Original Article

An Assessment of the Socio-economic Effect of Urban Sprawl on Household's Livelihood in Siaya Town, Kenya

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ABSTRACT

Urban sprawl is a worldwide phenomenon that is experienced in both developed and developing countries. Increasing demand for land in towns due to urban development globally has compelled cities to expand into their rural fringes to cater for space for urban development, and has consequences on inhabitants and the immediate physical environment that is associated with social and economic challenges. Population growth and economic considerations, environmental priorities, technical advancement and strategies have been the core causes of urban sprawl. To solve these problems, plans and strategies need to be put in place to overcome urban sprawl uncertainties. The objective of the study was to examine the socio-economic effects of urban sprawl on households' livelihood in Siaya town. The study employed a mixed-method design. The sample size used consisted of 371 household heads from the target population of 11,192 using the Krejcie and Morgan formula and table (1970). The data sources were questionnaires, key informants, focus group discussions, observation and photography. Data was analysed using the Statistical Package for Social Sciences (SPSS) version 22. The frequencies and percentages were used to present data using tables, pie charts, bar graphs and photographs. The factor analysis revealed a strong correlation between independent and dependent variables above 0.984 or 90% on average. KMO and Bartlett's tests were significant at 0.884. In conclusion, the study revealed the finding that urban sprawl is attributed to diminishing household livelihoods in low-income households, influencing the socioeconomic status of the households. The study recommended copying strategies such as Smart growth, intensification of agriculture and diversification of the economy. The findings may be used by developers and planners at both county and national governments to curb the negative effects of urban sprawl.

INTRODUCTION

Urban sprawl is the spreading out of urban areas and their suburbs over more and more rural land to the periphery of urban areas Haregewoin, 2007). In reality, it is a complex phenomenon that means different things in different areas and conditions Galster & Ratcliff, 2007). Haregewoin (2007) asserted that urban sprawl consumes excessive land in an uncontrolled, disorderly manner, leading to poor distribution and loss of space, which should be used for transportation and lead to social segregation. The process of urban sprawl is a worldwide phenomenon. It started with the earliest human civilisation of the Babylonians, Cemea (2013). The phenomenon is now a rising trend experienced all over the world, especially at an alarming rate in developing countries (Cemea, 2013). Sprawling development as a phenomenon is a serious concern worldwide for many environmental and socio-economic reasons (International Year of Soils (IYS), 2015). Sprawl in developed countries like the USA is a result of higher income, which in turn results in people preferring to live in the suburbs of the city, with open spaces at reasonable distances from cities (Haregewoin, 2007). In contrast, in developing countries like Malaysia, urban sprawl is largely a result of necessity. People move to the city in search of better employment and opportunities (Menon, 2018). The author further asserted that this trend leads to an increase in size well beyond the limits of the city.

Until recently, the problem of urban sprawl was a concern of the developed world, but it also exists in developing countries, although many authors posit that, theoretically, urban sprawl is a cause of externality, such as high automobile dependence, isolation of the poor, traffic congestion, environmental contamination, income and racial segregation of neighbourhood, job-house, miss-match, conversion of farmland and civil alienation (Downs, 2010; Sierra club, 2019; Orefield, 2005; US General Office, 2022; Poponoe, 2004). According to the UN (2018), urbanisation of Asia and the Pacific region will continue, and the majority of the region's population will live in urban areas by the year 2025. Certainly, this is an indicator to all other nations that urban sprawl will continue to be a world problem. This is also relevant to the current study, and there is a need for the stakeholders and the county government of Siaya town to be alert and prepare early, putting the necessary measures in place to address this phenomenon.

Furthermore, in the Pacific sub-region, over 70% of the population already lives in urban areas, while in East and Southeast Asia, the urban population is expected to reach the 50% level before the year 2025 (UN, 2018; McGee, 2015).

Urbanisation brings economic development with substantial improvement in the provision of social services to various communities and households in many countries like the USA and China (McGee, 2015). According to (Eigenbrod, 2014), it is apparent in many other parts of the world like Europe, especially Sweden, in which a significant amount of land has already been consumed by urban sprawl as a result of a large number of built-up areas, a high land uptake per person and high dispersion of built area. The author further asserted that increasing urban sprawl in Europe was causing land use conflict and was posing a major threat to the maintenance of livelihood for the people living on the farmland. Similar incidences were observed by the researcher in Siaya town during data collection and analysis; hence, they are quite relevant. The author concluded that mitigation of the challenges included mass transportation systems, density settlement, and efficient use of land or a smart growth model.

There is a need for Siaya town residents to adopt possible mitigation measures to curb the effects of urban sprawl that negatively impact their household livelihoods. Apart from the urban expansion or physical increase of the built environment, urbanisation also brings ecological and socio-economic effects, conversion of farmland and vegetation land cover into the urban built-up area. Consequently, it reduces the amount of land available for food and crop production. Raddad (2019) and WU (2008) put it that urban sprawl has decreased cropland, pasture land and range land in the United States (USA) from 76 million acres – 48 million acres, while the total developed land has increased from 36 million acres to 48 million acres.

In developing countries like Malaysia, urban sprawl resulting from the industrialisation policy adopted since 1970 has attracted a large group of young people to move to urban areas with the hope of a greener pasture (Ghazali, 2018). The massive migration to urban areas put high pressure on the existing social services and became a challenge for states to meet the demand for the continuing growing urban population (McGee, 2015; Ghazali, 2018).

The demand for housing and related services from the growing population has pushed built areas towards the peri-urban area and encroached into the hinterland (Mcgee, 2015; Von Fintel, 2010). They further affirmed that the movement has resulted in a lack of land for agricultural activities and space for recreation and infrastructure. In most African countries, urban sprawl affects agricultural productivity and land use in suburban locations (Simon, 2013).

He further posits that, generally, several patterns of urban sprawl have been used directly or indirectly to explain the urban sprawl. Most of the cities in Africa (Yeboah, 2014) identified the current development in Accra, the capital city of Ghana, as a quality residential sprawl with a unicentric urban form. Such a tendency is not different from what is happening in most Kenyan cities, including Siaya town.

In Kenya, population growth due to rural-urban migration was the most significant cause of urban sprawl (Omwenga 2018 & Simiyu 2012). They further asserted that there have been increasing densities in both low-rise and high-rise informal settlements, as was the case in Kibera, where densities were as high as over 2000 people per hectare. The second major cause of urban sprawl was land tenure systems, which made land acquisition in urban areas easier, coupled with policy deficiencies (Nicodemus and Ness, 2010; Steyn, 2012; Binswanger et al., 2016). According to Mubea & Menz (2012), Nakuru town had about 60% of its population living in dense and congested informal settlements. Ngayu (2011) also affirmed that the urban population of Kenya is estimated to

be 38 million by 2030 and will account for about 60% of the national population. Based on the information and findings highlighted, it can be deduced that urban sprawl affects most households' livelihoods in most urban and suburban locations in Kenya. Hence, it affects socio-economic household livelihoods, including Siaya town.

LITERATURE REVIEW

Social Effects and Urban Sprawl

Urban sprawl can be defined in various ways from different perspectives and by scholars. (Galster et al., 2001), Defined urban sprawl as a pattern of land use in an urbanised area that exhibits low levels of some combination of eight distinct dimensions: density, continuity, concentration, compactness, centrality, nuclearity, diversity and proximity. According to (Dutton, 2000), urban sprawl is a low-density, disordered and functional land expansion made along some major traffic roads to the suburb while (Soule, 2006) defines urban sprawl as a type of low-density land development, which is dependent on car traffic and occurs at the edge of urban centres. Furthermore, Jaeger & Shwick (2014) explain that urban sprawl is a type of urban construction and expansion, which builds beyond the existing built-up areas of cities and has a dispersed spatial configuration and low utilisation intensity in the built-up area. However, in the discussion through this study, urban sprawl refers to the spreading out of the city and its suburbs over more and more rural land at the periphery of the urban area.

The characteristics of urban sprawl in different countries and regions have both commonness and individuality (Catala et al., 2008). These prominent common characteristics include single-use development (Ewing, 2018, fragmentation Liu & Mengi, 2020, shape irregularity Keita, 2021, low concentration Tsai, 2005 and linear development Guite, 2019). Apart from these, Ewing (1997) studied the characteristics of urban sprawl in the USA and stated that leap-frog land use patterns, strip commercial development along highways and extremely low-density single-use development are the three characteristics of urban sprawl. (Zhang & Lou, 2014) compares the characteristics of urban sprawl in China and the USA. They conclude that the population leading to urban sprawl in the USA comes from the population migration within the city. Whereas that of China comes from the population outside the original city, moreover, urban sprawl in the USA and China started at high and low levels of urbanisation, respectively. Furthermore, (Wang et al., 2006) propose that China's urban sprawl originated in low-density urbanization, unlike in the USA and European countries, based on excessive sub-urbanization and intervention from local governments.

Economic Effects and Urban Sprawl

Economic effects typically refer to direct and immediate consequences or results of a specific action, policy or event. These are often qualitative and are usually more focused on specific, measurable changes (Imadi & Athukorala, 2022). Urban sprawl is related to economic development and fast urban expansion (Wang et al., 2019, Weilenmann, Seldl, and Schulz, 2017, and Yue et al., 2019). Unlike the sprawl of Western cities, primarily driven by lifestyle, changes (Mills, 2003). China's sprawl is significantly influenced by the national government. Studies have shown that China's dramatic urban sprawl is driven on one hand by market and economic development, as in the United States and other by China's land, finances and land-centred urbanization strategy (Lui et al., 2018, Tian, 2015, and Wang et al., 2019).

In the context of an imperfect land market and decentralisation process, local governments tend to oversupply land in pursuit of economic efficiency, leading to urban sprawl problems (Zhang, 2000). Different degrees of urban sprawl can have varying effects on economic development. Moderate urban sprawl can improve labour productivity and promote investment and consumption growth, positively influencing economic development

(Huang & Wei, 2015). By contrast, excessive urban sprawl can harm economic development. First, excessive urban sprawl is likely to cause high economic costs and generally weaken the energy level of the urban economy, thereby leading to a reduction in urban economic development rates (Vermeiren, 2021), owing to the expansion of urban boundaries, to suburbs, resulting in a mismatch between employment and living space (Nilles, 1991). This urbanised distribution of population and jobs might cause lagging effects in allocating labour supply and demand in different regions of cities and high costs of commuting (Smith & Blizard, 2021).
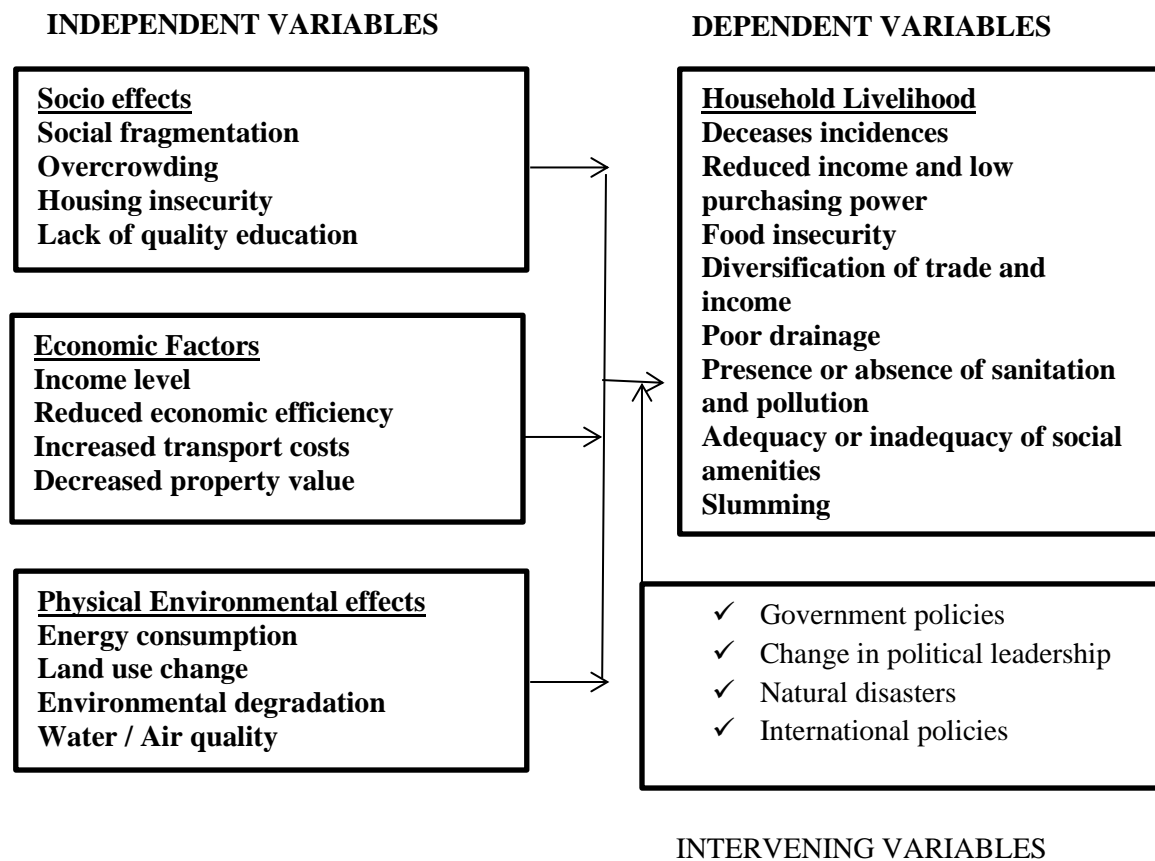
CONCEPTUAL FRAMEWORK

Independent variables for this study included: socioeconomic effects and environmental effects, whereas dependent variables were: disease incidences, presence or absence of slums, presence or absence of sanitation and adequacy or inadequacy of social amenities. The presence or absence of pollution, the presence or absence of drainage and intervening or extraneous variables included: Government policies, changes in political leadership and natural disasters. The conceptual framework has been presented in the diagram below:

Independent variables for this study include socioeconomic, physical environmental effects and coping strategies. While the dependent variables were household livelihood effects such as incidences of diseases, reduced income, and purchasing power, food insecurity, diversification and trade and income, poor drainage, presence or absence of sanitation and pollution, adequate or inadequate social amenities and slumming.

Figure 2: Conceptual Framework

INDEPENDENT VARIABLES   DEPENDENT VARIABLES

Socio effects
Social fragmentation
Overcrowding
Housing insecurity
Lack of quality education

Economic Factors
Income level
Reduced economic efficiency
Increased transport costs
Decreased property value

Physical Environmental effects
Energy consumption
Land use change
Environmental degradation
Water / Air quality

Household Livelihood
Deceases incidences
Reduced income and low purchasing power
Food insecurity
Diversification of trade and income
Poor drainage
Presence or absence of sanitation and pollution
Adequacy or inadequacy of social amenities
Slumming

✓ Government policies
✓ Change in political leadership
✓ Natural disasters
✓ International policies

INTERVENING VARIABLES

RESEARCH METHODOLOGY

The study used a mixed-methods research design. The design was preferred because it uses both qualitative and quantitative methods that provide a better understanding. The target population was 11,192 households drawn from Siaya town with a population of 40,201 people (KNBS, 2019). The sample size used consisted of 371 household heads from the target population using Krejcie and Morgan's formula (1970) and table.

The study adopted stratified random sampling, purposive and snowball sampling techniques to select estates and respondents. The tools for data collection were questionnaires, interview guides/schedules, focus group discussions and observation checklists. Data sources included questionnaires for quantitative data and qualitative data were generated using oral interviews with key informants and focus group discussions.

Both methods were used for corroboration and triangulation purposes. The validity of the instruments was checked and ratified by the supervisors from Jaramogi Oginga Odinga University of Science and Technology (JOOUST), while the reliability of the instruments was established by piloting of 10%. Qualitative data was analysed using descriptive and inferential statistics and presented in the form of percentages and frequencies. The data were analysed using SPSS version 22.

Study Area

The study area was Siaya town (Figure 2) in Siaya County. Siaya town was formerly the district headquarters in 1970 and is currently the county headquarters within the devolved government structure (SCSP, 2018-2028). The town has an area of 45.3 Km^2 with an urban population of 40,201 (KNBS, 2019). The town is bordered by Busia town to the North, Kakamega and Vihiga town to the northeast, Kisumu town to the East and Bondo town to the southwest (refer to Figure 3).

It lies between longitude 0° to 18° North and Latitude 33° 58' East and 34° 33' West. Siaya town is the governance hub of the county, as it hosts the Governor's office, County cabinet officials and County Directors' departmental offices. The town also hosts the County Assembly arm of the county government. It has financial institutions, hotels, educational institutions, public institutions, and hosts NGOs' offices. It has tarmac roads, electricity, and water reticulation systems within the CBD and peri-urban areas (SCSP, 2018-2028). Agriculture alone provides approximately 61% of all employment opportunities in Siaya County (SCSP, 2018-2028). Most rural dwellers are self-employed and engage in small-scale business.

In Siaya town, the migrant population is greater than the indigenous landowning families, and this has affected land access for farming activities in the area (SCSP, 2018-2028). Various forms of agricultural activities serve as a source of livelihood for about 55% of the economically active population in Siaya town directly or indirectly through farming, livestock development, fisheries, distribution of farm produce, and provision of services to the sector (SCP, 2018-2028). Therefore, the site was suitable for the proposed study to enable an understanding of the effects of urban sprawl on the household livelihoods of Siaya town. Further, following the information learnt from related literature reviews from different sources, including books, journals and the internet, on information concerning urban sprawl, the researcher developed an interest in studying a town within his reach for convenience and cost-effectiveness, hence, the choice for the study area.

Figure 1: A Map Displaying the Location and Sketch of the Study Area
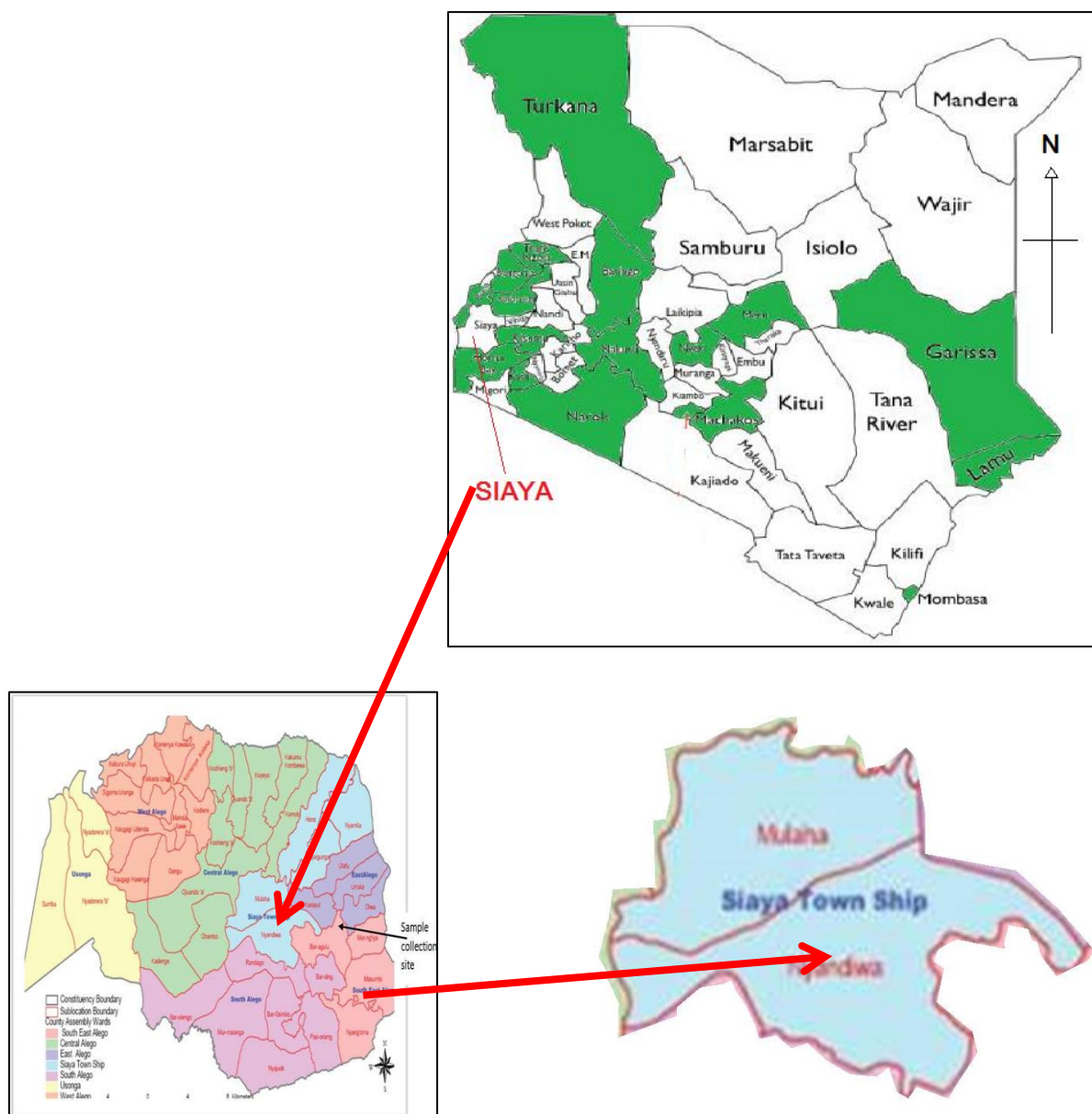
Source: *adapted and modified from KNBS (2009)*

The total number of 11,192 households was drawn from Siaya, a town with a population of 40,201 people (KNBS, 2019). The study targeted households from five estates within the town, which include Pandi, Awelo, Karapul, South Estate and Banana. The states were selected using stratified sampling.

The study sample size used consisted of 371 household heads drawn from the target population of 11,192 using Krejcie and Morgan's (1970) method of determining sample size. Krejcie and Morgan's (1970) formula.

The informants were selected through a stratified random sampling method from the selected estates in Siaya, where data collection occurred. For

qualitative data, the study adopted both purposive and snowball sampling techniques to select the respondents. The local administrator (chief or assistant) chief was used to select the first respondents, who then led the researcher to the next respondent until saturation of information was attained. Purposive and snowball sampling strategies were used to select key informants, such as Estate Elders, Church Elders, School Heads, Farmers, Traders, Administrators, Private Sector Practitioners, and County Officials from various departments who were knowledgeable about the effects of urban sprawl on household livelihoods in the study area.

Regarding quantitative research, once the researcher was within each of the estates, the study employed a simple random sampling technique to select the respondents (head of each household), where every household head had an equal chance of being selected randomly as a respondent to fill in the questionnaires.

DATA ANALYSIS, RESULTS AND DISCUSSIONS

Introduction

This chapter presents the data analysis, results and discussions in line with the objectives of the current study. It involved examining the socio-economic effects of urban sprawl on households' livelihood and determining possible strategies put in place by stakeholders to alleviate the effects of urban sprawl on households' livelihood in Siaya town.

Socio-demographic Characteristics of Household Respondents in Siaya Town

The study sought to establish the socio-demographic characteristics of respondents on the effects of urban sprawl on household livelihood in Siaya town. These included the general characteristics of household heads such as age, sex, marital status, working experience, dependents, education level and estate of residence. The data presented in this section were responses from 330 respondents whose social demographic attributes are shown in Table 1. All the respondents were drawn from Awelo, Pandi, Banana, Karapul and the Southern estates of Siaya town. Awelo had the highest number of respondents (32.1%) while Southern estate was the smallest (14.5%). The population were almost at close range, Pandi (19.1%), Banana (18.8%), and Karapul (15.5%), respectively.

The study employed descriptive and inferential statistics to analyse the collected data. For inferential statistics, the study used factor analysis, correlation analysis and regression analysis.

Table 1: Analysis of Socio-economic Demographics of the Household Respondents in Siaya Town (n = 330)

Characteristic	Frequency	Percentage	Characteristic	Frequency	Percentage
Gender			**Dependants number**		
Male	132	40%	11-15 Years	37	11.2%
Female	198	60%	16 and above Years	13	3.9%
Age			**Educational Level**		
18-29 Years	87	26.4 %	PhD	2	0.6%
30-49 Years	197	59.7 %	Post-graduate	3	0.9%
50 Years and above	46	13.9%	Undergraduate Level	23	7%
Marital Status			Post-secondary level	51	15.5%
Married	140	42.4%	Secondary Level	125	37.9 %
Single	72	21.8%	Primary level	112	33.9 %
Divorced	11	3.3%	Below Primary	12	3.6%
Separated	23	7.0%	Did not attend	2	0.6%
Widowed	84	25.5%	**Work experience**		

Characteristic	Frequency	Percentage	Characteristic	Frequency	Percentage
Occupation			1-2 Years	20	6.1%
Farming	87	26.4%	3-4 Years	42	12.7%
Trading	138	41.8%	5-6 Years	64	19.4%
Civil servants	63	19.1%	Above 7 Years	204	61.8%
Politicians	14	4.2 %	**Period of Residence**		
Apprenticeships	28	8.5 %	1-3 Years	31	9.4%
Estate of Residence			4-6 Years	36	10.9%
Awelo Estate	106	32.1%	7-9 Years	89	27.0%
Pandi Estate	63	19.1%	Above 10 Years	174	52.7%
Southern Estate	48	14.5%			
Banana Estate	62	18.8%			
Karapul Estate	51	15.5%			

Source*: researchers' field data 2022*

Based on the data in Table 1, the majority of the households in Siaya town are female (60%), while males are 40%, less than a quarter of the respondents. Glaesere et al. (2008) put it that urban sprawl has a large increase in racial and gender inequality for residents in terms of access to employment opportunities, public services and urban amenities. Hence affirms the findings. USAID (2023) has it that women in cities too often face unequal access to work, housing, health, education and representation in urban areas compared to men. The assertion attests to the finding.

Figure 1: Gender Distribution
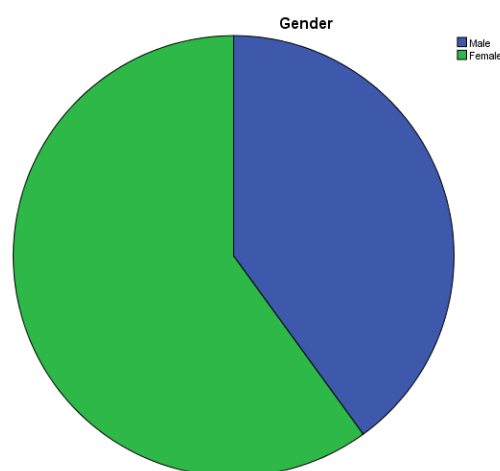
The majority of the respondents are between the ages of 35-49 (50%). It is followed by ages between 18-29 (26.4%). Alley, 2007, Lui, 2009 & Steel, 2005 asserted that what makes cities age-friendly is that cities offer a supportive environment that enables residents to grow older actively within their families and offer extensive opportunities for their participation in communities, hence in line with the findings of the current study. The majority of the residents, 50%, are of middle age (30-49). This age segment consists of the actively working age who either seek employment, in higher institutions of learning or are self-employed. Between (18-29), 26.4% is the age of consent. Kenya Constitution 2010, has it that at 18 years one has a right to take an identity card and become a Kenyan citizen. It usually consists of school school-going age segment and those who have completed school and want to join the workforce. Age over 50 years is decreasing in number, as some are preparing for retirement, and some have retired and would change their residential homes. The mean age is about 41.1, as this is where the majority segment is falling. This is the population that makes the town active in business, labour and public participation.
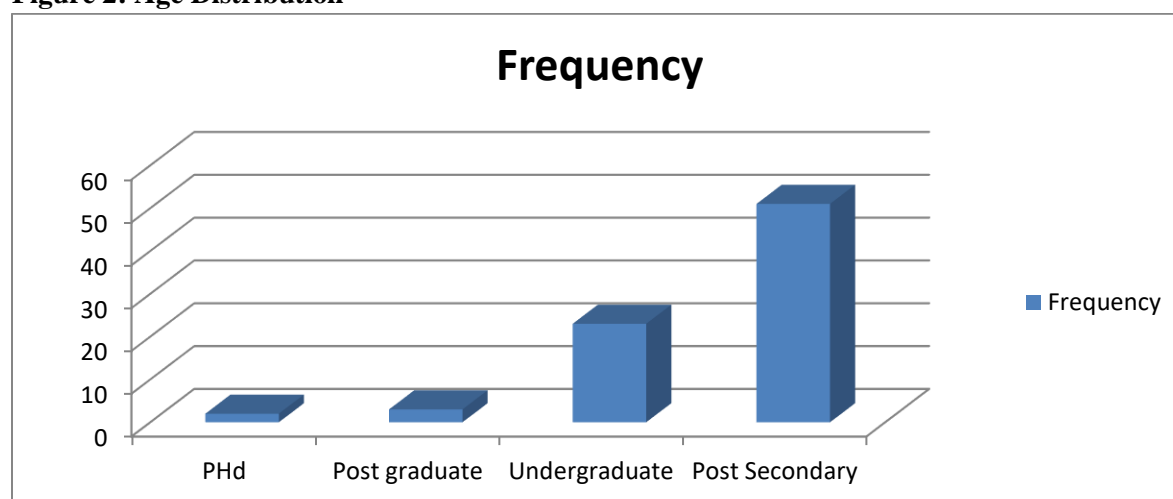
Figure 2: Age Distribution

Table 1 shows that the majority of the residents are married (42.4%). Khan et al, 2018 asserted that marital status plays a vital role in reducing poverty levels because married men feel more responsible and reliable in earning as compared to unmarried men due to the commitment they have to their families. The assertion is in line with the finding as the married lot had 42.4% is close to that of the total population. The widows are at 25.5%. This could indicate that the widowed try their best to earn their living in the urban towns and to enable them to provide for their family needs. Yan (2021) states that urban sprawl is detrimental to the physical health of males and females, but mainly has a negative impact on the mental health of families, hence leading to an increased number of widows. The assertion compares favourably with the findings of the study. The single is 21.8%. (Resnik, 2010) put it that residents of sprawling cities tend to live in single-family homes and commute to workplaces. The assertion is in line with the findings, as most of the single-family homes could not be found easily during the data collection period. However, they form a significant number of the urban population.

The divorced lot was small in number, 3.3%. Quora (2023) put it that divorce rates are more common in urban than rural areas because women are more financially independent, they are educated and want equal rights, they do not tolerate abusive behaviour of husbands and women are pampered a lot from childhood. The assertion compares favourably with the findings, hence, in line with the study. The same reasons apply to the separated, which are at 7.0% (Table 1).
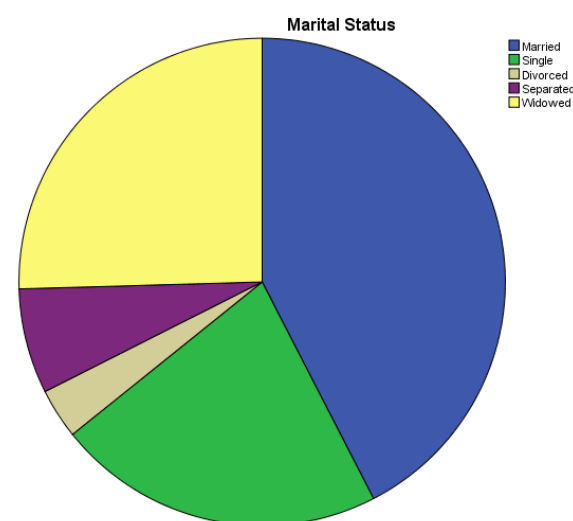
**Figure 3: Marital Status Distribution**

Table 1 shows that 41.8% of the residents in Siaya town are trading as their occupation. 24.4% engage in farming, 19.1% are civil servants, 4.2% are living as politicians and 8% are engaged in apprenticeships. The United Nations (2018) put it that some urban problems related to ongoing urban sprawl are associated more with the physical

structure of cities, while others, such as special segregation of households according to income, are related to social and economic conditions. The assertion is in line with the findings. In Siaya town, urban sprawl has contributed to a shift from previous occupations to diversified sources of income. Those who were traditionally farmers have changed to trade. This is likely because urban sprawl has contributed to the shortage of fertile agricultural land, hence trading is leading by 42%, followed closely by farming by 19.1%. There are incidences of urban farming taking place on a small scale in the peri-urban location. Trading takes the majority occupation as it includes the most economically active area in the town, including boda boda transporters, hawkers, and businesses, in all sectors like shops, fruits, vegetable sellers, and food sellers. There is a need to alleviate the effects of urban sprawl to solve the negative consequences of urban sprawl.

The other occupations, like civil servants, 19.1% consist of government workers for the national government and other workers, including national government workers who give services to the public and county government workers. Politicians take the lowest percentage of 4.2% as the occupation is sometimes seasonal and becomes active during elections. On the apprenticeship, 8.5% consists of the "Jua Kali" workers, including metal ware, shoes ware, clothes, furniture and building industry. Table 1.

Figure 4: Occupation Distribution
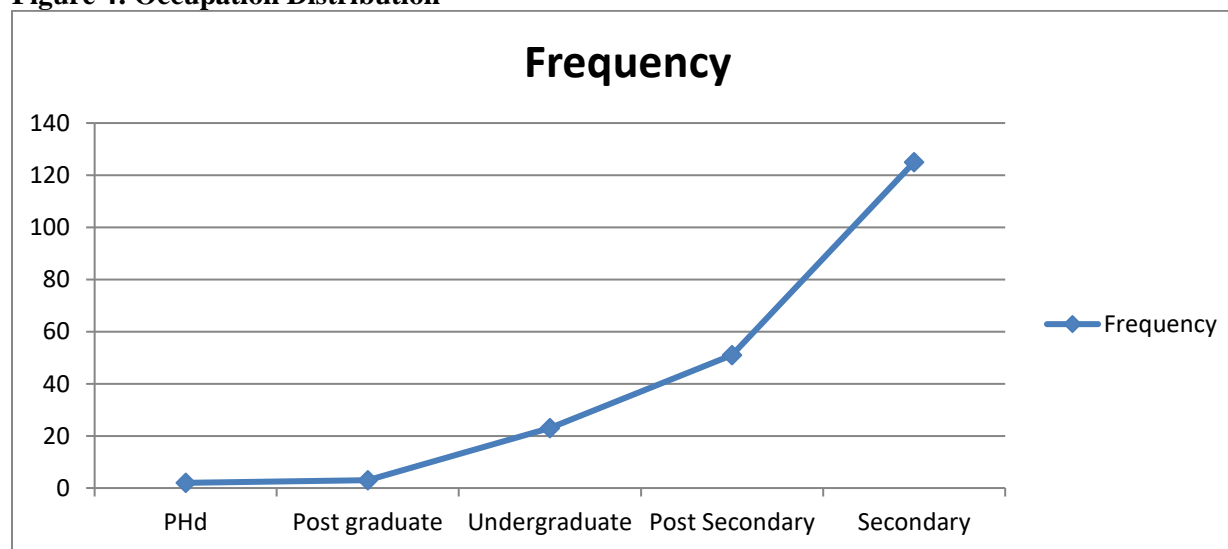
According to Table 1, households with 11-15 years of dependents are 11.2%, and those with above 16 and above years of dependents are at 3.9%. Gaube (2013) posits that the urban population may have significantly smaller household sizes than the rural population. Most of the family members in the household were found living in a desperate situation during data collection. Some came as job seekers, and others came as orphans who chose to live with relatives. The statement was reported by a key informant during the interviews.

Figure 5: Dependants Distribution
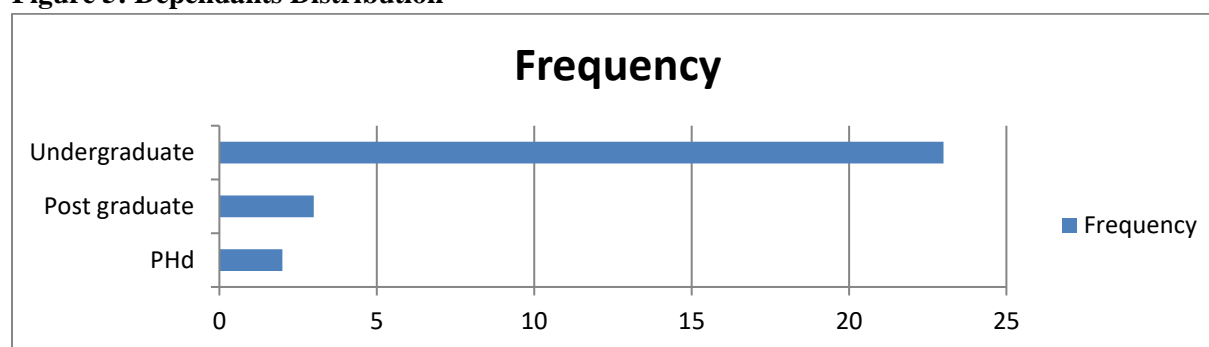
Based on Table 1, the majority of about half the population, 37.9%, had a secondary education level. Dowery (1978) put it that education itself has no final destination and is everything along with growth. UNESCO, 2022, has it that education is a tool for global change aiming to cultivate socially responsible individuals with lifelong learning, critical thinking and aesthetic appreciation, contributing to a harmonious society and cultural organisation. The observation is in line with the finding as the majority has achieved a secondary level of education at 37.9%. This was an informal segment of the population that could easily comply with enforcement agencies to alleviate the negative effects of urban sprawl in Siaya town. Dowery (2021) asserted that education has a significant role in creating social solidarity and controlling one's environment. This was realised when the respondent showed their cooperation and openness during interviews.

In Table 1, 33.9% had a primary level of education, 15.5% post-secondary, 7% undergraduate, 3.6% below primary, 0.9% postgraduate, 0.6% PhD, and 0.6% did not attend. It is important to note that most of the residents, about 98%, could read and write. This indicates that the literacy level in Siaya town is significantly high, over 90%. It makes understanding physical health and social issues and economic issues easy and achievable. Siaya town people call themselves the land of intellectuals, with pronounced professors, professional doctors, educational doctors and politicians. That education is a tool and a weapon to achieve all these. However, the urban sprawl challenge may influence education standards negatively. There is a need to alleviate the negative effects to achieve the desired educational goals.
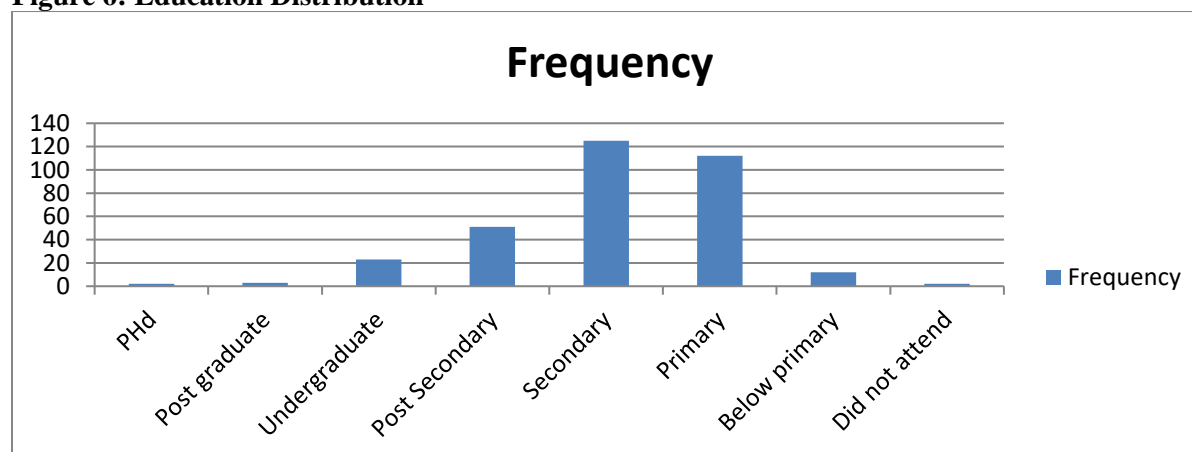
Figure 6: Education Distribution

Table 1 shows that the majority of the residents, 61.8%, had working experience over seven years, 19.4% had working experience of 5-6 years, 12.7% had 3-4 years, and 6.1% had 1-2 years of working experience. Mun (2024) has it that urban sprawl has adverse effects on economic and social disparities, with increased income disparity and reduced access to public services; however, despite these disparities, residents in high sprawling areas report higher overall life satisfaction due to increased satisfaction with the natural and living environment. In Siaya town, the findings revealed that the majority had over 7 years of experience. This could indicate that it is likely that most of this group had worked in other towns or retired to settle in urban areas for urban-friendly environmental reasons.

Table 1 indicates that the majority of Siaya town residents are from Awelo, 32.1%. The reason is associated with its size, and was meant to be a settlement area in that town, hence the Aringo residential area. It is also bordering the Dominion farm, where a lot of farm produce comes from, that feeds the town. It is also close to Siaya Jua Kali and an industrial area, hence it hosts many workers with low income. Pandi is next to Awelo as it hosts students from Siaya Institute, Siaya Medical College, Hospital staff and Siaya Township Primary and secondary schools. Karapul has 15.5% and hosts a middle-class population in the town, one of the most populated primary centres, Karapul and a business hub on Sundays-Ramba market. The southern estate is at 14.5%. It is influenced by the Bondo-Siaya tarmac road and hence attracts linear settlement towards Anduro. Banana estate has 18.8%. Even though it is close to the institutions and the hospital, the population is rather low and is like a residential area with long horizontal structures and a poor road network. (Ramirez, 2009 & Resnik, 2010) Puts it that laws forbidding commercial development in residential areas promote sprawl because they require residents to travel greater distances. Hence confirms the finding.

Table 1 shows that the majority had lived over 10 years as residents. 52.7% followed closely with 27.0%, which is close to a quarter population and those who have stayed between 4-6 years at 10.9% and 1-3 years at 9.4%. Gordon et al, (2006); Frankin, (2005); Ewing & Jackson (2011); Harris, (2009) and Ward, (2009) put it that property values may be adversely affected when high-density housing units are built in an area where low-density housing prevails because the increase in population density may exacerbate local traffic congestion and crime, which reduces value. This is in line with the findings. The interviews confirmed that most residents changed their place of residence due to a built-up environment. This is associated with the expansion of the town, hence urban sprawl.

Socio-economic Effects of Urban Sprawl in Siaya Town

This research was planned to investigate the effects of urban sprawl on the household's livelihood in Siaya town. The investigation had three major areas of concern: the socio-economic and physical environmental effects of urban sprawl on household livelihood, hence the possible strategies put in place by stakeholders in Siaya town to alleviate the said effects. Based on the above, the first area of concern was to examine the effects of urban sprawl on the household's livelihood in Siaya town. For the convenience of this research, the area of study (Siaya town) was subdivided into five residential estates: Awelo, Pandi, Banana, Karapul and the Southern estate.

With reference to socio-economic factors, the data were collected in relation to the income of the people, education level, employment, food security and housing insecurity. For the data analysis, the correlation coefficient was employed to gauge the strength of the relationship between dependent and independent variables. The correlation matrix depicts the strength of the relationship between variables by mathematically establishing the strength relationship. The data were then analysed

using SPSS version 22 to get the result. The findings were presented as shown in Table 2.

Table 2. Analysis of Socio-economic Factors and Urban Sprawl (n = 330)

Socio-economic factors	Awelo	Pandi	Banana	Karapul	Southern Estate
Income	0.984	0.960(96.0%)	0.977	0.979	0.979 (97.9%)
Education level	(98.4%)	0.982	(97.7%)	(97.9%)	0.983 (98.3%)
Employment	0.984	(98.2%)	0.982	0.954	0.979 (97.9%)
Food Security	(98.4%)	0.86.9	(98.2%)	(95.4%)	0.982 (98.2%)
Housing insecurity	0.942	(86.9%)	0.933	0.980	0.947 (94.7%)
	(94.29%)	0.980	(93.3%)	(98.0%)	
	0.964	(98.0%)	0.968	0.987	
	(96.4%)	0.958	(96.8%)	(98.7%)	
	0.946	(95.8%)	0.958	0.971	
	(94.6%)		(95.8%)	(97.1%)	
	100 (100%)	100 (100%)	100 (100%)	100 (100%)	100 (100%)

Table 2 shows the effects of socio-economic factors as a tenant of urban sprawl on peoples' livelihood on income were; Awelo at 0.984 (98.4%), Pandi at 0.960 (96.0%), Banana at 0.977 (97.7%), Karapul at 0.979 (97.9%), and Southern estate at 0.979 (97.9%). The correlation showed that socioeconomic factors were strongly significant and hence influenced the livelihood of the people. It was an indicator that people with strong or high-income levels had come to occupy the town, thus displacing the former occupants in the area to move and search for land elsewhere, hence urban sprawl. Those with no or low income were few, if any, in the area of study. People with low income were forced to settle as squatter or their homes were engulfed in the urban built areas.

Plate 1: A Photograph of an Engulfed Home in South Estate in Siaya Town

Source*: Researcher 2023*

(Plate 1) was a ground photo depicting the position of an engulfed homestead on the ground that remained because of the shortage of land. The photo was taken at the roadside of the rural access road that passed just at the edge of the fence. Interviews with the respondent (a village elder) revealed that the homeowner sold his piece of land and only left with the homestead. (Plate 1) deduced that urban sprawl led to a shortage of land in Siaya town.

According to Smeeding & Weinberg, (2003), the definition of income is that wage income is the total income received for a job performed by an employee in the current year. Urban problems such as urban sprawl are attributed to the physical structures of cities, while others, such as special segregation of households according to income, are associated with social and economic conditions (UN, 2014). Income and health are relatively connected. For households with a low income below the federal poverty level, the annual income threshold set by the federal government determines the financial eligibility criterion (FPL, 2022), leading to health challenges. This was affirmed by (WHO & Braveman, 2014) who stated that poor working conditions, housing insecurity and residence in unsafe neighbourhoods due to low income lead to adverse health challenges. Similar incidents are experienced in Siaya town that affect households and cause urban sprawl.

Gondar & Lalibela in Ethiopia are rapidly growing and expanding from population growth and have experienced the effects of urban sprawl and income level challenges Keflu, (2012) and Eyaga, (2014). In Kisumu, income level and population growth influenced by the search for employment that leads to urban sprawl have caused different urban sprawl challenges, including low income, displacement of people to informal settlements and social segregation (UN-Habitat, 2008). The findings on the effects of urban sprawl on households' livelihood in Siaya town revealed that income affects purchasing power, medical care and land ownership. This impacts negatively on household livelihood and contributes to urban sprawl.

The correlation was very strong at over 90%, as shown in Table 2. There is a need, therefore, to address the income levels of occupants in all the estates, including Awelo, Banana, Pandi, Karapul and Southern estates to curb the negative effects of urban sprawl. The residents should engage in diversified, economic and intensification of agriculture, including urban farming. Their financial resources can be hustler funds, Uweso funds and women's enterprises to boost their income.

Table 2 shows that the education level in Siaya town has a strong correlation with the selected estates at above 90%, on households' livelihoods. UNESCO, (2022) put it that education is a tool for global change, aiming to cultivate socially responsible individuals with lifelong learning, critical thinking and aesthetic appreciation, contributing to a harmonious society and cultural organisation. This was affirmed in the finding that education has effects on households' livelihood and has a strong correlation in all the residential estates within the area of study, Siaya. The finding revealed that education level influences literacy level, medical care, and public participation. Kemili, (2019) posit that low educational attainment is an independent predictor of adverse outcomes for patients with coronary artery disease. However, school policies and exclusionary discipline practices may negatively impact the achievement of learners and are correlated with substance use, and worse, mental health and social connectivity, with risk factors for adverse health behaviours.

According to Table 2, the findings revealed that employment as a socio-economic factor correlates strongly with household livelihood in Siaya town. The correlation records a high percentage above 80%, hence, a strong correlation is seen in Awelo, Pandi, Banana, Karapul and Southern estates. The data shown was extracted from a coefficient correlation table that shows that employment affects

or influences purchasing power, medical care and level of residence among household livelihood in Siaya town. WHO, (2008) put it that employment status, whether an individual is working to earn wages, is consistently identified as an indicator of socio-economic status strongly associated with health outcomes.

According to Silver, (2018), he noted that loss of employment results in a loss of healthcare and insurance coverage, which can contribute to health-associated challenges for an individual. The majority of the 456 million Africans, 60%, are unemployed. Most are self-employed, and 33 million are employed; 40% are outside the job market (ILO, 2003). Urban sprawl is associated with unemployment that has increased in urbanising towns. The inhabitants are compelled to diversify their income activities, as asserted by Ellis (2016), who states that urban sprawl has led to a diversified economy. The finding is therefore in line with the assertions.

In Siaya town, urban sprawl has contributed to low employment opportunities. A low percentage of individuals are employed in formal employment. The majority are in informal employment. This affects their source of income and eventually leads to diminishing livelihoods, especially the low-income earners. In certain cases, even the odd jobs are lacking within the town and peri-urban locations, alternatively, workers and individuals go for whatever comes their way.

Interviews and focus group discussions corroborated and revealed that urban sprawl had adverse effects on households' livelihood in Siaya town, including unemployment, low income and low education level in some low-income households. This may be attributed to the diminishing household livelihoods, particularly in low-income families.

Table 2 affirms that food insecurity is strongly correlated to the effects of urban sprawl on households' livelihood in Siaya town. This is evident when Awelo is at 96.4%, Pandi at 98%, Banana at 96.8%, Karapul at 98.7% and Southern estate at 98.2%. According to the researcher's observation, Awelo is situated on the western side of the town. It is larger than the other selected estates. It is within the Aringo estate that was meant to be an informal settlement area. The residents have generally low incomes except for a few. The findings rated them at a lower rate of 96.0%. Pandi and Karapul host high-class residents, including government and county government officers and well-to-do individuals with high income, hence a higher percentage of over 95%. The southern estate is towards Bondo-Siaya road, and most residents form linear settlement patterns, hence the lower housing insecurity compared to the others at 94.7%.

Food insecurity is defined as the distribution of food intake or eating patterns due to the influence of financial resources and other resources (Gregory, 2017). It is closely related to income and unemployment and is widely recognised as a risk for chronic diseases (CHD), including hepatitis, stroke, cancer, asthma, diabetes, arthritis, chronic obstructive pulmonary disease and kidney diseases (Tuvazquez, 2019 & USDA, 2022).

Food security is when a person is able to obtain a sufficient amount of healthy food on a day-to-day basis. People who do not consume enough food each day suffer from food insecurity, which is when a person is unable to obtain a sufficient amount of healthy food on a day-to-day basis. The finding revealed that food insecurity influences medical care, purchasing power and change in land ownership. This shows that people with high incomes afford food security and provide enough for their families, afford healthcare and are able to purchase as they need. They thus buy land from the low-income residents, leading to landlessness and diminishing household livelihoods for the low-income. During the interview, one participant had this to say: "*Pressure from developers and getting used to the urban lifestyle made some household sell their land. This had caused landlessness among*

households, leading to urban poverty". This was in line with the findings and is inconsistent with the area of study, Siaya town.

Table 2 shows that housing insecurity has a strong correlation with households' livelihood as a socio-economic factor of the effect of urban sprawl in Siaya town. Awelo recorded 94.6%, Pandi 95.8%, Banana 95.8%, Karapul 97.1%, and Southern Estate 94.7%. The strongest correlation is realised in Karapul (97%). This can be attributed to the fact that most residential structures are mainly for individuals and developers like Distinction, Villa and White House. The housing insecurity is likely to be high. There is a less formal settlement and also influenced by a tarmac road from Kisumu to Siaya. The rest of the residential areas, like Awelo, still experience some elements of housing insecurity.

Housing insecurity is commonly defined as the high housing cost relative to income, but also has been used as an umbrella term to describe multi-housing issues such as poor housing quality, unstable occupancy, overcrowding and unsafe neighbourhoods (Taylor, 2018; Sims, 2018 and Virgil, 2019). UN-Habitat, (2021) put it that their primary objective is to assist member states in working towards the realisation of the right to adequate and affordable housing. In Ethiopia, the horizontal pattern of housing structure has led to a shortage of land and is difficult to change.

Housing insecurity has led to land encroachment as developers need more space to construct. Roca, (2003) put it that land is becoming a scarce resource, creating the need for efficient land use allocation and innovation in agriculture. Oyusu (2008) put it that the cumulative effects of change, such as commercialisation, individual ownership and securing land title deeds, are the norms caused by urban sprawl. The finding finally revealed that housing insecurity influences medical care, as poorly constructed houses lead to health conditions such as breathing difficulties and eye-related diseases. It also influences the change of land ownership and the level or class of residence in Siaya town.

SUMMARY, CONCLUSIONS AND RECOMMENDATION

Introduction

This chapter gives a summary of the study findings, conclusions, recommendations and suggestions for further findings.

Summary of Findings

Objective One: To examine the social effects of urban sprawl on households' livelihoods in Siaya town, the findings revealed that the social effects of urban sprawl have a strong correlation with households' livelihoods in Siaya town. The correlation is at 0.9 on average, hence a strong positive correlation. The social factors, such as education level, food security and housing insecurity, were examined and analysed using the Statistical Package for Social Sciences (SPSS) version (22). In Awelo, education level was at (0.984), food security, (0.964), and housing insecurity, (0.946). The other selected estates, including Pandi, Banana, Karapul and Southern estates, had similar trends, hence 0.9 on average (Table 2).

The findings conform with UNESCO, (2022), which states that education is a tool for global change, aiming to equip socially responsible individuals with lifelong learning. Based on the findings, it can be deduced that the social effects of urban sprawl are responsible for households' livelihoods in Siaya town. It contributes positively but to a larger extent negatively to households' livelihoods. It is attributed to households' diminishing livelihoods in the selected estates.

Objective Two: One of the economic effects of urban sprawl on the livelihoods of the households in Siaya town, the finding revealed that on the analysed factors such as income and employment, the result revealed a strong correlation of over 0.9, hence strong positive correlation that is close to 1.

(Table (4.2) income level at Awelo, (0.948), Pandi, (0.960), Banana, (0.977) and South estate, (0.979). While on employment, Awelo (0.942), Pandi (0.869), Banana (0.933), Karapul (0.980) and South estate (0.979).

The strong correlation, 0.9 on average, suggests that the economic effects of urban sprawl contribute to diminishing household livelihoods in Siaya town. This is evident when people with low income were forced to settle as squatters on their homes were engulfed in urban built areas (plate 1).

Regression analysis was utilised to assess the strength of the relationship between variables and to model the future relationship between the linear regression. If coefficients indicate an increase, the mean of dependent variables also tends to increase (Figure 2). Correlation qualifies the strength of the linear relationship between a pair of variables, whereas regression expresses the relationship in the form of equation $Y = Mx + b_1$: Y is the response-dependent variable, X is the predictor, the independent variable, and M is the line.

The result showed a strong relationship between independent variables (social and economic factors) and dependent variables (household livelihoods). The results affirmed that the social and economic effects of urban sprawl are attributed to households in the selected estates in Siaya town.

Objective 3. On investigating the physical environmental effects of urban sprawl on household livelihoods, the findings revealed that environmental factors such as energy consumption, environmental degradation, water quality and supply, land use change and loss of biodiversity had a strong correlation at 0.9 on average.

At Awelo, energy consumption was at 0.950, environmental land use change (0.62) and loss of biodiversity (0.961). A similar trend cuts across all the selected estates, including Pandi, Banana, Karapul and the Southern estate. The strong correlation suggests that physical environmental

effects are responsible for the household livelihoods in the study area. The finding affirmed the assertion of Todmad, (2020) and Jyolik, (1991), who stated that urban people change their environment through their consumption of food, energy, water and land use, hence influencing the household livelihoods positively or negatively.

KMO and Bartlett's tests were employed to analyse the physical environmental factors, using SPSS version 22. The finding revealed that the data from the selected estates were at 0.8 – 0.9, hence reliable and superb. Pandi had the highest value at (0.884), and Karapul had the lowest at (0.831). Based on the findings, it can be deduced that the physical environmental effects of urban sprawl are linked to households' livelihood challenges, including loss of agricultural land, habitat loss, increased pollution and water scarcity, impacting households by reducing agricultural land and access to resources, potentially leading to economic hardship and social issues.

Objective 4: To determine possible challenges to curb the negative effects of urban sprawl on household livelihoods, the strategies used in other countries were analysed. Over half, 91.8%, asserted that smart growth was a possible strategy that could be adopted to curb the effects of urban sprawl. This was followed closely by new urbanism at (79.1%) and transit-oriented development at (76.3%). The copying strategies used by the respondents. Almost three-quarters (91.5%) confirmed that diversification of income activities was the most popular activity. This was followed closely by most respondents (87%) who practised mixed farming, (78%) who engaged with NGOs, and (65.5%) who adopted an urban lifestyle.

Based on the findings, there is a need for both the national and county governments, developers, planners, and the concerned stakeholders to consider implementing smart growth as a model to curb the negative effects of urban sprawl. The town residents should continue with diversification of income activities and are encouraged to intensify

agriculture and practice extensification of agriculture on open land and embrace positive change in properly planned urban development.

CONCLUSION

Objective one: On examining the social effects of urban sprawl on households' livelihoods in Siaya town, the findings revealed that the social effects of urban sprawl have a strong correlation of 0.9 (on average) on household livelihoods. This has contributed to social challenges such as loss of agricultural land, increased competition for resources, displacement and loss of income and increased poverty, hence diminishing household livelihoods. Coping strategies to social effects include agricultural diversification, intensification and extensification of farm practices, adoption of multi-income portfolios and migration and development effects policies.

Urban sprawl has a complex and multi-faceted impact on household livelihoods, with both positive and negative consequences. While it can lead to challenges like loss of agricultural land and increased competition for resources, it also presents opportunities for livelihood diversification and access to urban services. Understanding these dynamics is crucial for developing effective policies and strategies to mitigate the negative impacts and harness the benefits of urban sprawl for sustainable and equitable development.

Objective two: Urban sprawl can have mixed economic effects on household livelihood. Negative effects include loss of fertile land, reduced agricultural output and income, food insecurity, displacement and eviction. The finding revealed that on the analysed factors, such as income and employment, the result was 0.9, hence a strong positive correlation. Copying strategies for economic effects could include: agricultural intensification and diversification, adoption of non-farm livelihoods and migration to urban areas for better economic opportunities.

The finding also revealed a strong relationship between dependent variables and independent variables, using linear regression.

Objective Three: On investigating the physical environmental effects of urban sprawl on household livelihood in Siaya town, the result revealed the environmental factors had a strong correlation at 0.9, while the KMO test was at 0.8 – 0.9, hence reliable and superb. The negative impacts include loss of agricultural land, reduced access to national resources, increased environmental hazards, competition for resources, livelihood diversification and insecurity in livelihoods. Adoption of copying strategies could include: diversification of livelihoods in urban and peri-urban agriculture, seeking employment in urban areas and migration to urban areas.

Objective 4: To determine possible strategies, 91.8% asserted that smart growth was a possible strategy that could be adopted to curb the negative effects of copying strategies. 91.5% confirmed that diversification of income activities was confirmed as a coping strategy, and mixed farming was 78%.

In conclusion, copying urban sprawl's impact on livelihoods requires diverse strategies from diversifying income sources and adopting new technologies to strengthening social networks and advocating for policies that protect livelihood and resources.

Recommendation

Objective one: The national and county governments and planners should be encouraged to prioritise and implement integrated urban planning and land management. In Siaya town, the planners, the concerned authority and stakeholders should implement urban growth boundaries, promote compact and vertical urban growth and protect agricultural land.

Objective Two: There is a need for the planners and the residents to emphasise diversification of economic activities, promote entrepreneurship,

invest in skill development and strengthen the value chain in their respective areas of operation.

Objective Three: The national and county governments should work in collaboration to recommend and implement integrated urban planning and land use management, prioritise green spaces and parks, strengthen infrastructure and promote sustainable development projects.

Objective Four: The study highly recommends the adoption of a smart growth model, intensification, and extensification of agriculture and diversification of the economy to curb the urban sprawl challenges in Siaya town.

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