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Article

# From Farmland to Factories: How Industrial Growth Is Reshaping Water, Energy, Food, and Health in Namanve, Uganda

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## Abstract

Across sub-Saharan Africa, industrial growth is promoted as a path to economic development and job creation. However, industrial expansion often replaces forests, wetlands, and farmland, with limited understanding of its impacts on essential community resources: water, energy, food, and health (WEFH). This study explores these effects in Namanve, Uganda, a peri-urban area transformed by the Kampala Industrial and Business Park (KIBP). Drawing on nine key informant interviews with individuals from institutions such as the Uganda Investment Authority and Local Councils, and using a deductive thematic approach, the study examines perceived changes linked to industrial activity. While informants noted increased infrastructure and investment, they also reported water contamination, food insecurity, energy unaffordability, and health risks. These findings reveal how industrial development can create uneven impacts across interconnected systems. The study highlights the importance of inclusive planning, stronger environmental regulation, and active community engagement for achieving equitable and sustainable urban-industrial development.

**Keywords:** Namanve; industrial development; peri-urban transformation; resident perceptions

## 1. Introduction

Industrial development is growing rapidly across sub-Saharan Africa, as governments seek to boost economic growth, create jobs, and modernize infrastructure (Güneralp et al., 2018). In Uganda, this has taken the form of industrial parks, such as the Kampala Industrial and Business Park (KIBP), located in Namanve, just 14 kilometers east of Kampala (Queensland & Leeds, 2019; UIA, 2016). KIBP was planned as a major investment hub meant to attract factories and logistics companies, and it has become one of the largest industrial zones in the country (UIA, 2016).

As the industrial park has expanded, it has brought major changes to Namanve's landscape (Achoroi, 2017). Areas that were once covered by wetlands, forests, and farmland have been cleared to make space for roads, warehouses, and factories (Achoroi, 2017). These changes have disrupted the natural systems that many local residents once depended on for food, clean water, household energy, and health (Achoroi, 2017; Ahmed, 2023; Angiro et al., 2020; Biryomumaisho et al., 2022; Nyende, 2018).

Despite these visible changes, there is limited research on how industrial development affects people's everyday lives in peri-urban areas like Namanve. Most studies focus on national policies, land use patterns, or investment flows, but less is known about how industrialization is experienced

at the community level, especially in terms of its impact on essential resources such as water, energy, food, and health, referred to in this study as WEFH (Ahmed, 2023; Angiro et al., 2020; Biryomumaisho et al., 2022; Fowsia & Kakuba, 2019; Kazoora, 2003; Nyende, 2018). These systems are closely connected, and a change in one area often affects the others (Bwire et al., 2023; Nuwayhid & Mohtar, 2022). For example, water contamination can lead to illness, which affects food production and increases household vulnerability (Nuwayhid & Mohtar, 2022).

This study aimed to address this gap by exploring how long-term residents and stakeholders perceived the effects of industrial development on WEFH in Namanve. It used a qualitative approach, drawing on key informant interviews with individuals from government agencies, environmental institutions, and local councils who had lived or worked in the area for over two decades. Their perspectives offered insight into how industrialization was reshaping WEFH resources in peri-urban environment.

By focusing on these local experiences, the study contributed to the growing body of research advocating for more inclusive, sustainable, and community-informed approaches to urban and industrial planning in rapidly urbanizing cities (Ringler et al., 2016).

## 2. Methods

### a. Study Design and Research Paradigm

This study used a qualitative design to explore how long-term residents and institutional stakeholders understand the effects of industrial development on water, energy, food, and health (WEFH) systems. The analysis followed a deductive approach, using a predefined WEFH framework to guide both data collection and interpretation.

### b. Study Area and Context

The study was conducted in Namanve, a peri-urban area located in the Kampala Metropolitan Region, Uganda. The area includes the parishes of Bweyogerere, Kirinya, and Nantabulirwa, which lie within the Lake Victoria Basin. Over the past two decades, these communities have experienced rapid land use changes driven by the expansion of the Kampala Industrial and Business Park (KIBP), resulting in environmental degradation and shifts in local livelihoods (Ahmed., 2023).

### c. Sampling Strategy and Participants

Participants were selected through purposive sampling to ensure representation from institutions and individuals with long-term involvement in the area. Nine key informant interviews were conducted with representatives from the Uganda Investment Authority, the National Forestry Authority, and current or former Local Council leaders. All participants had either lived or worked in Namanve for more than 20 years. Three informants were selected from each parish to ensure geographic and institutional diversity. Sampling was concluded once variation in responses across sectors and parishes had been captured.

### d. Researcher Reflexivity

The researcher has professional experience in environmental health and development work in Uganda, which informed the study design and topic selection. To minimize bias, interview guides were pilot tested, and a structured coding framework was applied. Reflexive journaling was maintained to track positionality and analytic decisions throughout the process.

### e. Ethical Considerations

Ethical approval for this study was obtained from the Institutional Review Board of the United Nations University - Institute for the Advanced Study of Sustainability (UNU-IAS). Verbal informed consent was obtained from all participants, and confidentiality was ensured throughout the study. No personally identifiable information was collected, and transcripts were anonymized prior to analysis. The full verbal informed consent script is included as Supplementary Information 1 (SI 1).

#### f. Data Collection

Data were collected through semi-structured interviews conducted in English. The interview guide was organized around four domains i.e, WEFH, and included open-ended questions to explore perceived changes, challenges, and recommendations. The full guide is provided in Supplementary Information 2 (SI 2). Interviews lasted between 45 and 90 minutes and were held at purposively chosen key informants from 1st May 2023 to 17th May 2023. All interviews were audio-recorded with consent.

#### g. Data Cleaning and Preparation

All interviews were audio-recorded and transcribed verbatim. A systematic data cleaning process was followed to ensure accuracy and consistency:

- **Transcription Accuracy:** Transcripts were cross-checked with audio recordings to correct discrepancies (MacLean et al., 2004).
- **Anonymization:** Identifying information was removed to protect participants' confidentiality (Saunders et al., 2015).
- **Standardization of Terminology:** Common terms were standardized across transcripts to address language variation and ensure analytic consistency (Fennelly et al., 2021).
- **Exclusion of Irrelevant Data:** Non-pertinent material was excluded based on predefined inclusion criteria aligned with the study objectives (Yadav, 2022).
- **Formatting** – All transcripts were formatted uniformly to support clear analysis and traceability (Fennelly et al., 2021; Yadav, 2022).

#### h. Data Analysis and Trustworthiness

The data were analyzed using deductive content analysis, guided by a predefined framework based on the four WEFH domains. This approach allowed for a structured examination of how industrial development was perceived to affect each resource area. The categories WEFH were used as the primary coding framework, with sub-codes developed to capture specific issues raised by participants.

The analysis involved reviewing each transcript multiple times to identify key ideas, repeated concerns, and illustrative examples. Data were categorized by resource area, and patterns were examined for frequency, emphasis, and relevance. Coding and data management were conducted using Dedoose, a web-based qualitative analysis software that supports collaborative analysis (Grant et al., 2023).

In addition to resource-related impacts, the study coded and categorized recommendations made by informants. These were analyzed through descriptive content analysis and grouped according to the type of intervention (e.g., environmental restoration, policy enforcement, service delivery) and the resource domain concerned (Mishra & Dey, 2022; Yadav, 2022).

### 3. Results

The nine key informants represented diverse institutional roles and geographic areas within Namanve, including local governance, environmental regulation, and industrial planning. A summary of their characteristics, including parish affiliation, sector, and years of engagement, is provided in (SI 4).

Thematic analysis of the interviews revealed distinct but interconnected concerns across the domains of WEFH. The breakdown of themes, along with additional illustrative quotes not included in the main text, is available in (SI 5). The results below are organized according to the WEFH framework used in the study.

#### a. Water: Improved Access, Declining Quality

Informants widely recognized an improvement in the availability of piped water infrastructure over the past two decades. However, this gain was consistently overshadowed by deep concern over the deterioration of natural water sources due to industrial pollution. Respondents attributed the degradation of streams, rivers, and wetlands to effluents from factories, unregulated human activities, and poor waste management.

One informant noted:

*“Access to improved drinking water sources has increased... However, there has been a noticeable increase in water pollution.” (KI1)*

Another added:

*“The quality of water bodies has suffered due to industrial effluents and chemicals, leading to a significant increase in chemical contamination.” (KI2)*

The issue was not isolated to formal industries alone. Informants also mentioned informal sectors and increased urban activity as contributing to water degradation:

*“Water pollution has emerged as a critical issue, with human activities such as brick laying, washing bays, and industries contributing to the degradation of local water bodies.” (KI6)*

Overall, the perception was that improved access had come at the cost of water safety and ecological health.

#### **b. Energy: Greater Reliability, Shifting Use Patterns**

The expansion of industrial infrastructure in Namanve was widely credited with stabilizing the electricity supply in surrounding communities. All informants observed a marked improvement in reliability and fewer blackouts, which had positively impacted households and small businesses.

*“The availability of electricity has improved, supporting local businesses and improving quality of life for residents.” (KI9)*

Despite these improvements, some noted an environmental and social trade-off, particularly a shift away from renewable sources:

*“Strangely enough, solar energy consumption in the area has reduced over the last 20 years with more people relying on the national grid.” (KI3)*

Another respondent expressed concern about the broader impact of increased energy consumption:

*“While the reliability of the electricity supply has improved, the environmental cost of increased energy consumption is concerning.” (KI8)*

Overall, energy access had improved, but questions remained about sustainability and equity in distribution.

#### **c. Food: Loss of Agricultural Land and Food Insecurity**

The conversion of farmland to industrial and residential use emerged as a major concern across all interviews. Informants consistently linked land loss to reduced local food production, increased dependency on external food sources, and the erosion of traditional food systems.

As one informant explained:

*“The reduction in land has been one of the most significant impacts of industrial development, leading to a reliance on imported foods and a decrease in food security.” (KI3)*

Another noted:

*“Where families once grew a variety of foods, they now have to purchase food, often at higher prices.” (KI2)*

The shift was described not just as economic, but cultural and nutritional:

*“The loss of fertile land to industrialization has severely impacted local food production, increasing dependence on imported foods and affecting dietary diversity.” (KI7)*

This theme reflected growing concerns around affordability, nutrition, and the long-term sustainability of food access in a rapidly urbanizing environment.

#### **d. Health: Emerging Illnesses and Environmental Risk**

Health was the most cross-cutting theme, with respondents attributing increased illness to air and water pollution, dust, vehicle emissions, and industrial waste. Several noted a rise in respiratory issues, waterborne diseases, and lifestyle-related illnesses such as diabetes and hypertension.

One informant stated:

*“There has been an increase in respiratory issues due to air pollution especially flu/cold in children.” (KI1)*

Another reflected:

*“Air, soil, noise and water pollution have directly impacted community health, with a rise in flu, asthma, allergies, etc.” (KI7)*

The shift in disease patterns was widely noted:

*“Health concerns have broadened beyond traditional diseases like malaria.” (KI3)*

These health impacts were seen as the outcome of cumulative environmental stress and inadequate local health infrastructure. Informants emphasized that industrial growth had introduced a new set of challenges that existing public health systems were not adequately prepared to manage.

## **4. Discussion**

This study explored how long-term stakeholders in Namanve Central, Uganda, perceived the impacts of industrial development on WEFH resources. Through nine key informant interviews with representatives from government, regulatory bodies, and community institutions, the findings reveal a complex picture of infrastructural progress coupled with environmental and social trade-offs. While the expansion of the KIBP has brought improvements in electricity access and piped water infrastructure, it has also contributed to environmental degradation, reduced food security, and new health risks for local communities.

### **a. Environmental Trade-offs in Water and Energy Access**

Informants acknowledged that access to piped water and electricity had improved over the last two decades. However, this infrastructure expansion has come at the expense of natural water systems. Industrial effluents, unregulated human activity, and poor waste management have led to widespread contamination of rivers and wetlands, which previously served as community water sources. These findings are consistent with other studies in the Lake Victoria Basin and similar peri-urban contexts in Africa, where rapid industrialization outpaces environmental safeguards (Badamasi et al., 2019; Isunju et al., 2016; Kundu et al., 2017).

Similarly, while electricity reliability has improved due to industrial investment, several respondents expressed concern over increasing dependency on the national grid and the decline in use of renewable energy sources, such as solar. The loss of ecological infrastructure, wetlands, forests, and soil cover, raises questions about the sustainability of current energy and water systems, particularly in the face of growing urban and industrial demand (Güneralp et al., 2018; Mugo et al., 2020).

### **b. Industrialization and the Decline of Local Food Systems**

Across all interviews, the conversion of farmland into industrial and residential zones was cited as a key driver of reduced food production and increased food insecurity. Informants described how households that once relied on small-scale farming have become dependent on market-based food systems, often facing higher prices and reduced dietary diversity. These findings reflect a broader regional pattern, where land use change undermines the resilience of peri-urban food systems.

The erosion of traditional agricultural practices also represents a cultural loss, as generational farming knowledge and food heritage are displaced by urban expansion. This dynamic echoes global literature warning that unchecked industrial development can marginalize rural and peri-urban communities, shifting them from producers to consumers in ways that increase vulnerability.

### **c. Health Impacts and Emerging Environmental Risks**

All key informants raised concerns about the health impacts of industrial development, particularly the rise in respiratory illnesses, waterborne diseases, and emerging conditions linked to pollution and lifestyle changes. Dust, traffic emissions, and contaminated water were frequently cited as contributors to a deteriorating health environment. These perceptions align with recent studies linking urban-industrial emissions to increased public health risks in East African cities.

Importantly, informants noted that local health infrastructure had not kept pace with environmental change. The increase in disease burden was not matched by improvements in healthcare services, leading to gaps in prevention, treatment, and monitoring. This supports arguments that environmental injustice is often concentrated in peri-urban zones, where regulatory enforcement is weak and institutional support is uneven.

### **d. Implications for Policy and Planning**

The study's findings highlight the urgent need for more inclusive and ecologically sensitive urban-industrial planning. While infrastructure gains have occurred, they have not been equitably distributed, nor have they accounted for the degradation of vital ecological systems. Planning processes must better integrate community voices, protect critical green spaces, and prioritize multisector coordination across environment, health, and land use sectors.

Furthermore, regulation of industrial waste disposal and energy efficiency should be strengthened to protect the long-term sustainability of water and health systems. Policy frameworks such as Uganda's National Environment Act (2019) provide a legal foundation, but their enforcement at the local level remains limited.

### **e. Limitations, Strengths, and Boundaries**

This study has a few limitations. It involved only nine key informants, which may not fully reflect all views within the community. Although participants were selected for their long-term experience in the area, the study may have missed perspectives from other groups, such as women, informal workers, or younger residents. The findings are also based on people's experiences and observations, not on direct measurements of water quality, food security, or health. Because the study was cross-sectional, it captures perceptions at one point in time and does not show changes over time.

Despite these limitations, the study has important strengths. It draws on the deep local knowledge of people who have lived or worked in Namanve for many years. This helps provide a rich and grounded understanding of how industrial development is affecting daily life. Using the WEFH framework helped organize the findings in a way that shows how water, energy, food, and health are connected.

The study is limited to one location, i.e., Namanve, and focuses on four key areas. While the findings may not apply to every peri-urban or industrial area, they offer useful insights that can inform similar settings facing rapid change.

## **5. Conclusions**

This study explored how long-term residents and local stakeholders in Namanve Central understand the impacts of industrial development on water, energy, food, and health. Based on nine key informant interviews, the findings show that while infrastructure such as piped water and electricity has improved, this progress has come with serious trade-offs. Informants pointed to increased water pollution, the loss of farmland, rising food insecurity, and growing health problems linked to air and water contamination.

These results suggest that industrial development in peri-urban areas can bring uneven outcomes, offering some benefits while also creating new risks for the communities that live nearby. The experiences shared by key informants highlight the urgent need for better environmental protections, stronger regulation of waste and pollution, and more inclusive planning that involves local voices.

As Uganda and other countries continue to expand industrial parks, it is essential to ensure that development plans consider not only economic growth but also the health and wellbeing of affected communities. Future research should continue to document these local experiences and inform more sustainable and equitable approaches to urban-industrial development.

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**Informed Consent Statement:** Verbal informed consent to participate was obtained from all participants in accordance with ethical protocols approved by the UNU-IAS ethics committee. All participants provided verbal informed consent for the publication of anonymized data. No identifiable personal information was included in the manuscript

**Data Availability Statement:** The data that supported the findings of this study were included as Supplementary Information (SI), containing anonymized interview transcripts, the coding framework, and a thematic breakdown. Additional materials could be provided by the corresponding author upon reasonable request.

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