustainable consumption and production patterns (NUA/GoK 2008). The Affordable Housing Programme provides for site surveys and compliance checks to assess the suitability of sites for housing development and mitigate environmental risks by avoiding flood-prone and environmentally sensitive areas (Government of Kenya, 2018b). Urban areas, especially in developing countries, have characteristics that make them inordinately vulnerable to the adverse impacts of climate change and other environmental hazards. There is need to preserve and promote the ecological and social function of the land. To ensure sustainable development, it is important to strengthen the management of resources, including land, water, energy, materials, forests and food and minimize waste. It is imperative that cities plan for disaster risk reduction and management to reduce vulnerabilities and risk, especially in risk-prone areas of formal and informal settlements and enable communities to prepare for, respond to, adapt to and rapidly recover from the effects of natural and man-made hazards (UN-Habita, 2017). The criteria identified under this objective include the distance from flood-prone areas and environmentally sensitive areas.

The social, economic and environmental development objectives were used to develop criteria for the spatial analysis. The criteria selected for the analysis is presented in Table 4.1.

Table 4.1: Objectives, criteria and rationale for the analysis

Development objective	Criteria	Rationale	Reference
Economic	Access to jobs and commercial market centres: measured as proximity to industrial zones and commercial zones	The distance, time and costs associated with accessing worksites, jobs or zones of commerce and trade act as constraints to the participation of low-income household in livelihood streams and further put a strain to the household budget expenses. The closer the proximity of low-income housing to worksites the better the outcomes and wellbeing of households. In addition, approximately 45 per cent of road users are pedestrians and cyclists who cannot afford public transport	Vision 2030; SDGs; National Spatial Plan 2016; National Land use Policy 2017; Central Florida Regional Planning Council and University of Florida (2014); Siqueira-Gay, J., Gallardo, A.L.C.F., and Giannotti, M. (2018); Musakwa, W., Tshesane, R. M. and Kangethe, M. (2017)

Social	Proximity to primary schools and health facilities Proximity to public transport services Proximity to informal settlements	Access to basic services and public transport enhances the spatial equity for low-income households. Proximity to schools and hospitals can enhance school attendance and health-seeking behaviour thereby enhancing human capital development. Proximity to informal settlements that low-income households previously occupied could help maintain social capital and networks they rely upon. It also helps to mitigate the adverse disruptive effects of relocation and translocation.	Vision 2030; National Spatial Plan; NUA; Sierra L.A., Yepes, V. and Pellicer E. (2018;); Al-Hafith, O., Satish B.K., Bradbury S. and de Wilde P. (2018); Musakwa, W. Tshesane, R.M. and Kangethe, M. (2017)
Environmental	Distance from rivers, riparian areas, swamps, wetlands and water bodies	Informal settlements and areas occupied by low-income households are often locations that expose them to environmental hazards such as floods and water-borne diseases. To protect these households and conserve environmentally fragile areas, it is important to locate housing away from these sites.	Vision 2030; National Spatial Plan 2016; Siqueira-Gay, J., Gallardo, A.L.C. F. and Giannotti, M. (2018); Jeong, J.S. and Ramírez-Gómez, Á. (2018); Central Florida Regional Planning Council and University of Florida (2014); Musakwa, W., Tshesane, R.M. and Kangethe, M. (2017); Adero (2008)

Source: Author's compilation

4.1.2 Design: Suitability analysis, planning model and alternatives

The objective of the suitability analysis was to create a map of suitable locations for social housing development. Suitability analysis is a method used to connect spatially independent factors within the local or regional area and enables a unitary view of their interactions. The range of spatial independent factors could include biophysical factors, social factors and infrastructure (Al-Shalabi et al., 2006; Parry et al, 2018; Steiner and McSherry, 2000; Dujmović and Tré, 2011; Puntsag, 2014).

In order to select locations suitable for social housing, we define constraints and factors as:

(i) Constraints: conditions which are not good for social housing and areas excluded as sites for housing (housing cannot be put in place inside these locations).

(ii) Factors: conditions that contribute to the attractiveness of a location for social housing.

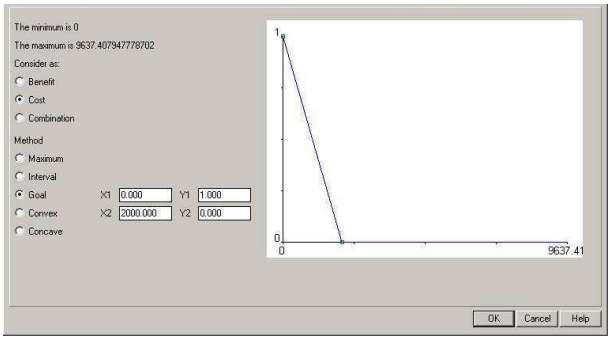
This follows approaches applied in Steiner and McSherry (2000) and Sharifi and Rodrigues (2002). The following location characteristics were selected to identify locations that would be adjudged suitable or not for social housing.

Table 4.2: Factors and constraints for suitability analysis

Location attribute	Suitability	Spatial (pixel) Scoring	Factor / Constraint
National park	Not Suitable	0	Constraint
Parks	Not Suitable	0	Constraint
Riparian reserves	Not Suitable	0	Constraint
Lakes and other water bodies	Not Suitable	0	Constraint
Forests	Not Suitable	0	Constraint
Swamps	Not Suitable	0	Constraint
Cemetery	Not Suitable	0	Constraint
Undeveloped areas	Suitable	1	Factor
Transport hubs	Proximity suitable	Proximity =benefit	Factor
Sports	Proximity suitable	Proximity =benefit	Factor
Recreation	Proximity suitable	Proximity =benefit	Factor
Airports	Proximity not suitable	Proximity =cost	Factor
Land use -High density	Suitable - for change of use	Proximity =benefit	Factor

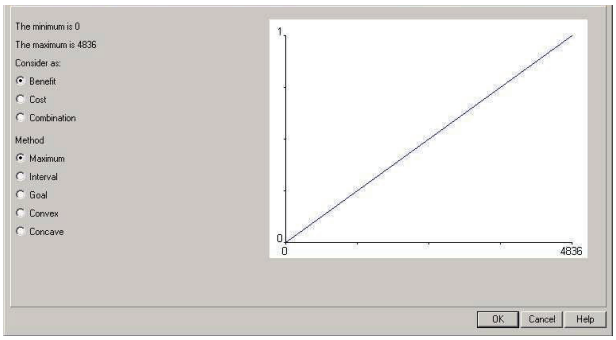
Each criteria map was standardized to convert class maps into maps with values that can be analyzed. Through standardization, criterion maps were classified as costs and benefit maps. A cost (Figure 4.1) is a criterion that contributes negatively to the output; the less you have (the lower the values) the better, while a benefit criterion (Figure 4.2) is a criterion that contributes positively to the output; the more you have (the higher the values), the better it is.

Figure 4.1: Example: Cost standardization using the Goal method



Source: Author's screen grab from flow map software

Figure 4.2: Example: Benefit standardization using the Maximum method



Source: Author's screen grab from flow map software

4.1.3 Choice: evaluation of alternative options and decision-making

The Analytical Hierarchy Process (AHP) was used to generate the weights for each evaluation criteria according to stakeholders' pairwise comparison ranking for the goals and criteria. The analysis used the AHP model as advanced by Goepel (2018). Pairwise comparison is a methodology designed to make decision-makers indicate how much more important, or how much more desirable, or how much better qualified a criterion is compared to a similar one (Dijkstra, 2010). In determining the relative importance of each pairwise comparison of criteria, Saaty's nine-point

ranking scale was applied using primary data.

A higher rank indicates the most suitable criterion for affordable housing and lower rank indicates the least suitable criterion. In specific: 1 for equal importance, 3 for moderate importance, 5 for strong, 7 for very strong and 9 for extreme importance, integers in between for refinements and reciprocals for inverse judgements (Dijkstra, 2010); the higher the score, the better performance of the option with respect to the considered criterion. Thereafter, each stakeholders' rankings were converted to numerical values and statistically combined to create a weight for each criterion representing the combined preference of all stakeholders. Literature provides alternative frameworks for ranking and generation weights such as Group Analytical Hierarchy Process - GAHP (Musakwa et al., 2017 and Adero, 2008); Analytic Network Process - ANP (Manupati et al., 2018); and the Fuzzy-Decision-Making Trial and Evaluation Laboratory/Multi-Criteria-spatial decision support system (Jeong and Ramirez-Gomez, 2018). However, the Goepel AHP model was chosen for ease of fit with available data for this study.

4.1.4 Spatial multi-criteria evaluation

The study uses Spatial Multi-Criteria Evaluation (SMCE) in identifying and evaluating locations for social housing. SMCE combines Geographic Information System (GIS), remoting sensing (RS) and Multicriteria Analysis. The SMCE approach allows for measuring how different alternative solutions to a problem achieve the objectives of a decision problem situation using weighted criteria. In SMCE decision problem, criteria and alternatives have a spatial dimension (Sharifi and Rodrigues, 2002). The analysis in SMCE involved combining the spatially referenced information for Nairobi with the views and decision-makers' preferences into discrete decision alternatives.

To run the SMCE, alternative locations for social housing were identified and delineated from the suitability map generated in the suitability analysis described in section 4.1.2. Locations with a high suitability score were selected. For each of the locations delineated, maps were created corresponding to the criteria identified in section 4.1.1

The criteria maps for each of the selected locations were standardized and normalized to give uniform values for analysis. Table 4.3 shows the standardization treatment for each criterion.

Table 4.3: Standardization treatment for selected criteria

Criteria	Standardization	Method
Access to jobs and markets	Cost	Goal
Distance to health services	Cost	Goal
Distance to primary schools	Cost	Goal
Proximity to informal settlements	Cost	Goal
Proximity to public transport services (matatu routes)	Cost	Goal
Access to electricity	Benefit	Maximum
Access to water and sanitation	Benefit	Maximum
Distance from environmentally sensitive areas (river, swamp, wetland and lake riparian areas)	Benefit	Maximum
Access to recreational areas	Cost	Goal
Distance to police station	Cost	Goal

Source: Author's compilation

This was followed by a ranking of each criterion as per the weights generated from the AHP analysis. Based on this, each location was evaluated against the multi-criteria and an overall score generated by computation of composite maps. The composite maps present the scores for each map as sum, mean and total values for all cells in the raster maps. An alternative related approach is the use of weighted overlay analysis. The Weighted Overlay Analysis (WOA) is a tool for solving complex spatial problems based on a common measurement of diverse and dissimilar inputs (Kuria et al., 2011). Overlay of the raster maps is generally conducted by converting their cell values to a common scale, assigning a weight to each criterion and then adding weighted cell values together (Zolekar and Bhagat, 2015). The cell values of each input raster are multiplied by the raster's weight (Zolekar and Bhagat, 2015).

4.2 Study Area

The area of focus for the study is Nairobi City County, which has a total area of 704 km^2 (KNBS, 2019) and is located between longitudes 36^{o}45' East and latitudes 1^{o}18' South and lies at an altitude of 1,798 meters above sea level. The physiographic nature of the county greatly varies, with the eastern side characterized by gentle slopes while the north is occupied by forest cover and steep-sided valleys. The County is divided into seventeen sub-counties. Nairobi is selected as the case study due to its identification as one of the counties where the AHP projects will be implemented. The city is among major cities in Eastern

Africa, with its population matching that of cities such as Addis Ababa, Dar es Salaam and Harare. As indicated by Nairobi City County Government (2018), the city has major industries and accounts for about 80%of the total industries in the country. The rate of population growth in Nairobi is significantly high compared to a 3.4 per cent average rate for cities in developing countries, and way above the global urban growth rate of 1.8 per cent (Omwenga, 2011). It also offers a diverse mix of spatial data available for the analysis. Over years, Nairobi County has experienced rapid urbanization and is projected to be inhabited by more than 6 million residents by 2030, up from an estimated 4 million in 2015 (World Bank, 2016). On land use type, residential areas take up the largest share of land use of about 25.22 per cent followed by industrial/ commercial/ service centres at 4.57 per cent.

4.3 Data

4.3.1 Spatial data

Spatial data covering the Nairobi Metropolitan region is applied in the analysis. The data includes shapefiles of physical infrastructure, social services, administrative boundaries, natural features, drainage features and public facilities, as listed in Table 4.4. The data was derived from secondary sources as compiled in the KIPPRA geo-database over time. Data for each variable in the criteria tree was obtained from secondary source databases for the City-County of Nairobi. The data was georeferenced for analysis. Data capture and processing was undertaken by applying Geographic Information Systems (GIS)[5].

Table 4.4: Spatial Data

Thematic area	Dimension	Attributes
Land	Land use	Residential, commercial, industrial, institutional, utility, other 2010
	Planning	Planned(zoned), unplanned (current)
Environment and Drainage	Features	Rivers, riparian areas, wetlands, water bodies (2015)
Transport	Access	Public transport (matatu routes and stops); airports (2015)
Education	Access	Primary schools (2014)
Health	Access	Public health facilities (2015)

5 https://qgis.org/en/site/

Employment/ jobs	Access	Potential work site (commercial and industrial zone) (2010)
Recreation	Access	Distance to open space or public park, sports facility (2015)
Security and safety	Access	Distance to nearest police station (2015)

Secondary data was also collected from literature to inform the housing location requirements of low-income households. Non-spatial data was applied for access to electricity, water and sanitation based on the Kenya Population and Housing Census (KNBS, 2019).

4.3.2 Primary data

Goals and criteria for suitable sites for affordable housing in Nairobi City County were identified with the help of stakeholders. A questionnaire comprising a pair-wise comparison matrix was developed and administered to experts and the relevant stakeholders in the housing sector to capture their individual preferences, opinions and priorities for social housing locations in 2019. The key informants were randomly selected.

5. Results and Discussion

5.1 Descriptive Data

5.1.1 Land use distribution and space allocation

The land use distribution in Nairobi is presented in Table 5.1. Open space takes up the biggest land area in Nairobi City at 56.75 per cent. This constitutes features such as public parks, forests and nature reserves. Residential land use occupies 16.84 per cent of the total land in Nairobi. This comprises a mix between high density, medium density and low-density residential users. In contrast, informal settlements take up to 1.24 per cent of total land use. Anecdotal evidence shows that informal settlements have a high population density, which is indicative of overcrowding with associated adverse health and environmental concerns. This paper takes into account the existing informal settlements in the multi-criteria analysis of the location of affordable housing programmes (see section 5.1). Nairobi covers a total of approximately 153,918 acres or 704 km² excluding the Nairobi National Park[6].

Table 5.1: Land use share of total space

Land use	Acreage	Share of total space
Open space	87,345	56.75
Residential	25,924	16.84
Unknown	10,921	7.10
Institutional	9,820	6.38
Industrial	5,564	3.61
Transportation	3,851	2.50
Water	2,989	1.94
Recreational	2,143	1.39
Informal settlement (Slum)	1,915	1.24
Commercial	1,466	0.95
Mixed residential and commercial	1,102	0.72
Mixed commercial and institutional	878	0.57
Sum	153,918	100

Source: Author's compilation

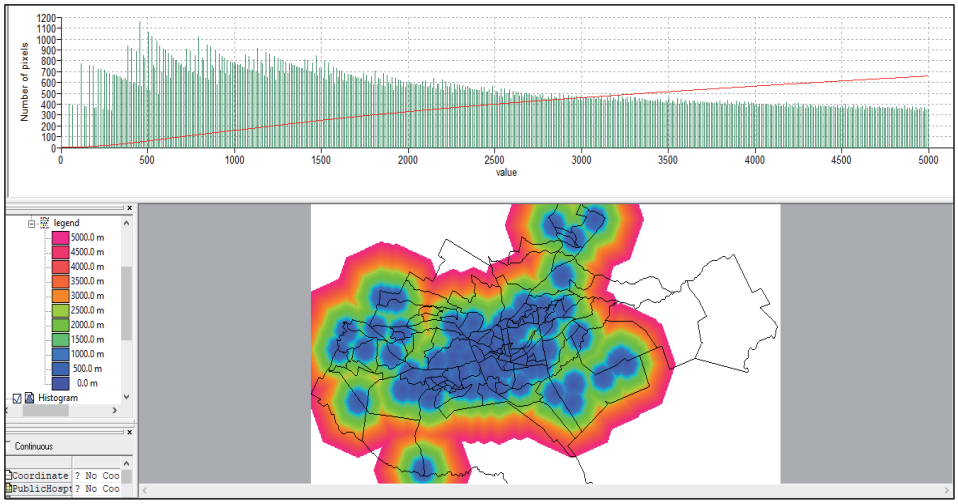
6 Using Geodata from the center for Sustainable Urban Development (CSUD)

5.1.2 Social analysis

Access to health

Spatial analysis of access to health using distance measures is presented in Figure 5.1. Using a 5 kilometres threshold[7], the map shows that there are regions to the east and north of Nairobi that are not well covered by health services. This translates to a walking time of approximately 60 minutes (1 hour) for the health-seeking population on foot. This could imply that residents in these areas lack adequate access to health services, signifying inequality. However, from the map histogram, the majority of the area in Nairobi are within 2.5 km of a health facility. The analysis is based on 169 health facilities in the geodatabase.

Figure 5.1: Distance to hospitals (5 km buffer threshold)



Source: Author's compilation

In Nairobi, health facilities and services are provided by the public sector and private and institutional (religious) sectors. Approximately 16 per cent of health facilities are public, while 20 per cent are faith-based and non-governmental, and 63 per cent are private. Given the projected population in 2019 of approximately 4.5 million and the recommended standard of one health centre for every 25,000, the city has an overall deficit of 50 public health facilities. According to the Nairobi Integrated Urban Development Plan (NIUPLAN) 2015, 47 per cent of health seekers prefer private health care services and only 8 per cent preferred major public facilities. This highlights a possible challenge in service provision in public facilities. NIUPLAN 2015 further revealed that the average number of beds per 1,000 people in Nairobi City was 0.74, compared to the Kenyan national average of 1.4.[8]

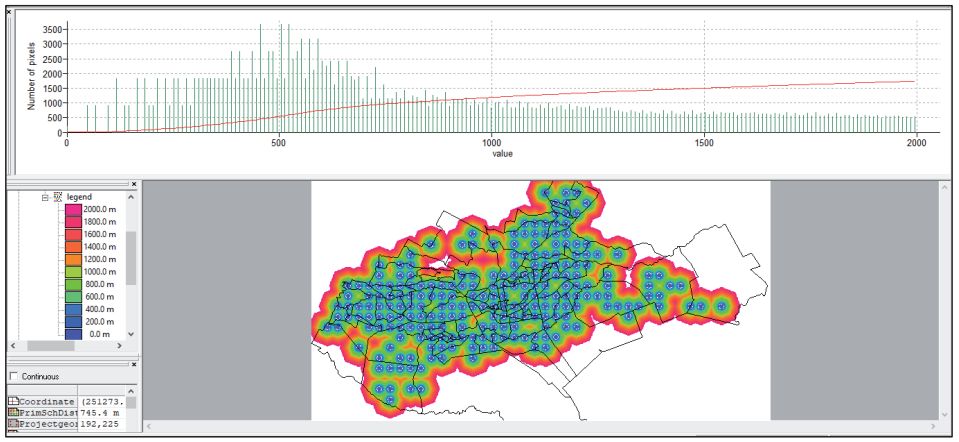
7 5 km distance to health facilities is considered a reasonable threshold for health seekers, according industry practice

8 The 2 km threshold is recommended by the Physical Planning Handbook in Kenya.

Access to schools

Analysis of access to primary schools was based on a threshold walking distance of 2 km. Figure 5.2 shows the spatial coverage of primary schools based on this standard. The histogram-based on pixels (y-axis) and distance (x-axis) shows that a high number of pixels (spatial area) is within 1km distance of primary schools. The map reveals that sections to the east and south of Nairobi are inadequately covered by primary schools.

Figure 5.2: Distance to primary schools map (2 km buffer)



Source: Author's compilation

There were approximately 237 public primary schools in Nairobi City against a population of 4.5 million in 2019. This implies a deficit of approximately 600 public primary schools, applying the physical planning standard of one school for every 5,000 people (Nairobi City County Government, 2015).

Proximity to informal settlements

The distance map of informal settlements is presented in Annex 1. The mean distance from informal settlements, applying a 5 km threshold is 2.09 km. Therefore, on average, existing informal settlements are within reach for the mapped area of Nairobi. This is important when viewed against the social objective of preserving social networks and social capital among the urban poor.

Proximity to public transport services (matatu routes)

Access to public transport services is an important factor in selecting locations for housing the urban poor. The distance map of proximity from public transport routes is depicted in Annex 2. On average, matatu routes can be reached within 1.2 km, with a median if 0.7 km applying a 5 km threshold.

Access to recreational areas

Applying a 5 km threshold, Annex 3 shows the distance map of recreational areas. The results indicate that, on average, recreational areas can be reached within 2.04 kilometres, with a median of 1.7 kilometres.

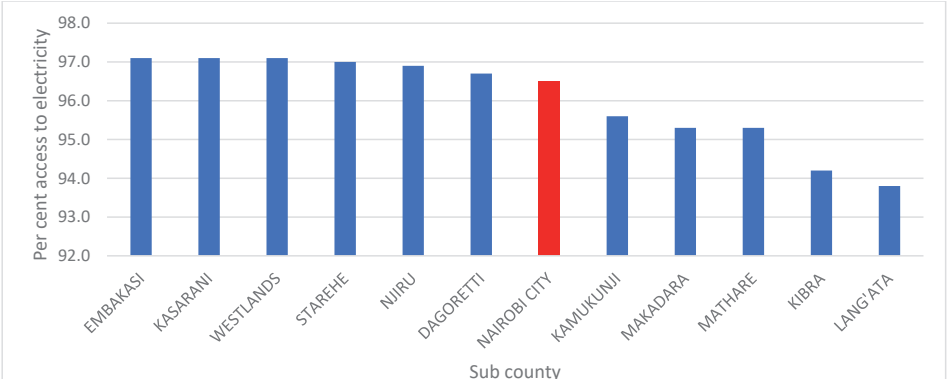
Distance to a police station

The distance map showing access to police stations is presented in Annex 4. The results indicate that police stations can be reached within a distance of 4.5 kilometres, on average, with a median distance of 4.2 kilometres.

Access to electricity

According to the Kenya Population and Housing Census, 2019, 96.5 per cent of residents in Nairobi County use electricity as their main source of lighting, Figure 5.3 (KNBS, 2019). Other forms of energy applied for lighting include lanterns, tin lamps and fuelwood. The sub-county analysis of electricity access shows Kamukunji, Makadara, Mathare, Kibra and Langata recording the lowest prevalence of electricity use, below the Nairobi City average as shown in Figure 5.3.

Figure 5.3: Per cent of households using electricity for lighting by sub-county



Source: KNBS (2019)

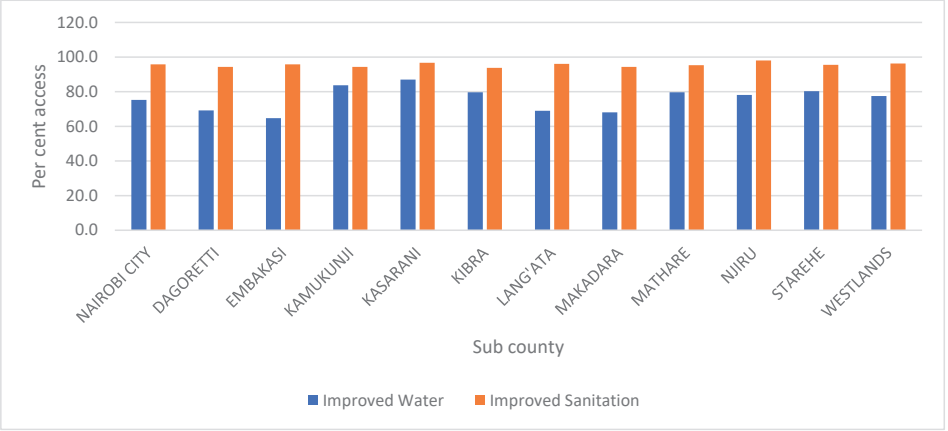
Access to water and sanitation

Data shows that 75.3 per cent of residents in Nairobi County used improved sources of water[9], with the rest relying on unimproved sources (KNBS, 2019. As shown in Figure 5.4, households in Kasarani sub-county recorded the highest level of

9 Improved sources of water comprise piped water, protected spring, protected well and borehole, while unimproved sources include pond, dam, lake, stream/river, unprotected spring, unprotected well, jabia, water vendors and others.

access to improved sources of water (87.0%), while those in Embakasi sub-county had the lowest access at 64.7 per cent. With regard to sanitation (management of human waste), households in Njiru sub-county recorded the highest prevalence in access to improved methods of sanitation[10] at 98.0 per cent, while Kibra sub-county has the lowest access at 93.8 per cent.

Figure 5.4: Access to improved water and sanitation by sub-county



Source: KNBS (2019)

5.1.3 Economic objective–access to jobs and employment opportunities

The economic objective was analysed based on proximity to jobs and economic opportunities, captured as areas within the City in close proximity to commercial and industrial land use classification. The proximity map in Annex 5 shows that there are more pixels (spatial area covered) within 2 km of jobs and economic opportunity zones. However, there is spatial differentiation in locational access to jobs, indicating spatial inequality. However, the coverage map does not take into account road network routes and transport modal choice or options of the residents. Spatial inequality in access to jobs is observed in Cira, Kamunyori and Babijes (2016). It is observed that while use of non-motorized modes of transport and use of Public Service Vehicles (PSVs) is the predominant modes of transport, private car users have better access to employment opportunities. Applying the recommended travel time threshold of 47 minutes, car users could access 58 per cent of employment opportunities. In 2013, the estimated total number of jobs in Nairobi City stood at 1,813,000 out of whom one million were formal jobs, according to an estimation based on the business registration data of the Nairobi

10 Improved sanitation comprises main sewer, septic tank, Very Important Person - VIP latrine, covered pit latrine, bio septic tank/bio digester.

City (Nairobi City County Government, 2015).

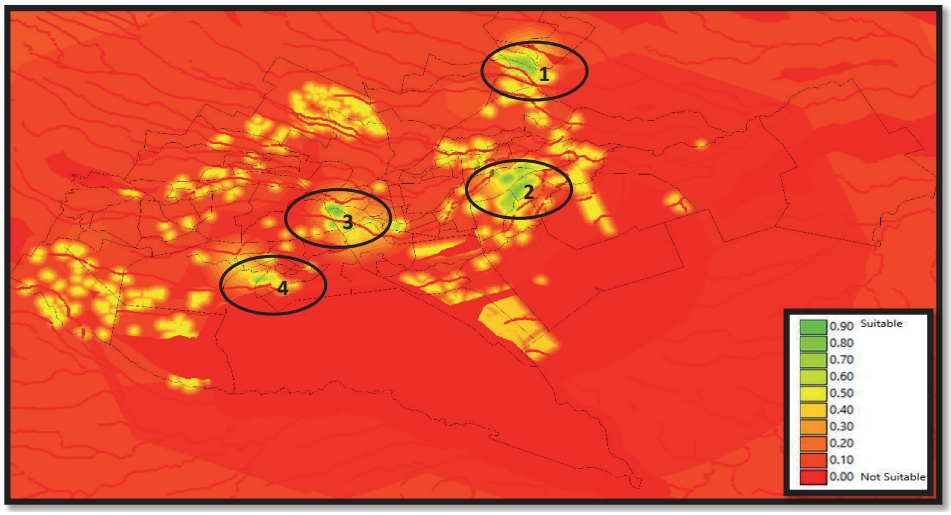
5.1.4 Environmental analysis

The spatial analysis in regard to environmental objective was performed by creating a 30-meter wide buffer zone along environmentally sensitive areas (rivers, lakes, swamps, wetlands, as shown in Annex 6. There is high pixel concentration in areas ranging 0-500 meters. According to Tibaijuki (2007), the urban population living in informal settlements is subjected to environmental risks due to lack of proper housing and public services. Rivers in Nairobi are also profoundly affected by improper dumping of domestic garbage from informal settlements since most of them lack waste collection services and adequate public amenities (Tibaijuki, 2007).

5.2 Suitability Analysis

The suitability analysis map is presented in Figure 5.5. The map identifies locations with high suitability scores between 0.7-1; moderate suitability 0.4-0.7; and low suitability 0.0-0.4. It should be noted for interpretation that areas with 0 score were excluded from the analysis. Such areas include, for example the national park, water bodies, and rivers.

Figure 5.5: Map of suitable areas for social housing in Nairobi



Source: Author's compilation

Analysis of the suitability map shows that Kasarani (Kahawa, Githurai, Umoja, Kariobangi South, Kayole, Njiru, Starehe. Kilimani (part) and Kibra (Mugumoini)

areas of Nairobi depict the highest suitability score between 0.70-0.90 (depicted in Figure 5.5 by circles labelled 1-4). It should be noted that the results show that the area covering the Central Business District (CBD) depicts high suitability but is unlikely to be practical for social housing development. The next category of areas depicts a suitability score of 0.5-0.7 and may be considered for social housing development upon detailed site analysis and topographical surveys. These areas are South C, Mukuru Kwa Njenga, Karura, Langata, parts of Hardy, Karen, Viwanda and Mihango.

Based on the suitability map generated and foregoing analysis, alternative potential locations for social housing were identified for Spatial Multi-Criteria Evaluation (SMCE). The rationale and approach for this are explained in the next section.

5.3 Analytic Hierarchy Process: Housing Location Priorities

A total of 10 respondents were involved in the pairwise comparison of housing location criteria. The participants were from mixed backgrounds, including County Government Planning officers; ordinary residents residing in low-income areas of Nairobi; and Urban Planners. Table 5.2 presents the results of the AHP pairwise comparison and overall ranking. With a consensus rate of 58.9 per cent, the results indicate that respondents place more emphasis on environmental factors in considering locations for housing, in particular, areas not exposed to floods. This criterion has a weight of 28.0 per cent. Access to water and sanitation and access to electricity follow in order of importance at 17.4 and 10.20 per cent, respectively. The least important criterion reported is the proximity to informal settlements with a weight of 2.60 per cent. For interpretation, this would indicate that the respondents do not place much weight on being relocated away from informal settlements, or that disruption from social networks may not be important.

Table 5.2: Criteria and weights for social housing location based on pairwise comparison

Criteria	Weights %			
	All respondents	Public	Planning experts	Ratio (public: experts)
Distance from environmental sensitive areas (flood-prone areas)	28.90	31.20	18.60	1.68
Access to water and sanitation	17.40	17.70	14.10	1.26
Access to electricity	10.20	11.10	8.60	1.29
Proximity to public transport services (routes)	9.70	10.50	9.30	1.13

Distance to police station	9.30	7.30	13.80	0.53
Distance to health services	7.10	6.90	7.90	0.87
Access to jobs and markets	7.00	7.30	6.90	1.06
Access to recreational areas	3.90	2.60	9.00	0.29
Distance to primary schools	3.90	3.20	7.10	0.45
Proximity to informal settlements	2.60	2.30	4.70	0.49

Source: Author's compilation

However, if we compare the decision-making outcome between urban planning experts and the public (residents), there is an observed difference in the weights. The experts place more emphasis on the distance to a police station (which is a proxy for security) than access to electricity when compared to the public. The same applies to access to health services, access to recreational areas, distance to primary schools and proximity to informal settlements. This confirms the need for a participatory approach in planning social housing projects to take into account the views of all, as discussed in (Musakwa et al., 2017).

5.4 Spatial Multi-Criteria Evaluation: Choice and Decision-Making

Composite SMCE index with weights

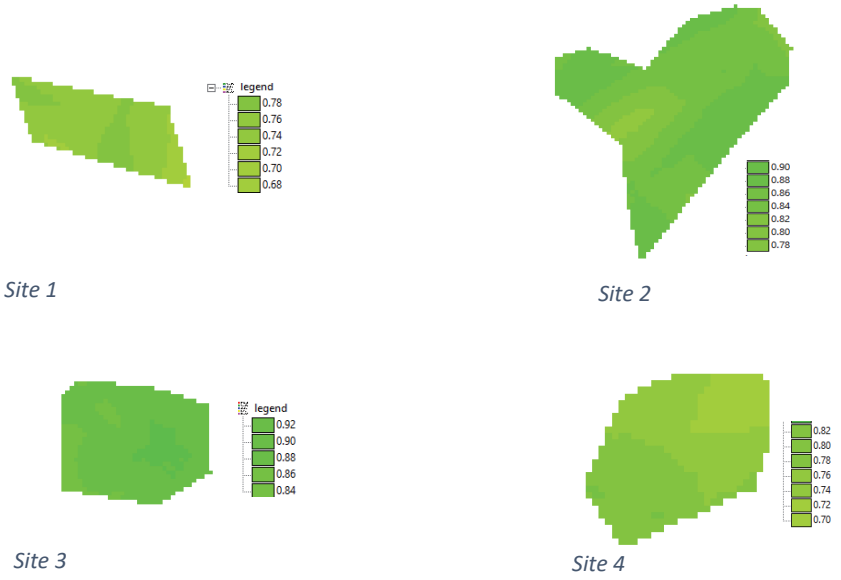
Results of the SMCE analysis using weights derived from the Analytic Hierarchy Process in section 4.3 are presented in Table 5.3 and Figure 5.6. The composite index shows that Site 3 in Starehe has the highest score of 0.914 when all dimensions are considered. For choice and decision-making on where to provide affordable housing, this site is ranked first. As depicted in Table 5.3, the ranking is followed by Kibra at second, Kasarani at third and Embakasi being the lowest-ranked.

Table 5.3: Composite SMCE index and ranking of sites

Site	Sub county	Average	Minimum	Max	Rank /choice
Site 1	Kasarani	0.811	0.730	0.860	3
Site 2	Embakasi	0.805	0.710	0.870	4
Site 3	Starehe	0.914	0.860	0.950	1
Site 4	Kibra	0.840	0.750	0.900	2

Source: Author's compilation

Figure 5.6: SMCE composite index maps



Source: Author's compilation

Disaggregated SMCE analysis

The results of the SMCE are presented in this section. Table 5.4 reports the disaggregated results showing how each site performs with respect to the three dimensions of economic, social and environmental and associated criteria.

Table 5.4: Average performance for each site in economic, social, environmental dimensions

Site	Sub-county	Economic	Social	Environmental
Site 1	Kasarani	0.823*	0.811	0.521
Site 2	Embakasi	0.787	0.805	0.502
Site 3	Starehe	0.834	0.914	0.227
Site 4	Kibra	0.495	0.840	0.179

**Values represent average standardized pixel value 0-1 for each dimension*

The results indicate that the environmental dimension, which represents the distance from flood-prone and environmentally sensitive areas, has the lowest performance across all sites, with values ranging from 0.521 to 0.179. Site 1 in Kasarani sub-county performs best in this dimension with a value of 0.521. On

the social dimension, which captures access to social and physical infrastructure, Site 3 in Starehe records the highest performance at 0.914 with Site 2 in Embakasi recording the lowest score at 0.805. This means that the site in Starehe is in closer proximity to schools, hospitals, recreational areas and better served with water and electricity in aggregate as shown in Table 5.5.

Table 5.5: Disaggregated indicators of the composite scores

Indicator	Site 1-Kasarani	Site 2 - Embakasi	Site 3-Starehe	Site 4-Kibra
Distance to health services (metres)*	764	990	403	537
Distance to primary schools (metres)*	433	494	465	428
Access to recreational areas (metres)*	4,044	916	343	1,334
Distance to police station (metres)*	4,171	2,252	579	1,562
Proximity to public transport services (routes) (metres)*	277	194	105	411
Proximity to informal settlements (metres)*	431	627	2381	339
Access to electricity -proportion of population (%)	97.1	97.1	97	94.2
Access to water - proportion of population (%)	87	64.7	80.3	79.7
Access to sanitation (metres)- proportion of population (%)	96.7	95.8	95.5	93.8
Access to jobs and markets (metres)*	178	214	166	508
Distance from environmental sensitive areas /flood prone areas (metres)**	715	689	310	244

Source: Author's compilation
** The smaller the distance the better*
*** The bigger the distance the better*

On the economic dimension, which measures access to economic opportunities, Site 4 in Kibra records a disproportionately low score of 0.495 compared to the other three sites. This could reflect that the site in Kibra is far removed from zones of employment and economic opportunity, which in this case are captured as commercial and industrial land use zones. Site 3 in Starehe performs best in this dimension with a mean score of 0.834.

6. Conclusion and Policy Recommendations

6.1 Conclusion

The study sought to examine the housing location needs for low-income households in urban areas, while identifying and evaluating suitable locations for social housing that enhance sustainable development and equity. Using spatial analysis methods, the study first identified suitable locations (sites) for affordable housing provision. The identified sites were then evaluated for prioritization and decision-making using the spatial multi-criteria evaluation method. The criteria for the analysis were identified from the literature and prioritized using a participatory approach; that is, the Analytic Hierarchy Process (AHP).

Aided by literature, the study established location needs for social housing based on economic, social and environmental criteria. Through suitability analysis of physiographic and man-made factors, four sites in the study area were identified as most suitable for social housing development. The prioritization of criteria and the consequent determination of weights for relative importance (each criterion using the participatory approach) showed differences based on the background of stakeholders. For instance, what the local citizens defined as a priority was not given the same weight by professionals or public officials. This highlighted the nature of the 'decision problem' in planning and provision of social housing and the need for bottom-up approaches.

There is observed spatial inequality with regard to access /coverage of physical and social infrastructure. Locations have been identified that are less equity-enhancing and would further adversely affect the lives and well-being of targeted beneficiaries, barring any affirmative infrastructure interventions. The environmental criteria performed the lowest for all selected sites, with variation in performance of the social and economic criteria across the different sites. This site-by-site analysis across the different criteria is useful for targeting interventions and investments during implementation of the Affordable Housing Programme. In terms of decision making on which site to prioritize for investment in social housing, the study provides a composite index with a rank order for choice.

6.2 Policy Recommendations

6.2.1 General recommendations

- Sustainability principles of urban development, which cater for economic, social and environmental objectives of development, need to be incorporated in the planning and provision of affordable housing. This is imperative for the realization of project goals and overall impact on the well-being of the

targeted beneficiaries.

- Investment in physical and social infrastructure is required to address the spatial inequality of locations for affordable housing. This should take into account the performance of each location against the chosen criteria.
- Deeper stakeholder analysis and participation in the Analytic Hierarchy Process (AHP) is required. Identification and prioritization of the criteria should involve the targeted beneficiaries. For inclusivity and to enhance acceptability, there is need to capture the diverse priorities of the targeted population and establish consensus. This can be expanded to include opinions on housing architecture and design, beyond housing location.
- Further research is recommended to analyze budget allocation and expenditure on housing and infrastructure at the sub-county or ward level. The analysis would examine if the criteria applied for budget allocation matches the deprivation in housing and infrastructure unique to each sub-county unit.

Table 6.1: Summary of detailed recommendations

Key recommendation	Actor /agency	Rationale
Site selection and prioritization for social housing should incorporate sustainability assessment applying the SMCE framework for Kenya	SDHUD-IPDU, PDU, County Governments,	SDGs, National Principles and values - equity and fair treatment
Investment in physical and social infrastructure should focus on the deprived areas in budget allocation (by sub-county/ward)-hot spots	SDHUD-IPDU, County Assembly Committees on Housing and Infrastructure	Leave no one behind. Spatial heterogeneity of needs; scarcity of resources; PFM principles on resource efficiency
Analytic Hierarchy Proces - should be used in public participation, with a focus on the target population	County Executives, and County Assemblies	Consumer Satisfaction; acceptance; Principle of Subsidiarity; people-centred development framework
Further research is recommended to analyze the budget allocation and expenditure on housing and infrastructure at the sub-county or ward level.	County Executives, and County Assemblies	PFM principle on resource efficiency

6.2.2 Specific area-based recommendations and strategies

Table 6.2: Summary of area-based recommendations

Site 1: Kasarani			
Indicator	**Baseline-Average**	**Target**	**Strategy**
Access to recreational areas (meters)*	4044	500	Provide planned space for recreation through allocation of public land, partnership with the private sector or acquisition.
Distance to a police station (metres)*	4171	1500	Introduce police posts to cover the threshold population to achieve a target response time of 10 minutes and enhance the efficiency of police patrol coverage from dispatch or command base/ post
Access to electricity - the proportion of the population (%)	97.1	100	Enhance household connectivity to the grid through the last mile connectivity
Access to water-the proportion of the population (%)	87	100	Provide piped water to households where possible and provide community standpipes through boreholes with pumps where home connectivity is not practical
Access to sanitation (metres)- the proportion of the population (%)	96.7	100	Expand the trunk sewer system to connect households and avail modern VIP latrines where the sewer system is not practical

** The smaller the distance the better*

*** The bigger the distance the better*

Site 2: Embakasi			
Indicator	**Baseline**	**Target**	**Strategy**
Access to recreational areas (metres)*	916	500	Provide planned space for recreation through allocation of public land, partnership with the private sector or acquisition
Distance to a police station (metres)*	2252	1500	Introduce police posts to cover the threshold population to achieve a target response time of 10 minutes and enhance the efficiency of police patrol coverage from dispatch or command base/ post
Access to electricity - the proportion of the population (%)	97.1	100	Enhance household connectivity to the grid through the last mile connectivity
Access to water - the proportion of the population (%)	64.7	100	Provide piped water to households where possible and provide community standpipes through boreholes with pumps where home connectivity is not practical
Access to sanitation (meters)- the proportion of the population (%)	95.8	100	Expand the trunk sewer system to connect households and avail modern VIP latrines where the sewer system is not practical

** The smaller the distance the better*

*** The bigger the distance the better*

Site 3: Starehe			
Indicator	**Site 3-Starehe**	**Target**	**Strategy**
Access to electricity - the proportion of the population (%)	97	100	Introduce police posts to cover the threshold population to achieve a target response time of 10 minutes and enhance the efficiency of police patrol coverage from dispatch or command base/ post
Access to water - the proportion of the population (%)	80.3	100	Enhance household connectivity to the grid through the last mile connectivity
Access to sanitation (meters)- the proportion of the population (%)	95.5	100	Provide piped water to households where possible and provide community standpipes through boreholes with pumps where home connectivity is not practical

Distance from environmentally sensitive areas /flood-prone areas (meters)**	310	500	Relocate and resettle households within proximity of flood-prone areas and riparian zones. Prepare physical and land use plans for settlements within 500 meters of environmentally sensitive and flood-prone areas, for environmental protection and disaster risk reduction and management

Site 4: Kibra			
Indicator	**Baseline**	**Target**	**Strategy**
Access to recreational areas (metres)*	1,334	500	Provide planned space for recreation through allocation of public land, partnership with the private sector or acquisition
Access to electricity - the proportion of the population (%)	94.2	100	Introduce police posts to cover the threshold population to achieve a target response time of 10 minutes and enhance the efficiency of police patrol coverage from dispatch or command base/post
Access to water - the proportion of the population (%)	79.7	100	Enhance household connectivity to the grid through the last mile connectivity
Access to sanitation (metres) - the proportion of the population (%)	93.8	100	Provide piped water to households where possible and provide community standpipes through boreholes with pumps where home connectivity is not practical
Distance from environmentally sensitive areas /flood-prone areas (meters)**	244	500	Relocate and resettle households within proximity of flood-prone areas and riparian zones. Prepare physical and land use plans for settlements within 500 meters of environmentally sensitive and flood-prone areas, for environmental protection and disaster risk reduction and management

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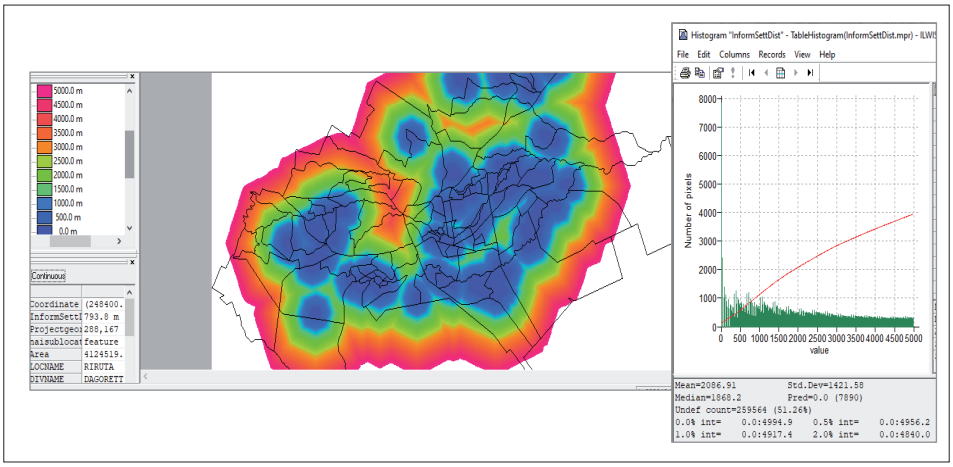
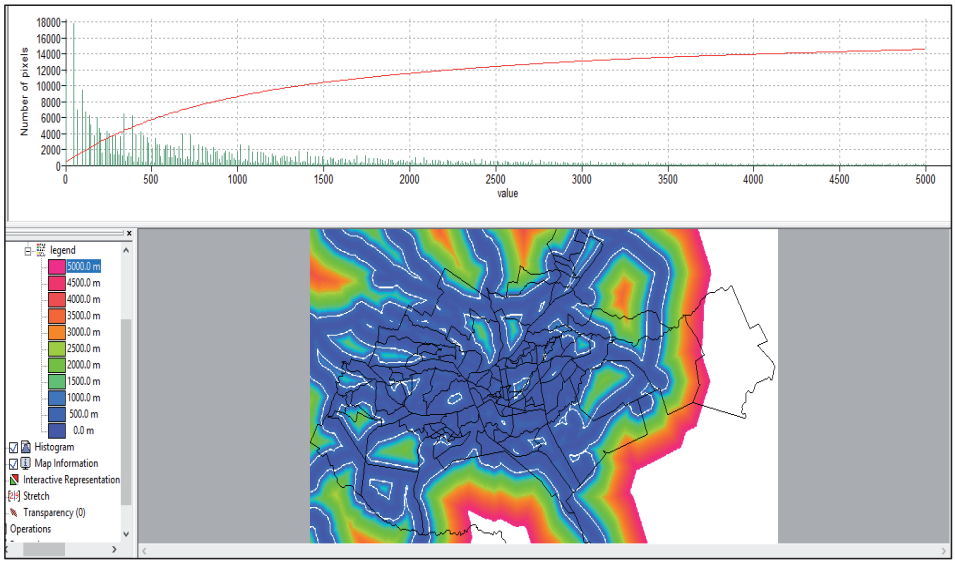
Appendix

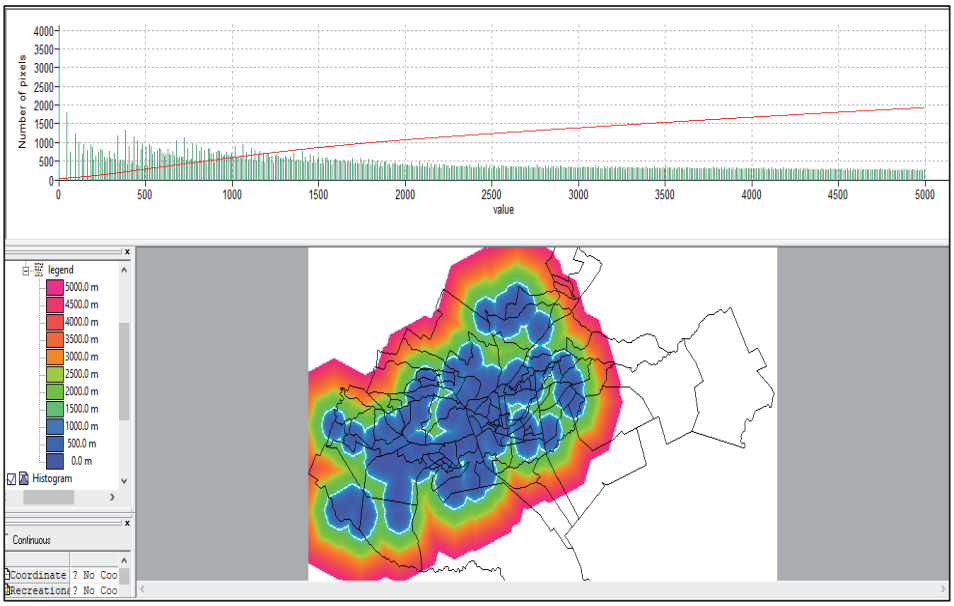
Appendix 1: Proximity to informal settlements



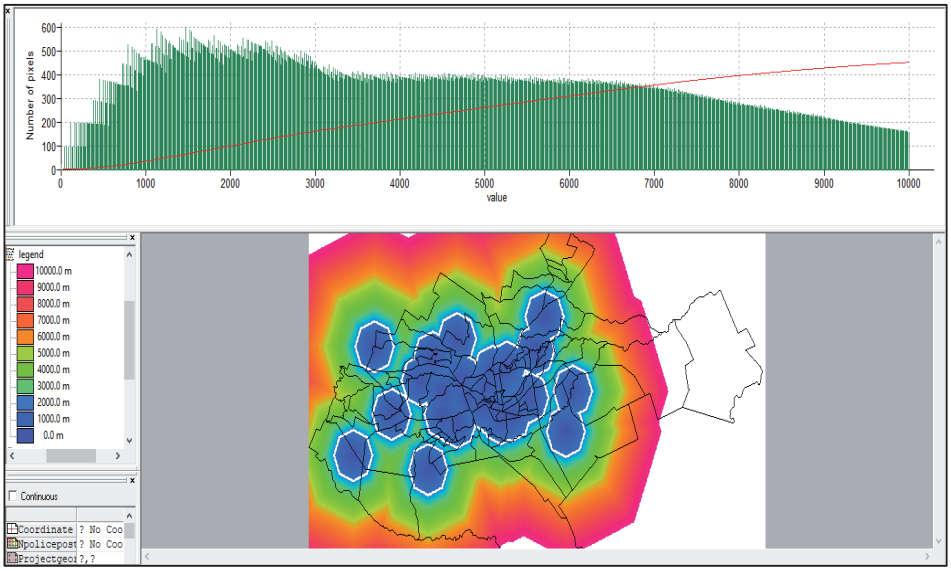
Appendix 2: Proximity to public transport



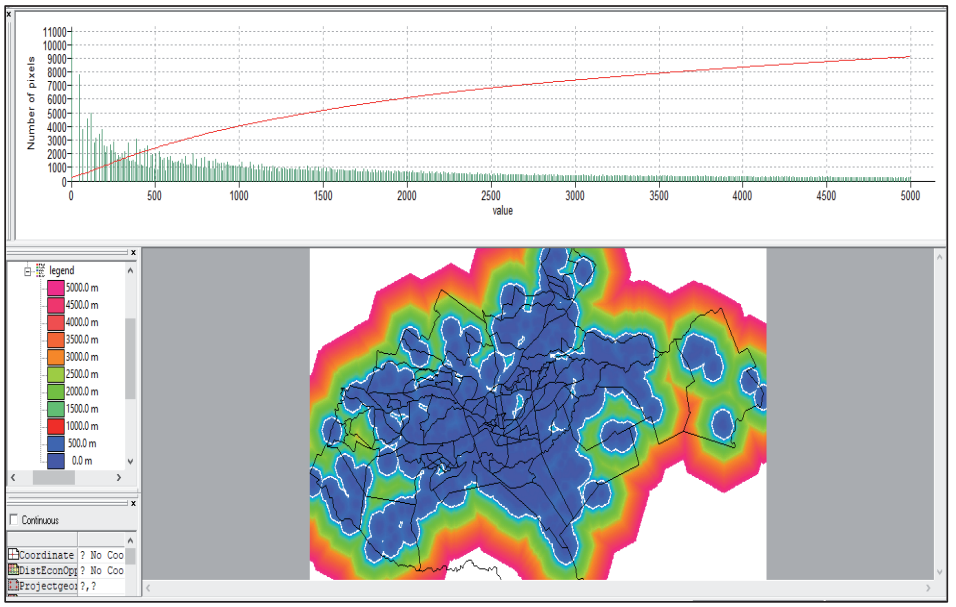
Appendix 3: Access to recreational areas



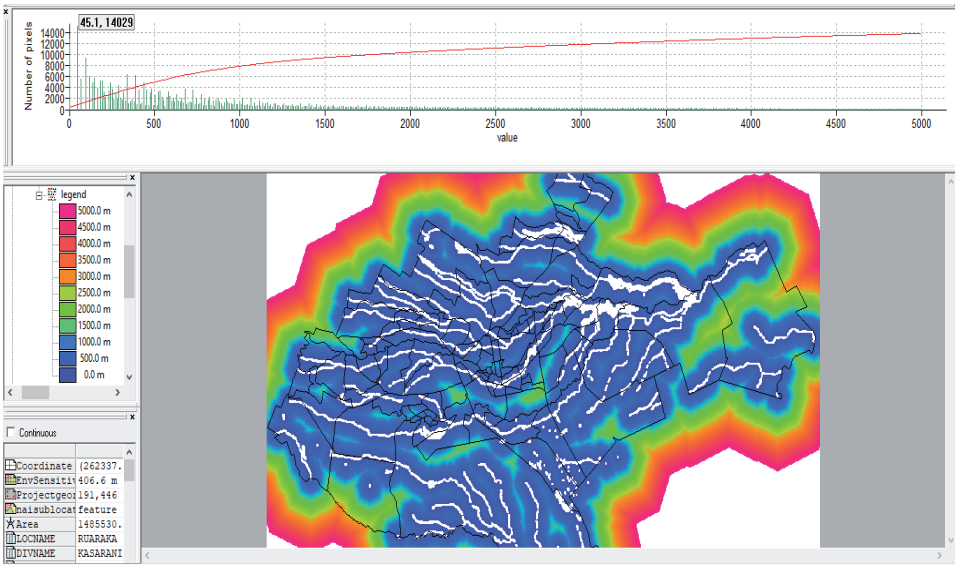
Appendix 4: Proximity to police stations



Appendix 5: Proximity to jobs and economic opportunities



Appendix 6: Distance from environmentally sensitive areas



ISBN 978 9966 817 59 4

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