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Appraisal of compliance with land subdivision planning regulations in residential neighbourhoods

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ARTICLE INFO	ABSTRACT
	Although previous studies have attempted to address the challenge of land subdivision, there is still a scarcity in the literature on how the extent of conformity to land subdivision planning regulations may be statistically and spatially analyzed. This study, therefore, explores the extent to which residential developers comply with land subdivision planning regulations in Kenya, a case study of Kisii Town. It was guided by the public interest theory of regulation with a target population of 7,430 residential developments from the seven sublocation neighbourhoods of Kisii Town. Four administrative sublocations were used as strata out of which proportional random samples were drawn from their respective residential neighbourhoods to attain a sample size of 364. Structured checklists were used to collect data on the extent of conformity. Results revealed that although the recommended minimum plot size in Jogoo, Nyamataro and Nyanchwa neighbourhoods was 0.1 ha, 84%, 100% and 88% of developers did not respectively comply. Further, although the recommended minimum plot size for Egesa, Daraja Mbili, Mwembe and Nyamage neighbourhoods was 0.05 ha, 83%, 46%, 58% and 63% of developers failed to, in that order, comply. The problem continues notwithstanding the legal framework that grants the County Government of Kisii powers of development control. Key recommendations comprised establishing a coordinating committee to harmonize agencies that deal with land subdivisions and ensuring that only registered persons' process of land subdivisions. This study generally benefits international readers by highlighting how compliance with recommended land subdivision planning regulations may be statistically and spatially analyzed.

INTRODUCTION

Every person has at least some affiliation with the land. As a factor of production, it enables its owners to access loans, build shelter and establish businesses in urban areas. Conversely, in rural areas, the land is acknowledged as fundamental in promoting food security, employment creation and daily subsistence (the Republic of Rwanda, 2017; UN-Habitat, 2012; FAO/UNEP, 1997). Because land acts as an important facet of development (Oluwatayo et al., 2019; Chitonge and Mfune, 2015), it remains an indispensable necessity for survival by not only

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embodying the foundation upon which individual activities are anchored but also presents economic and social opportunities (Kuma, 2017). This evidence suggests that a country's potential for realizing its social and economic development is largely dictated by its physical resource base as may be substantiated by the amount of land under its spatial jurisdiction (Jin *et al.,* 2018). From the human settlement point of view, since land supports development, social justice and delivery of decent housing; it should be used to address the general interest of the society (the Republic of Kenya, 2007). As a natural resource, land presents a multiplicity of uses that may be grouped into categories that consist of the environment, economics, society and spirituality. Regarding the environment, some may regard it as soil and habitat, thus denoting the nexus between atmospheric, hydrological and climatic systems. To an economist, land may be considered as a scarce space for locating activities that are intended to support economic production, housing and attendant infrastructure. Socially, ownership of land signifies prestige, hence, a symbol for socioeconomic affluence (Hubacek and van den Bergh, 2002; Mwangola, 2001). Land use, therefore, emerges as a product of human activities operating within the political, social, institutional and legal context. More often than not, this results in spatial competition among multiple interests (Omollo, 2020; Hermunen, 2004). If the status quo continues in the absence of planning and development control, the quest is bound to attract unregulated land subdivisions leading to unsustainable spatial development. Because of this, Nha (2017) suggested that land-use planning should be used as a tool for allocating and reallocate land resources for sustainable development. This, without doubt, includes subdivision control. From the introductory overview, this study examines the extent to which residential developers in Kenya comply with approved land subdivision planning regulations. It is undertaken in Kisii Town as a case study. It addresses the limitations of earlier approaches by filling the current research gap in land use planning literature through a demonstration of how compliance with land use subdivision regulations may be statistically and spatially analyzed. It further links the theoretical and philosophical approaches to land subdivision development control in the context of a developing country that hopes to attain a middle-income country by the year 2030.

Regulation of Land Subdivision: A Literature Review

Unsustainable land subdivision is a common challenge that occurs in developing countries (Cengiz, 2013). Thus, in an attempt to propose an orderly development within the selected Sub-Saharan African cities (Kihonda, Tanzania; Kumasi, Ghana; Dar es Salaam, Tanzania; and Benin City, Nigeria), Agheyisi (2018) established that the lack in the enforcement of the approved regulatory framework on land subdivision contributed to land-use conflicts. The study recommended that the growth of urban centres should be planned and regulated to promote a healthy and safe environment. A further suggestion was made for stringent regulation of the land subdivisions to ensure that new areas added to the towns form an integral part of the overall urban spatial structure that does not compromise the tenets of sustainable development. An earlier study by Agheyisi (2016) attempted to evaluate if informal land subdivisions in Benin metropolis, Nigeria, conformed with the existing planning law. The results of the independent-sample t-test from the selected neighbourhoods, however, showed no statistically significant difference in the mean scores of the two variables. In Massachusetts, Ben-Joseph and Phelan (2005) argued that inadequate streamlining of land subdivisions resulted in unnecessary delays in the approval process, a subject further linked with developers' inability to present adequate documentation. The problem was heightened by the revelation that since subdivisions were concurrently approved by multiple government agencies, this increased bureaucracy and red tape, thus encouraging noncompliance by developers. In a different context, Musambayi (2013) found out that there was a link between the land subdivisions and performance of the agricultural sector. In this case, unregulated subdivisions in Kenya were significantly correlated with a decline in agricultural productivity, thus a key determinant of food security. This line of argument relates to that of Museleku (2018) who validated that economic variables were the leading drivers of agricultural land subdivision. These drivers included agricultural land inheritance practices, the price of agricultural land and demand for urban housing. A related study at Kaputiei North, Kenya by Kebaso (2017) additionally found a significant association between the increase in settlements as a function of land subdivisions and food security. In the end,

subdivisions of less than one ha pointedly increased by 411%, while those of over 100 hectares reduced by 89%. During the same period, meat production, notably reduced by 78%. Another comparative finding was reported by Ram *et al.,* (1999) whose study in Khabra Kalan village, India, also found out that the landholding size halved every 20–30 years due to uncontrolled subdivisions. As such, Boob and Rao (2014) established that inadequate monitoring and enforcement of subdivision regulations provided room for developers who violated building regulations in India. Generally, 75 % of open spaces were not developed as required. At the same time, the minimum width of access roads, side and rear margins were also grossly violated. In the same way, most developers disregarded floor space index owing to the excessive coverage on the ground floor. A similar challenge was raised by Mwesige (2007) who established that 80% of the developers in Kampala City, Uganda, did not comply with the subdivision requirements. Research findings specifically showed that informal land subdivision was responsible for the disorderly spatial development, consequently resulting in the non-attainment of the city's development plan. These challenges were attributed to inadequate enforcement of approved planning regulations. Although reviewed studies have so far attempted to enrich the literature on unregulated land subdivisions, there is still a scarcity in knowledge on how compliance with prescribed land subdivision planning standards may be both statistically and spatially assessed, a gap filled in the current study. The objective of this study was therefore to determine the extent to which residential developers in Kenya comply with land subdivision planning regulations, a case study of Kisii Town. It was undertaken between 13th September 2019 and 28th November 2019. The study begins by appraising the regulation of land subdivisions in Kenya as enshrined under enabling legislation and policy documents.

Land Subdivision in Kenya: Legislative and Policy Framework

The first reference point for land use regulation in Kenya is provided for under article 60 of the Kenya Constitution (the Republic of Kenya, 2010) that sets the principles of land policy to include, among others, sustainable and productive management of land resources, transparent and cost-effective administration of land, and sound conservation and protection of ecologically sensitive areas. Article 61 further provides three classifications for land in Kenya. These include public land, community land and private land. To ensure they are sustainably used, article 66 (1) gives the State the power of regulating the use of any land, a requirement reinforced by Section 2 of the Physical and Land Use Planning Act (PLUPA) (the Republic of Kenya, 2019a) that defines development to include carrying out any works on land or making any material change in the use of any structures on the land. Section 56 (b) the Act, empowers county government to control the subdivision of land. Besides the Constitution and PLUPA, the land subdivision in Kenya is also regulated by the Land Control Act (the Republic of Kenya, 2012). Section 6 requires that the subdivision into two or more parcels is invalid unless the Land Control Board for the land control area in which the land is situated has given its consent. Further, Regulation 43 (2) (a) of the Land Registration (General) Regulations, 2017 (the Republic of Kenya, 2017a) requires any developer who applies to the Land Registrar for the consent to combine or subdivide parcels of land to obtain a copy of the approved development application from the relevant county government. This includes approval for land subdivisions. Notwithstanding the existing legal framework, the need to control land subdivisions in Kenya has also been addressed in key national policy documents. For example, in 2017, the Government of Kenya developed the first National Land Use Policy (the Republic of Kenya, 2017b). The policy commits the development of a framework that will facilitate the attainment of orderly and sustainable land use. Moreover, to provide a national spatial vision, the Government of Kenya in 2015 prepared the first National Spatial Plan (2015-2045) (the Republic of Kenya, 2017c) which proposes a land development strategy that regulates the subdivision of land. It is, therefore, apparent that regulation of land subdivision in Kenya is sufficiently addressed under various enabling legislative and policy instruments. An immediate query at this juncture is whether the provided instruments are adequately being utilized in controlling land subdivision with a specific case study of Kisii Town in Kenya. However, to guide this interrogation, the paper commences by giving a deeper insight into the study's theoretical context.

Theoretical context

Regulation of the economy by the state intervention has existed since time immemorial. The notion of public interest is, therefore, as old as the political viewpoint of the state regulation. Consequently, both state intervention and public interest exist in the philosophical, political, and legal spheres (Hantke-Domas, 2003). From this background, this study is anchored in the Public Interest Theory of Regulation (PITR) which explicates that regulation should protect and benefit the public instead of only favouring a section of the society. The theory was developed by Pigou (1932) who argued that the regulations are developed in the interest of the public interest as a necessity for addressing inefficient undertakings in the economic markets. In this case, the regulations are perceived to benefit the entire society as opposed to a person's interest. Applied to the current study, PIRT vindicates why land subdivision in Kenya with a specific reference to Kisii Town needs regulation by the County Government of Kisii (CGOK). The aim is to safeguard statutory compliance with approved subdivision regulations. In this circumstance, the CGOK carry out enforcement by restricting rights to land subdivision and in so doing, development control intercedes in the processes of land subdivision. This is because land subdivision development control is enforced through obligatory edicts solely issued and enforced by the CGOK. Failure to conform subsequently attracts penalties as may be specified in the applicable legislation. To further contextualize the theory as it relates to compliance with land subdivision regulations in the study area, PLUPA grants county governments in Kenya the powers to control the use and development of land by prescribing a stiff penalty for anybody who subdivides land without development permission. PITR, therefore, provides a theoretical foundation expounding why the CGOK should consistently regulate land subdivision in Kisii Town, a scheme towards achieving a sustainable land use as enunciated under Kenya's National Spatial Plan, 2015-2045.

MATERIALS AND METHODS

Study area description

Kisii Town is located in the south-western part of Kenya (Fig. 1). It is the current administrative headquarter of Kisii County, one of the 47 county governments that constitute the Republic of Kenya as per the Constitution of Kenya (Omollo, 2020; the Republic of Kenya, 2010). The town is situated

Fig. 1: Geographic location of Kisii Town, the study area, in Kenya (Encyclopaedia Britannica, 2011)

approximately 300 km from Nairobi, the capital city of Kenya, and about 120 km from the shores of Lake Victoria, the second-largest freshwater lake in the world. Although the town spatially covers an area of 34 km^2, only 4.35 km^2 is planned, an indication that much land use development is taking place in the absence of an updated land use development plan.

The population in 2018 was 93,959, which is further projected to 140,118 by 2032 (the Republic of Kenya, 2019b). In the national context, the town is ranked as the third most densely populated urban area after Nairobi City County (4,515 persons per square kilometre) and Mombasa County (4,292 persons per km^2). Further, according to Kenya Population and Housing Census Survey of 2019 (the Republic of Kenya, 2019b), the town's annual population growth rate of 2.7% is ranked among the highest in Kenya, in fact, higher than Kenya's annual average of 2.6%. A combination of these variables continues to intensify land use development, which in the absence of effective land-use planning has given rise to unsustainable land use development such as unregulated land subdivisions and conflicting land uses.

Population, Sample and Sampling Design

The target population comprised 7,430 residential developments from the seven sublocation neighbourhoods of Kisii Town. As suggested by Saunders *et al.,* (2016), the choice of sample size was informed by the confidence level, the margin of error and the target population from which the sample was drawn. The selection of sample size was guided by the Sample Size Determination Table as recommended by Krejcie and Morgan (1970). According to the table, at a 95% confidence level, if the population (N) falls between 7,000 and 7,999, the sample size (N) should be 364. The sample size for the study was, therefore, 364 residential building developments whose plot coverage in terms of the acreage was empirically measured to determine the extent to which they were complying with the recommended land subdivision planning regulations issued and enforced by the CGOK. This sample size was above 357 as suggested by Saunders *et al.,* (2016) at a margin error of 5%. Four administrative sublocations of Kisii Town were used as strata out of which proportional random samples were drawn from their respective residential neighbourhoods to attain

the sample size of 364. These neighbourhoods were Jogoo, Egesa, Nyamataro and Daraja Mbili (located in Mwamosioma sublocation), Nyanchwa (located in Nyanchwa sublocation), Mwembe (located in Nyaura sublocation) and Nyamage (located in Bobaracho sublocation). Escamilla *et al.,* (2014) suggested that because obtaining sampling frames for urban residential developments is a challenge because such records are seldom maintained by relevant authorities, high-resolution satellite images and spatial analysis software may be used to digitize each development within an area of interest to generate an accurate list in the inform of a representative sampling frame, which can be used to draw random samples. Based on this recommendation, given that there were no records maintained by the CGOK on the number of residential building developments in Kisii Town, their numbers were first identified using a high spatial resolution satellite image (QuickBird 2, 0.34-metre spatial resolution) obtained from the Regional Centre for Mapping of Resources for Development, Nairobi City County, and thereafter digitized to generate a sampling frame in the form of the feature attribute table. The process entailed delineation of sublocation boundaries of Kisii Town, followed by the digitization of all building developments and thereafter spatial segregation of neighbourhood boundaries from respective sublocations. This was attained through the adoption of participatory mapping exercises incorporating Assistant Chiefs drawn from respective sublocations, thus giving credence that there were no overlaps in data collection. As justified by Natarajan (2017) and Warner (2015), such participatory mapping has the advantage of collecting and agglomerating local knowledge of different people to create a high-resolution composite map that serves to provide a greater level of knowledge than can be achieved from traditional mapping methods. Ground truthing exercises to ascertain that delineated boundaries were accurate in addition to confirming that digitized developments were residential was additionally undertaken. As a whole, 7,430 residential developments were successfully mapped from the neighbourhoods of the four sublocations. This formed the target population as well as provided the sampling frame (Table 1).

To obtain a proportional representative sample size for residential developments per respective stratum (sublocation neighbourhoods), the number

of buildings from each stratum was divided by the total number of buildings for all strata (7,430) and the product multiplied by the desired sample size of 364 (Table 1). Because Mwamosioma sublocation (stratum) was the largest, its four neighbourhoods (substratum) were further demarcated for sampling. These included Jogoo (1,551 buildings), Nyamataro (808 buildings), Egesa (821 buildings), and Daraja Mbili (1,301) totalling to 4,481 buildings. Since the desired sample size for the sublocation was 220, to get the corresponding sample size for each neighbourhood, their respective number of buildings were further divided by the total number of buildings in the sublocation (4,481) and the product multiplied by 220, resulting to sample sizes of 76, 40, 40 and 64 respectively for Jogoo, Nyamataro, Egesa and Daraja Mbili. As regards other sublocations, in Nyaura, Mwembe was the only dominant neighbourhood. The same occurred in Bobaracho and Nyanchwa sublocations where Nyamage and Nyanchwa were respectively the only dominant neighbourhoods. To safeguard credible representation, samples from each stratum and substrata were afterwards drawn using a random number table. According to Saunders et al., (2016), random numbers allow a selection of

the desired sample without bias in a situation where an accurate sampling frame has been provided.

Data Collection and Analysis

Structured observational checklists were used to collect data on conformity with recommended land subdivision planning regulations. While the first column gave the name of the residential neighbourhood, the second column denoted the standard value of the recommended planning regulation. The third column recorded the observed value concerning the recommended standard value of the planning regulation. The last column reported deviation, indicating the extent to which each regulation was complied with by the sampled residential developers. During data collection, the size of each residential plot was physically measured after permission was sought from the respective developers and results recorded on the checklist. Compliance with recommended standard value for land subdivision denoted accordance while noncompliance indicated deviation. The recommended planning regulations regarding the minimum plot size in Kisii Town are presented in Table 2.

Table 1: Neighbourhood sampling proportion

Sublocation /Strata	Sublocation Residential Neighbourhood	No. of Developments/ Residential Plots	Proportional Sample size
Mwamosioma	Jogoo	1,551	76
	Nyamataro	808	40
	Egesa	821	40
	Daraja Mbili	1.301	64
Nyaura	Mwembe	1,105	54
Bobaracho	Nyamage	1,171	57
Nyanchwa	Nyanchwa	673	33
Total		7,430	364

Table 2: Recommended minimum plot size in Kisii Town

Sublocation /Strata	Sublocation Residential Neighbourhood	Recommended Minimum Plot Size (Ha.)
Mwamosioma	Jogoo	0.1
	Nyamataro	0.1
	Egesa	0.05
	Daraja Mbili	0.05
Nyaura	Mwembe	0.05
Bobaracho	Nyamage	0.05
Nyanchwa	Nyanchwa	0.05

Data were analyzed using descriptive and inferential statistics that included means, standard deviation, one-sample t-test, paired sample t-test, correlation analysis and GIS. To spatially illustrate the extent to which developers were complying with the recommended subdivision planning regulations, Registry Index Maps (survey maps) for selected parts of the neighbourhoods were obtained from the Kisii County Survey Office and thereafter scanned, georeferenced and digitized using QGIS software version 3.6.0. This enabled an accurate computation of the area (in hectares) covered by each sampled residential plot.

RESULTS AND DISCUSSIONS

This section concurrently presents the results and discussions of the research findings. To attain this, it is systematically organized into two broad subsections. These include a test for normality and response rate; and extent of compliance with the recommended minimum plot size per sublocation neighbourhood.

Test for Normality and Response Rate

The normality assumption assessment in the collected data is a criterion when undertaking any parametric statistical tests. This is because data validity depends on it (Meterko *et al.,* 2015; Ghasemi and Zahedias, 2012; Hoekstra *et al.,* 2012). In the current study, the test for normality was undertaken using the Kolmogorov-Smirnov Test which reported a p-value of 0.316. The alternative hypothesis was, therefore, rejected and a conclusion made that the collected data on the extent of compliance with the recommended land subdivision regulations come

from a normally distributed population. In addition to the test for normality, the survey response rate is likewise regarded as a key data-quality indicator (Meterko *et al.,* 2015). In the current study, out of the 364 checklists used to collect data, 290 were completed representing a response rate of 80%. This was above the minimum of 50% as suggested by Mugenda and Mugenda (2003) and 55.56% by Baruch (1999). Based on these suggestions, the response rate of 80% was considered adequate for subsequent data analysis and reporting.

The extent of Conformity with Subdivision Regulations in Kisii Town

Minimum plot size is determined by the user, type of waste disposal, availability of water and the level of building technology applied (the Republic of Kenya, 2007). The objective is to control the subdivision of private land to ensure that such land is held in economically viable parcels, contributing to the attainment of development control principles of access, aesthetics, conformity, efficiency, convenience, suitability, safety, and environmental conservation. Assessment of compliance was undertaken per sublocation neighbourhood in the following order: Nyanchwa Sublocation (Nyanchwa Estate), Mwamosioma Sublocation (Jogoo, Egesa, Nyamataro, and Daraja Mbili estates), Nyaura Sublocation (Mwembe Estate), and Bobaracho Sublocation (Nyamage Estate).

Nyanchwa neighbourhood

Recommended minimum plot size in Nyanchwa was 0.1 hectares. Descriptive statistics conversely demonstrated that the mean for the observed plot
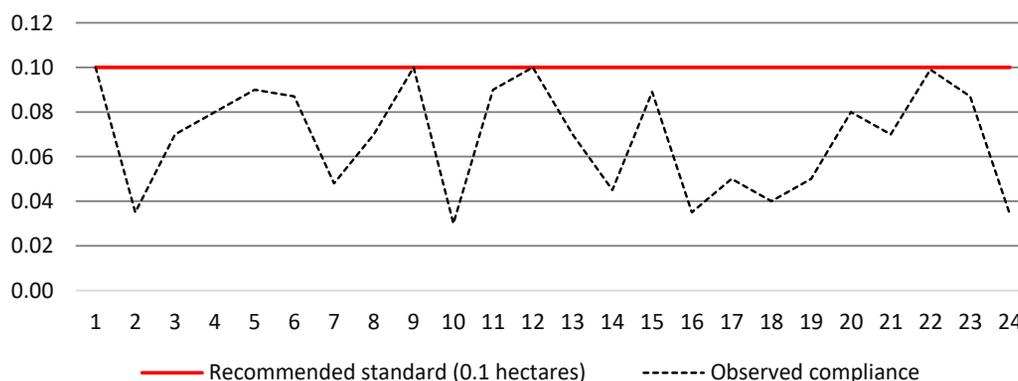

Fig. 2: Graphical depiction of the extent of compliance in Nyanchwa neighbourhood

sizes (M = 0.068, SD = 0.224) was lower than that of the recommended plot size/test value of 0.1 hectares. This difference was further subjected to a one-sample t-test to determine its statistical significance. The test demonstrated that the differences between observed and recommended compliances were statistically significant, t (23) = -6.305, p = .000. Furthermore, the mean difference between the two variables (observed compliance and recommended standard) was -.0312, implying that compliance declined by an average of -.0312 hectares. The extent of compliance is further depicted graphically (Fig. 2) with an indication that most plots did not comply with the recommended planning regulation of 0.1 hectares.

A further analysis was undertaken on a case by case basis to determine the extent to which each developer had disregarded the planning regulation on the minimum plot size of 0.1 hectares. Results indicated that while 8.3% of plots had areas of 0.03 hectares and 0.08 hectares respectively, a majority (20.8%) had an area of 0.09 hectares compared to 12.5% that had an area of 0.04 hectares. Conversely, 16.7% had respective areas of 0.05 hectares and 0.07 hectares. Generally, it can be construed that 83.3% of the sampled plots in Nyanchwa failed to comply with the recommended minimum plot size of 0.1 ha.

Mwamosioma sublocation

The recommended minimum plot size for Jogoo, Nyamataro, Egesa, and Daraja Mbili were 0.1 hectares (Jogoo and Nyamataro) and 0.05 hectares (Egesa and Daraja Mbili). From this background, analysis commenced by spatially representing the extent of compliance, using Jogoo neighbourhood as a case example (Fig. 3). The GIS spatial analysis makes evident that while most noncomplying residential plots were located along the Kisii – Nyamira transportation corridor, those complying were mainly located within the neighbourhood's interior. This underpins the primacy role that this corridor has occasioned on land subdivisions. As a consequence, in the absence of effective development control initiative by the CGOK, the trend is bound to replicate in other plots at the disadvantage of sustainable spatial development.

Although it was established that some sampled residential developments in Daraja Mbili complied with the prescribed minimum plot size, analysis of each plot showed that 46% failed to meet the set minimum threshold of 0.05 hectares. The significance of this observed noncompliance was tested statistically. The one-sample t-test results indicated that in Jogoo, the mean difference (0.03) was statistically significant, t (69) = -8.35, p = .00, likewise, at Nyamataro, the mean
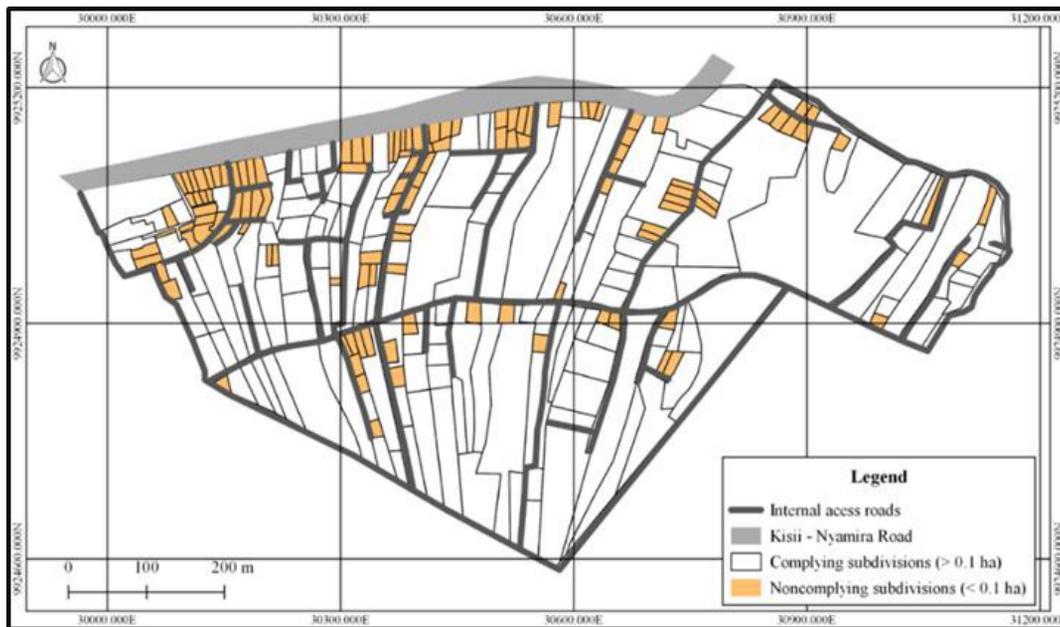

Fig. 3: Noncomplying land subdivisions in Jogoo neighbourhood

difference (-0.03) was significant, t (34) = -2.24, p = 0.03. This significant trend was simulated in Egesa (mean difference = -0.01), t (30) = -3.30, p = 0.00. Nonetheless, as mentioned before, in Daraja Mbili, though the mean difference (0.01) was not unfavourable, it was still statistically significant, t (59) = 2.56, p = 0.01. A summary of the observed extent of mean compliance regarding plot size and their corresponding test values were further demonstrated graphically (Fig. 4).

Nyaura and Bobaracho Sublocations

Compliance with recommended land subdivision regulations in Nyaura and Bobaracho sublocations were jointly analyzed because their applicable planning regulations on minimum plot size were the same. Whereas the notable residential urban neighbourhood in Nyaura sublocation is Mwembe, Nyamage, on the other hand, is the major neighbourhood in Bobaracho sublocation. The descriptive one- sample statistics showed that the mean size of plots in Mwembe and Nyamage were within the recommended minimum standard of 0.05 hectares (M =.065, SD =.087 and M =.16, SD =. 25). Results of significance using one-sample t-test further demonstrated that both respective mean differences for the minimum plot size in Mwembe and Nyamage

(0.06 and 0.16), were significant, t (39) = 4.75, p =0.00 and t (29) = 3.51, p = 0.00 suggesting general compliance (Table 3).

Given the above results, the study examined each sampled plot to determine the extent to which they were independently complying with the recommended regulations. Results disclosed that in Mwembe and Nyamage, 57% and 45% of the plots were respectively less than 0.05 hectares. This confirmed that enforcement was ineffectual at the disadvantage of effective development control in Kisii Town. From the foregoing, the study sought to investigate the implication of uncontrolled land subdivision in Mwembe and Nyamage. To achieve this, a particular reference was made to the Building Coverage Ratio (BCR) as a key land use planning standard. The justification for this choice is that uncontrolled land subdivisions in urban areas potentially contribute to the uneconomical size of land, consequently resulting in inadequate space within a plot. This, in turn, negates the land use development control objectives of access, convenience and aesthetics. The BCR refers to the size of the constructed building floor plate (that is, first-floor total area) as compared to the total size of the plot of land. This is demonstrated in Fig. 5.
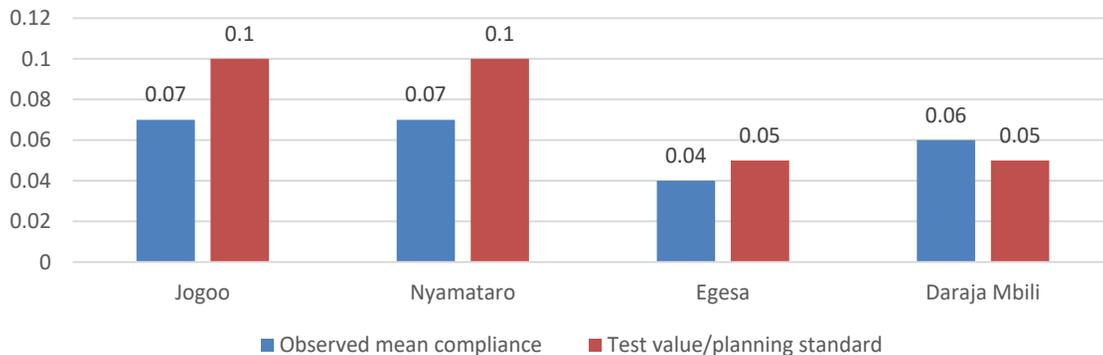

Fig. 4: Compliance with minimum plot size in Mwamosioma sublocation neighbourhoods

Table 3: Test on compliance with the minimum plot size in Mwembe and Nyamage residential neighbourhoods

Residential Neighbourhood	Test Value = 0.05 Hectares			
	t	df	Sig. (2-tailed)	Mean Difference
Mwembe	4.75	39	.00	.06
Nyamage	3.51	29	.00	.161

The recommended BCR for Nyamage and Mwembe neighbourhoods by the CGOK is 70%. Enforcing the standard is largely intended to contribute towards the following urban sustainability benefits: 1) Establishing increased provision of essential services such as on plot parking; 2) Providing planners with options to design additional habitable and open spaces, in consequence enhancing the quality of buildings by maintaining the ratio of open space to built-up space; 3) Increasing mandatory open spaces around the domestic building which enables sufficient natural lighting and ventilation by reducing the amount of built-up environment, and so positively impacting on urban microclimate. From the foregoing, the study consequently explored the correlation between BCR and plot sizes in Nyamage and Mwembe neighbourhoods (Table 4).

Results demonstrate that in Nyamage, a negative and significant correlation emerged between BCR and plot size (r = -.594, n = 30, p = .001), suggesting that plots with higher BCR tended to be smaller in size. The same was, however, not observed in Mwembe

(r = -.064, n = 40, p = .694). Spatial distribution of noncomplying plots, a case of Mwembe was further undertaken (Fig. 6). Though noncompliance with recommended minimum plot size seems to have affected less than 50% of plots, the situation could have changed by the time the current study was completed in October 2019, since the Preliminary Index Diagram (PID) sourced from the Kisii County Survey Office was last updated in 2001. In the absence of effective land subdivision control by the CGOK, challenges such as provision for adequate access roads and optimal densities are predicted to soon escalate.

Table 5 presents a summary (%) of non-compliance with the recommended minimum plot size per neighbourhood in the study area. This is based on the field measurements undertaken in the respective neighbourhoods. The highest noncompliance has been registered in Nyamataro (100%), followed by Nyanchwa (88%) and Jogoo (84). This gives a clear indication that enforcement of subdivision regulations remains inadequate in the entire Kisii Town.
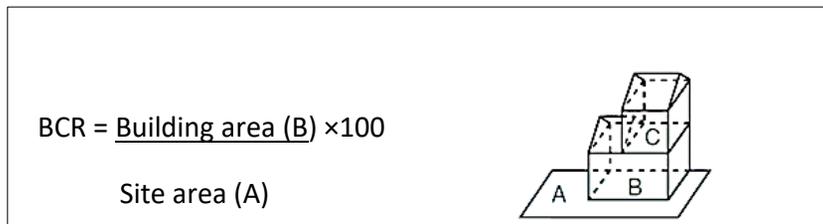

$$BCR = \frac{\text{Building area (B)}}{\text{Site area (A)}} \times 100$$

Fig. 5: Illustration of BCR (UN-Habitat, 2013)

Table 4: Correlation between BCR and plot size in Mwembe and Nyamage neighbourhoods

Nyamage		BCR	Plot size
BCR	Pearson Correlation	1	-.594**
	Sig. (2-tailed)		.001
	N	30	30
Plot size	Pearson Correlation	-.594**	1
	Sig. (2-tailed)	.001	
	N	30	30
Mwembe			
BCR	Pearson Correlation	1	.064
	Sig. (2-tailed)		.694
	N	40	40
Plot size	Pearson Correlation	.064	1
	Sig. (2-tailed)	.694	
	N	40	40

Fig. 6: Noncompliance with minimum plot size in Mwembe neighbourhood

Table 5: Summary of noncompliance with subdivision regulations

Sublocation	Sublocation Residential Neighbourhood	Recommended Minimum Plot Size (Ha)	% of non-compliance
Mwamosioma	Jogoo	0.1	84
	Nyamataro	0.1	100
	Egesa	0.05	83
	Daraja Mbili	0.05	46
Nyaura	Mwembe	0.05	58
Bobaracho	Nyamage	0.05	63
Nyanchwa	Nyanchwa	0.1	88

The findings of this study agree with that of Agheyisi (2018) who found out that inadequate implementation of the existing legal framework on land subdivision encouraged land-use conflicts in the urban areas of developing countries. The findings further relate to that of Kiama (2010) who established that although there were subdivision regulations which guided land use in Karen Langata, Nairobi, Kenya, irregular subdivisions persisted resulting in negative impacts to the environments. The research findings further confirm the arguments by Boob and Rao (2014) who established that insufficient enforcement of land subdivision regulations in India provided room for developers who violated building regulations. Nonetheless, while Agheyisi (2018); Boob and Rao (2014) and Kiama (2010) were limited to descriptive analyses, the current study addresses its self to the positivist research philosophy, a deductive method of inquiry through factual field measurements to determine the extent to which developers complied with recommended land subdivision regulations by working on quantifiable and measurable observations where spatial and statistical analyses were used.

CONCLUSION

The objective of this paper was to determine the extent to which residential developers in Kenya were complying with land subdivision regulations, a case study Kisii Town. The study findings have demonstrated that most land subdivisions from the neighbourhoods of the four sublocations in Kisii Town do not comply with the recommended land subdivision planning regulations attributable to inadequate enforcement by the CGOK. The scope of this study was limited to the subdivision of land planned for residential use. To further contribute to the discourse on land use planning, a suggestion for further research is made for other categories urban land uses such as commercial, educational and industrial. This will ensure that challenges afflicting subdivision of all categories of urban land are exhaustively addressed through research, hence informing academia, governance and policy. The problem continues unabated notwithstanding the existing legal and policy framework that grants the CGOK the powers to regulate land subdivisions to attain a sustainable spatial urban development. In the end, uncontrolled land subdivisions in Kisii Town has hastened land use planning challenges that include, but not limited to the uneconomic size of land, especially in the peri-urban areas; encroachment on road reserves; the proliferation of informal settlements; the diminishing of planned urban green spaces; high BCR and inadequate on plot parking in residential areas. If the status quo remains, these problems are anticipated to further escalate owing to increased demand for land on the account of the ever-increasing population in the study area. The following recommendations are, therefore, made towards land subdivision control in Kisii Town: 1) There is a need for the CGOK to adopt strict enforcement and monitoring regime that ensures total compliance with recommended land subdivision regulations in Kisii Town; 2) The CGOK should regularly mount sensitization campaigns to enlighten members of the public on development control procedures concerning land subdivisions; 3) The public/developers should frequently be educated on the dangers of involving incompetent/ non-accredited persons in the processing of land subdivisions in Kisii Town; 4) At the same time, the CGOK should deliberately establish a County Spatial Planning Coordinating Committee to harmonize and coordinate institutions and related agencies that deal with development control processes and management such as land subdivisions; 5) To ensure that only registered professionals undertake consultancy on land subdivision development control, the CGOK should form a collaborative partnership with relevant professional associations and Boards that regulate professional practice such as the Physical Planners Registration Board, Institution of Surveyors of Kenya, and Land Surveyors Registration Board; 6) The CGOK should ensure that only registered persons are involved in the development control process of land subdivision. It should, therefore, implement more rigorous mechanisms for detection of frauds in the preparation of land subdivision proposals, including implementation and supervision of these proposals.

AUTHOR CONTRIBUTIONS

W.O. Omollo sought for the study authorization from the relevant government institutions. He developed the study methodology that also comprised preparing a checklist that was used in data collection. He further interpreted and analyzed the data. R.O. Opiyo undertook a literature review that included the introductory background information and the theoretical context. He trained and supervised the research assistants as well as coordinated primary data collection. He also coded the collected questionnaires and thereafter undertook data entry using SPSS. Both authors, edited the paper to ensure completeness and consistency with the journal's formatting guidelines.

CONFLICT OF INTREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript. In addition, the ethical issues; including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy has been completely observed by the authors.

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