Urbanization-Triggered Industrial Development in Kenya's Peri-Urban Areas and Its Implications on Food Security: The Case of Kiambu County

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ABSTRACT

Urbanization presents significant challenges and transformations in rural development and food security, particularly in rapidly expanding peri-urban regions. This study examines what urbanization-triggered industrial development means for food security in Kiambu County, Kenya, which neighbors the national capital city, Nairobi. Using Neo-Malthusian theory and a pragmatic research approach, a mix of qualitative and survey-based data was collected and analyzed in responding to the study questions. The study sought to evaluate how industrial expansion as an element of urbanization influenced food production, distribution and the local food system. From a sampling frame comprising of farmers, agricultural workers, urban planners and officials from the government drawn from Kiambu Town, Kikuyu and Ruiru subcounties, a sample size of 400 was determined using Slovin's formula. Purposive and proportionate simple random sampling techniques were used to share the sample across the subcounties. Quantitative data was analyzed using descriptive statistics while the qualitative data set was analyzed using content analysis. The study established an 85% increase in conversion of farmland into industries over the last 20 years. The increase in industrialization had contributed to a decline in food production as reported by 65% of the respondents as more people left farming to work in the industries. Land-use transformations caused by urbanization-triggered industrial development show that fewer farms are involved in agriculture and old food systems are being replaced. The study points out that local realities differ greatly from the national rules set in the form of zoning and greening policies. It recommends to policy makers and development experts that improving land management, city planning and developing urban farming will improve food security and put peri-urban industrial growth on a sustainable path.

Key words: urbanization, industrialization, food security, agricultural productivity, peri-urban development, land-use transformation, urban farming, zoning policies

INTRODUCTION

The increasing trend of urbanization since the start of the 21st Century is changing global economies, influencing populations and altering land use in both industrialized and emerging countries. Rapid changes in urban areas can be seen in Africa, especially with extraordinary increases in populations of peri-urban zones. When cities spread into rural areas, part of the land that was previously used for farming often changes to other uses such as housing development, roads and factories which may put the region's food security at risk. This dynamic is evident in Kenya, as cities grow, causing the conversion of farming zones into industrial parks or housing estates to accommodate the growing population. These land use changes have a profound effect on food security in these areas as production decreases while populations requiring to be fed increase.

Evidence from across the world indicates that urban growth often reduces the size of farm land under cultivation and consequently the volume of food produced in such environs, irrespective of presence of laws, policies and regulations. For instance, even though China has passed land protection measures like the Red Line, industrial development has still resulted in loss of large tracts of farmland in the Pearl River Delta and cities such as Shenzhen (Gao & Wu, 2014). Bengaluru, in India, has also made a similar change from a mainly agricultural area to a metropolitan center (Ramachandra, *et al*., 2012). Urban sprawl has also been found to damage the environment, result in increased food prices and made some regions in Latin America dependent

on imported foods (Valdres & Garcia, 2018). These studies serve to buttress the fact that the nexus between urbanization-triggered industrial growth and food security challenges is no longer a matter of academic pursuit, but one that requires firm policy and strategy intervention to alleviate the attendant negative effects.

In Africa, Lagos in Nigeria and Addis Ababa in Ethiopia have also experienced exponential population growth coupled with industrial development that has eaten into land previously used for food production, adversely affecting food security in the two cities and the adjacent peri-urban areas (Gnamura, Antwi & Abenet, 2025; Osayomi & Lawanson, 2022). While industrialization remains key in the growth and advancement of a country, its effect on farming activities have not received the scholarly attention that should trigger policy and strategy action to ensure balance that fosters sustainability. United Nations projections for 2023 showed that the world's urban population would increase to 6.29 billion people by 2050, putting more strain on resources needed for food, water and shelter.

In Kenya, urban development is estimated to be expanding at 4% annually, leading to conversion of farmland in adjacent peri-urban areas such as Kiambu into residential areas as well as industrial parks. Real estate companies and entrepreneurs continue to convince land owners to sell their land, zoning regulations notwithstanding, further reducing the size of available farm land and hence food production. Ruiru, Kiambu Town and Kikuyu subcounties have experienced increased industrial growth, a development that continues to impact food security in the localities. Despite this reality, the link between urbanization-triggered industrial development and food security has not received adequate academic attention in terms of research. Moreover, Kiambu County Nutrition Action Plan (CNAP 2020/2021 – 2024/2025) shows that malnutrition is high among residents of informal settlements within the county and available food produced in the county no longer matches the rising demand for it. This study is particularly important given that Kenya is working to achieve her Vision 2030 which emphasizes among other things industrialization and food security.

Using county-based data, the study builds a base for rethinking the policy and strategy actions that drive sustainable industrialization that does not compromise food security. From an academic point of view, most of the existing studies (Karambu *et al.*, 2024; Abuya, 2020; Njiru 2016) have studied the question of urbanization in Kiambu County without, directly zeroing in on urbanization-triggered industrial development and its attendant effects on food security therein. In addition, these studies, though informative, present fragmented and sometimes conflicting findings, underscoring the need for an integrated approach that directly examines how the two study variables intersect. The study narrows down to the period between 2020 and 2024, during which Kiambu County experienced declining farm land and hence rising food insecurity as industrial development flourished.

LITERATURE REVIEW

Industrialization is the process of transforming an agrarian economy into a manufacturing one (Allen, 2010). Due to the creation of jobs and economic growth, the process has historically resulted in urbanization. The establishment of one or more factories in an area, which raises the demand for factory labor, is usually the catalyst for urbanization. The factories are then followed by other companies like retailers, service providers, and building manufacturers to satisfy the workers' needs for products. This establishes an urban area and generates even more jobs and housing demands.

The industrial sector's rapid growth has had a significant impact on agricultural land used for food production because they competed for the same land. Over time, fertile agricultural land is frequently turned into industrial sites, residential neighborhoods, and infrastructure projects because of this expansion (Davis & Golden, 2017). As a result, there is less land available for farming, which put pressure on the capacity to produce food, thus undermining food security, especially in urban and peri-urban areas.

Ratcliffe, Stubbs and Keeping (2021) established that agricultural land is increasingly seen as prime real estate for commercial development in areas that are rapidly growing industrially. Small-scale farmers are increasingly finding it challenging to maintain their landholdings or grow their farming businesses because of the competition among investors to purchase their land for industrial development or real estate. Furthermore,

by decreasing the supply of locally grown produce and increasing reliance on imported food which may be less expensive or nutrient-dense the change in land use can upset regional food systems.

Industries "catalyze" the transformation of agrarian communities that are dominated by smallholders (Mmbengwa *et al.,* 2019; Woldemichael *et al.,* 2017). Smallholder agriculture used to dominate the economies of some of Asia's rapidly developing industrial nations, including China, Malaysia, Taiwan, Vietnam, and South Korea (Welteji, 2018). Despite the "catalytic" role that industries play in achieving rapid economic growth, this sector frequently has significant costs and societal and environmental effects. Rapid urbanization and industrialization lead to ongoing demands on land in urban and peri-urban areas, transforming local economies and converting smallholders' agricultural lands (Liu *et al.,* 2016; Welteji, 2018).

Most of the world's agricultural output comes from smallholder farming, an important but underappreciated sector (Mukasa *et al.,* 2017). Smallholder farmers are those who almost entirely rely on family labor and own small plots of land where they grow one or two cash crops and subsistence crops. Despite their poverty, smallholders are crucial to economic development, have a significant impact on the process of changing land use and cover, and contribute to the preservation of agrobiodiversity in developing nations (Manandhar *et al.,* 2018; Sabo *et al.,* 2018). A common definition of land conversion is the process of transferring land from one use to another; in the context of this paper, this includes turning agricultural land into urban and industrial uses.

Across the globe, ongoing industrial development involves changes in land use, especially in peri-urban areas in many nations (Martellozzo *et al.,* 2018). The creation of industrial zones in peri-urban areas can create strong development opportunities by diversifying sources of income from off-farm and non-farm employment, according to studies done in Bangladesh, PR China, Vietnam, and sub-Saharan African countries Henke & Vanni 2017). Additionally, according to a study by Rondhi *et al.,* (2018), rural areas benefited economically more from agricultural land. According to them, agricultural land produced a value that was only 19% higher, suggesting that conversion of agricultural land is simple. Therefore, attention should be paid to how to establish strong urban-rural connections so that both rural and urban communities can benefit from the forward and backward links of industrialization.

Some studies contend that the negative effects of agricultural land conversion (ALC) outweigh the positive effects on nearby smallholder communities. For example, some studies specifically demonstrate how ALC decreased employment opportunities in the agricultural sector and increased landlessness (Tian *et al.,* 2016). In addition to ALC, Bonye, Aasoglenang & Yiridomoh (2020) says that the development of massive infrastructure projects because of urbanization and industrialization is another factor contributing to the loss of agricultural land in many Global South peri-urban areas. However, since all economies and societies must evolve in some way and because socioeconomic transformation invariably entails significant changes in land use, particularly in the least developed nations like Ethiopia, some short-term negative effects are offset by favorable long-term results.

Gelan and Dukem towns lack a proper prior planning and ALC monitoring system, even though ALC may have a lot of positive or negative effects. The stabilization of the food supply and the livelihoods of smallholder farmers depend on the appropriate management of ALC. El-Azeim & El-Mageed (2021) found that ALC is not the only significant issue with agricultural land; improper cropping patterns also contribute to the deterioration of land quality. Despite the significance of assessing and analyzing how industrialization and ALC affect smallholder farmers' livelihoods, no systematic study has been conducted in Gelan and Dukem towns to our knowledge.

Thus, for the first time, we have assessed the impact of ALC and industrialization in these towns in this study (Dadi *et al.,* 2016). Household surveys, library searches, expert interviews, field observations, official reports, and statistics were among the methods used to gather and analyze the effects of industrialization and ALC. These methods were also used in similar earlier studies (Dadi *et al.,* 2016; El-Azeim *et al.,* 2021).

The study's findings suggest that both local and international communities as well as investment firms would gain from proper planning before land conversion and the application of suitable monitoring techniques. More

significantly, this paper offers a thorough multidisciplinary case study that contributes to a better understanding of the dynamics and structure that sustain and enhance smallholder farmers' sustainable livelihoods. To support food security and the livelihoods of farming communities, policies that safeguard agricultural land and encourage sustainable land use must be balanced with industrial development, which is essential for economic growth and job creation. This paper seeks to analyze the role of industrial development in Kiambu County in shaping food supply chains, including how urban industries affect agricultural practices and food availability from 2000 to 2024.

Theoretical Framework

This study is anchored on the Neo-Malthusianism and Social Exclusion theories. Neo-Malthusianism Theory, rooted in the work of Thomas Malthus and developed further by contemporary scholars such as Ehrlich and Ehrlich (1990), posits that rapid population growth exerts significant pressure on environmental resources, leading to resource depletion and food insecurity. The theory suggests that as population increases faster than food production capacity, issues such as land fragmentation, reduced agricultural productivity, and resource scarcity become inevitable. Several studies have applied this theory to analyze challenges related to food security in rapidly urbanizing areas (Lerner, 2018; Tupy & Pooley, 2022). Its strength lies in highlighting the physical limits imposed by population growth on food production. However, the theory has been criticized for oversimplifying food insecurity by focusing mainly on resource scarcity while underestimating social and economic factors (Simon, 1981). Despite this limitation, Neo-Malthusianism provides a valuable lens to examine how land-use changes and population pressures in Kiambu County impact agricultural productivity and food availability.

To complement Neo-Malthusianism, this study incorporates Social Exclusion Theory, originally conceptualized by Marshall and Townsend in the 1970s and further developed by scholars such as Silver (1994) and Andress (2020). This theory argues that food insecurity is not only a result of physical scarcity but also social and economic marginalization, where certain groups are systematically denied access to resources and opportunities. Studies employing Social Exclusion Theory have effectively explained food insecurity in urban contexts by emphasizing poverty, discrimination, and unequal access to food distribution systems (Freedman *et al.*, 2016; Andress, 2020). The theory's strength is its focus on the socio-economic barriers that prevent equitable food access, though it may sometimes overlook ecological and resource constraints.

The rationale for integrating these two theories is to capture a comprehensive understanding of food security challenges in Kiambu County. Neo-Malthusianism addresses the biophysical limits imposed by urbanization and population growth, while Social Exclusion Theory sheds light on the socio-economic inequalities exacerbated by these changes. This combined approach allows this study to contribute uniquely to the literature by linking environmental pressures with social dynamics, thus offering a more holistic analysis of how urbanization affects food security. It also provides a framework to identify targeted interventions that address both resource constraints and social inequities.

METHODOLOGY

This study is grounded in the pragmatic research paradigm, which emphasizes workable solutions by combining qualitative and quantitative methods to address the intricate relationship between food security and urbanization in Kiambu County. Because of this paradigm's support for methodological flexibility, the study collected diverse data types and adjusted to new insights. The study employed a descriptive survey research design, enabling broad analysis of land use patterns while also delving deeply into the main causes of urbanization and its effects on food security. Triangulation, or cross-verification of results from several data sources and viewpoints, was used to improve validity and reliability and guarantee a more comprehensive, well-rounded understanding of the problem. This method went beyond simply summarizing trends by systematically linking contextual insights with empirical data, thereby demonstrating the pragmatic paradigm's commitment to generating knowledge that is both relevant and applicable.

The target population comprised local subsistence farmers, agricultural workers, urban and rural residents, small and medium business owners in the food supply chain, local government officials and urban planners,

agricultural extension officers, and food security experts. A sample size of 400 was obtained from a target population of 1,150,000 using Slovin's formula. Purposive and stratified simple random sampling procedures were employed to proportionately allocate respondents across the sub-counties of Ruiru, Kikuyu, and Kiambu. Heads of institutions engaged in policy and strategy work were purposively chosen for key informant interviews, while the rest of the members in each stratum were subjected to a semi-structured questionnaire. Policy and strategy documents were also reviewed and compared against primary data to ensure reliability of the findings. Quantitative data were analyzed using descriptive statistics, while qualitative data were analyzed using content analysis. All ethical considerations, including informed consent and anonymity, were strictly observed.

Limitations Of the Study

Despite the methodological rigor, this study faced certain limitations. First, reliance on self-reported data through questionnaires and interviews may have introduced response bias, as some participants could have provided socially desirable rather than candid responses. Second, although stratified sampling improved representativeness, the geographical scope was confined to three sub-counties, which may limit the generalizability of the findings to the entire Kiambu County or other urbanizing regions in Kenya. Third, while triangulation strengthened validity, researcher bias in interpreting qualitative data cannot be completely eliminated, even with systematic coding. Furthermore, the use of Slovin's formula provided a practical sample size, but it does not fully account for the heterogeneity within sub-groups, particularly informal food vendors and marginalized households who may have been underrepresented. Finally, time and resource constraints limited the possibility of conducting longitudinal analysis, which could have offered deeper insights into the long-term dynamics of urbanization and food security**.**

Sampling Techniques

The study employed a mixed sampling approach, combining purposive, convenience, and multistage cluster sampling. The Planning Department and Lands Office were purposively selected as institutional respondents through expert sampling, given their specialized knowledge of land use, urbanization, and development planning. This ensured that key informants with direct experience provided relevant insights.

To capture geographic representation, the study population was divided into three clusters Kiambu Town, Ruiru, and Kikuyu sub-counties reflecting their proximity to Nairobi Metropolis and their significance to urbanization dynamics. Within each cluster, respondents were proportionally distributed in line with population statistics. Convenience sampling was then applied to identify specific categories of participants, including local farmers, agricultural workers, urban and rural residents, business owners in the food supply chain, local government officials, urban planners, agricultural extension officers, and food security experts. This combination of techniques provided both depth from expert perspectives and breadth from diverse community representation.

Limitations And Possible Biases

Despite the methodological rigor, this study faced certain limitations. First, reliance on self-reported data through questionnaires and interviews may have introduced response bias, as some participants could have provided socially desirable rather than candid responses. Second, although stratified sampling improved representativeness, the geographical scope was confined to three sub-counties, which may limit the generalizability of the findings to the entire Kiambu County or other urbanizing regions in Kenya. Third, while triangulation strengthened validity, researcher bias in interpreting qualitative data cannot be completely eliminated, even with systematic coding. Furthermore, the use of Slovin's formula provided a practical sample size, but it does not fully account for the heterogeneity within sub-groups, particularly informal food vendors and marginalized households who may have been underrepresented. Finally, time and resource constraints limited the possibility of conducting longitudinal analysis, which could have offered deeper insights into the long-term dynamics of urbanization and food security.

Ethical Considerations

The study adhered to the ethical standards of the National Defense University–Kenya and received research clearance from the National Commission for Science, Technology, and Innovation (NACOSTI). Prior to data collection, the research underwent a full ethics review to ensure impartiality and fairness. Participants were fully informed of the study's purpose, procedures, and potential risks, and consent was obtained voluntarily. Anonymity and confidentiality were strictly maintained, with all data securely stored and used solely for research purposes. The study respected cultural contexts, identified vulnerable groups such as low-income households and marginalized communities, and implemented safeguards to protect their interests. Care was taken to communicate results responsibly to prevent stigmatization or misinformation. Finally, the study acknowledged potential researcher bias and emphasized minimizing harm while maximizing benefits, including considering possible effects on local food systems.

RESULTS AND DISCUSSION

Response Rate

The study targeted 400 respondents across Kiambu Town, Ruiru, and Kikuyu sub-counties, comprising subsistence farmers, agricultural workers, urban and rural dwellers, food supply chain business owners, urban planners, local government representatives, agricultural extension agents, and food security experts. Data were collected through questionnaires, Key Informant Interviews (KIIs), and Focus Group Discussions (FGDs). Of the 107 questionnaires issued to departmental heads and relevant institutions, 89 were returned (83.1%), while 253 of 276 distributed to other respondents were completed (91.6%), resulting in an overall questionnaire response rate of 90.3% (346 usable questionnaires). Additionally, 9 of 11 KIIs (81.8%) and all 6 FGDs (100%) were successfully conducted. The high completion rates exceeded the 70% threshold recommended by Kumar (2018), ensuring that the data collected was sufficient and reliable for analysis.

Table1: Response Rates for Questionnaires, KIIs, and FGDs

Table 1: Response Rates

Method	Targeted	Completed	Response Rate (%)
Departmental Questionnaires	107	89	83.1
Other Respondent Questionnaires	276	253	91.6
Total Questionnaires	**383**	**346**	**90.3**
Key Informant Interviews (KIIs)	11	9	81.8
Focus Group Discussions (FGDs)	6	6	100
Overall Total Respondents	**400**	**361**	**90.3**

Source: Field Data (2025)

Main Results

The study attained a response rate of 83%, which was adjudged good enough to warrant analysis and reporting of findings. Most respondents (85%) reported that industrial activity had increased significantly in their area over the past 20 years. They associated this growth to factories and industrial zones, especially in peri-urban and urban areas such as Kiambu Town, Kikuyu, and Ruiru. Fewer respondents (15%), who frequently live in primarily rural areas or in areas less affected by urbanization and industrial growth, reported no discernible rise in industrial activity. In one of the FGDs, a participant commented that:

Nowadays, there are factories everywhere, especially around Ruiru. What used to be vast stretches of farmland has quickly transformed into industrial estates. The area has changed dramatically over the years, with warehouses and factories replacing crops and livestock. While this brings jobs and growth, it also raises concerns about environmental impact and loss of agricultural land.

The following is a distribution of the industries that have grown in the respondents' area based on their feedback. Significant growth in manufacturing industries was noted by many respondents (40%) especially in urbanized areas like Kiambu Town and Ruiru. With new structures and infrastructure initiatives changing the landscape, the construction sector (30%) was identified as a key force behind urban transformation. Agro-processing industries, especially those that support the value chains for tea, coffee, and dairy, saw moderate growth, according to 15% of respondents. Urbanization and the county's proximity to Nairobi are driving the gradual emergence of technology and ICT-related industries (10%). A respondent in Kidfarmaco, Kikuyu stated as follows:

Constructions in Kikuyu Town seem endless as each time I pass through, there is a new building coming up. The pace of development is remarkable, with former farmlands and open spaces quickly turning into residential flats, commercial buildings, and business centers. While this urban growth creates jobs and improves infrastructure, it also raises concerns about reduced agricultural land, increased congestion, and pressure on essential services.

As demonstrated by Kiambu's proximity to Nairobi, the World Bank (2021) states that industrial expansion is frequently concentrated in areas with better infrastructure, market accessibility, and proximity to major cities. Early stages of urban-industrial development are often dominated by the manufacturing and construction sectors, which are fueled by the growing demand for consumer goods, commercial space, and housing (UN-Habitat, 2020). In areas with a strong agricultural heritage, agro-processing industries are also essential because they enable value addition and connect rural and urban markets (FAO, 2019). A participant in a FGD commented as follows regarding industrial expansion:

The agro-processing plant near us used to rely heavily on milk from local farmers. But now, many farms have shut down due to high input costs, low milk prices, and changing land use. With fewer active dairy farms, the plant struggles to get enough supply, which affects its productivity and local livelihoods. This decline in dairy farming has also disrupted the value chain, from transporters to vendors, highlighting the broader economic impact on the entire rural community. The loss of steady income for families has led to increased poverty levels, and some youths have migrated to urban areas in search of work.

The respondents were asked how much Kiambu County's food security was impacted by industrial development. Where 5 means "not at all," and 1 means "to a very large extent." There have been both positive and negative effects of industrial development on food security in Kiambu County, according to the respondents' insights. Just 10% of those surveyed thought that industrialization had substantially improved food production, processing, or availability in their region when asked about the connection between industrialization and food production. The majority (40%) said the effect was average, while 25% reported a moderate impact. Only 15% of respondents said there was no impact at all as displayed in **Table 2** below.

Table 1: Effects of Industrial Development on Food Security

S/No.	Statements	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
1	Increase in food availability in your area	10	25	40	10	15
2	Affected your access to food	65	20	10	5	5
3	Contributed to changes in food prices	15	75	10	0	0
4	Led to environmental pollution affecting	20	65	5	10	0
5	Increased competition for natural resources	80	10	5	5	0
6	Led to shift from farming to industrial labor	30	70	0	0	0

Source: Authors (2025)

These findings are consistent with those of Wambugu (2018) who established that areas like Juja, Limuru, and Lari have historically been important agricultural zones in Kiambu County, but major amounts of agricultural land have been converted into residential, commercial, and industrial uses due to rapid urbanization and

economic development. This change is especially noticeable in the creation of industrial parks, such as the Kiambu Industrial Park

The study also sought to assess the impact of industrialization on food access and overall food security in Kiambu County. The findings indicate that industrial growth, closely linked to urbanization, has significantly influenced food systems and the livelihoods of residents. Notably, 65% of respondents stated that urbanization had a significant impact on their ability to access food. This was attributed to increased demand for land, rising food prices, and infrastructural developments displacing traditional food markets or farming spaces. An additional 20% noted a moderate effect, while only a minority (15%) felt that urbanization had a negligible or no effect on food access. These results suggest that most of the population perceives urbanization, driven in part by industrial expansion, as a central factor affecting food availability and accessibility.

A key area of concern raised by respondents was the change in food prices, which were reported to be closely linked to industrial development. While 15% of respondents reported a very large effect, a significant 75% acknowledged a moderate impact. Notably, none of the respondents stated that industrial development had no effect on food prices. This universal acknowledgment underscores the role of industrialization in altering local economic dynamics, particularly in increasing the cost of living and reducing the affordability of food for low- and middle-income households. This dynamic can be attributed to factors such as disrupted food supply chains, land conversion from farming to industrial or residential use, and a shift from subsistence agriculture to market dependency.

Another critical aspect emerging from the study was the environmental consequences of industrialization, particularly pollution. About 20% of respondents believed that pollution-such as from factories, waste disposal, and water contamination had a major negative impact on agricultural productivity. An additional 65% reported a moderate impact, indicating that pollution is widely recognized as a factor contributing to declining soil fertility, water quality, and crop yields. Only a small portion of respondents perceived the effects as negligible. These findings highlight a pressing environmental-security concern: as industrial development progresses, it risks undermining ecological systems necessary for food production, thus threatening the sustainability of local food sources.

A major theme that emerged from the data was competition for natural resources, especially land and water, both essential for agriculture. Here, most respondents (80%) noted a significant impact of industrial development on resource availability, while another 10% reported a moderate impact. Only 5% saw the effects as minor, indicating a strong consensus that industrial activities have displaced agricultural use of resources. This competition has introduced tensions over land rights, water access, and equitable resource distribution, which have strategic implications for regional stability.

The transition from farming to industrial labor was raised as a core issue. Seventy percent of respondents noted a moderate impact, while 30% described the transition as having a significant negative effect on food production. None of the participants believed that this shift had no impact. This labor migration highlights a structural transformation in the county's economy: as individuals seek employment in factories and urban services, agricultural labor dwindles, leading to a decline in local food production.

Kiambu County has benefited from the economic opportunities presented by industrialization and this development has come at a cost to food security. The region faces multiple interlinked challenges, including resource competition, environmental degradation, rising food costs, and declining agricultural participation. These findings underscore the urgent need for strategic planning that balances industrial growth with sustainable food systems to ensure long-term security and stability.

The study also collected a range of views from respondents on how food security in Kiambu County can be improved in the context of ongoing industrial expansion, which underscored the urgency of balancing economic development with sustainable agriculture and food access, particularly in peri-urban regions. As industrial growth continues to alter land use patterns, respondents emphasized the need for multi-layered strategies that address food production, land preservation, and institutional coordination.

A key theme that emerged was the protection of farmland from industrial encroachment and land fragmentation. Respondents stressed the importance of enforcing zoning laws that clearly demarcate agricultural land and protect it from speculative or unauthorized development. They noted that unchecked land subdivision has made farming economically unviable in some areas, threatening local food supplies and rural livelihoods. According to many participants, establishing strict land-use policies combined with regular monitoring would help preserve arable land and maintain agricultural productivity. This, in their view, is a foundational step in ensuring food security under pressure from industrialization.

One practical and increasingly relevant solution to mitigating food insecurity is the promotion and support of urban agriculture-the cultivation, processing, and distribution of food within urban and peri-urban areas. As global urbanization continues to accelerate, including in developing countries like Kenya, the need to incorporate food production into urban planning becomes more critical. Kiambu County, due to its proximity to Nairobi and its rapidly urbanizing nature, presents a unique opportunity to implement this approach as a strategic measure to improve local food access, promote environmental sustainability, and enhance urban resilience.

Governments, especially in rapidly urbanizing regions, should prioritize integrating food production into city planning, particularly in informal settlements and low-income neighborhoods where food insecurity is often most severe. Favorable policy frameworks, including inclusive zoning laws, subsidies, and training programs, can empower communities to reclaim control over their food systems. Zoning laws that explicitly allow for urban agriculture such as rooftop gardens, community farms, and edible landscapes can significantly increase access to fresh food while also promoting community cohesion and ecological sustainability. Urban agriculture is not only a food security solution but also offers environmental and social benefits. The conversion of vacant lots, rooftops, balconies, and small home gardens into food-producing areas helps create green spaces that beautify urban environments. These green spaces serve multiple functions: they provide shade, reduce the urban heat island effect, and improve the aesthetic value of neighborhoods particularly in densely populated and underserved urban areas. This contributes to residents' psychological well-being and social pride, fostering a sense of ownership and empowerment.

Urban agriculture enhances urban resilience and reduces dependence on increasingly volatile food supply chains. By enabling communities to produce a portion of their own food, cities become more self-reliant and better able to withstand shocks such as inflation, supply disruptions, pandemics, or climate-related disasters. Moreover, this can reduce social tension related to food scarcity, which has historically contributed to unrest in many urban centers. The availability of locally grown food can act as a buffer against conflict and instability, particularly in times of economic or environmental crisis.

Another important feature of urban farming is its efficient use of limited space and resources. Innovations such as vertical farming, hydroponics, and container gardening demonstrate that even small spaces can be highly productive with the right techniques and inputs. Advocates often say, "No space is too small to grow something." This is particularly relevant in urban slums, where land is scarce but the need for fresh, affordable food is urgent. Additionally, urban farming promotes circular economies, as organic waste can be composted and reused, and rainwater can be harvested for irrigation.

Urban agriculture therefore offers a practical, scalable, and sustainable solution to the problem of food insecurity in urbanizing regions like Kiambu County. For such initiatives to succeed, government support through policy, investment, and education is essential. As cities continue to expand, integrating food systems into urban planning must be viewed not as a luxury, but as a strategic necessity for achieving long-term food security, public health, and urban stability.

CONCLUSION

The experiences of Kiambu County show that urban development, industrial change and food security influence each other. Because Nairobi is so easily reached, land is being quickly turned into housing and business areas, reducing areas for farming. People lose their previous occupation, harvest less because they cannot farm themselves and are less able to handle sudden changes in food supply or costs. Because land is

divided into smaller pieces by inherited land distribution and growing populations, many individuals move away from farming and buy more of their food. Obstacles like pollution and higher resource use from industry add pressure to farm environments which threatens their sustainability.

There are immediate pressures in the county to control unlicensed growth and divide land between competing uses. Because policies are not enforced properly and the systems are not well organized, communities are at higher risk from economic and environmental problems.

Kiambu should plan its land use carefully so farming traditions are honored as the county grows into an urban area. Both innovative urban farming and new technology in farming may reduce food insecurity. For strategies to benefit everyone and support the food system, policymakers should involve many different stakeholders.

RECOMMENDATIONS

1. The National Land Commission should enact and enforce legislation banning subdivision and sale of key agricultural land in the interest of enhancing food security.

2. The County Government of Kiambu should empower zoning enforcement units to prevent illegal land conversion and construction in protected farming areas

3. The Ministry of Lands and Physical Planning should swiftly institutionalize real-time land-use monitoring systems (Remote Sensing and GIS) to detect agricultural land encroachment.

4. The Ministry of Agriculture and Livestock Development should increase investment in urban-resilient agricultural technologies such as greenhouses, hydroponics, and precision irrigation to enhance food security in the face of competing land uses.

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