

Developing an Evidence-Based Urban Security Management Framework for Sustainable Smart Cities in Kenya: A Case Study of Konza Technopolis

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ABSTRACT

This study was aimed at determining the effect of governance practices on the security management in urban areas within Konza Technopolis, and at creating an evidence-based Urban Security Management Framework to help with the development of smart cities in sustainable way. The results show that good urban security requires not only technological innovation but good governance practices to coordinate institutions, involve stakeholders and embed digital technologies and foster organisational learning. Governance, then, is more about the institutional base along which the outcomes of smart technologies in terms of sustainable security outcomes can be realized. The study identified the positive effect of institutional coordination on collaboration between the organisations in charge of planning, implementation and management of urban security. Good coordination enables timely sharing of information, improves the efficiency of operations and minimises institutional fragmentation where institutions have overlapping security mandates. The results also show that the involvement of stakeholders in meaningful ways leads to better transparency, increases public trust, and fosters mutual accountability for urban safety through greater joint efforts from governments, private sector organisations and communities. The study also proves that use of technology in urbanization improves the surveillance, communication and emergency response in urban security. But technology is not enough to solve the complex security challenges in urban areas. It requires effective governance, institutional accountability and ongoing partnership between stakeholders. The results show that the two aspects of technology and governance are not competing but complementary elements of the smart city development process. This study has made an important contribution by inductively developing an evidence-based Urban Security Management Framework based on the empirical findings from the Key Informant Interviews, Focus Group Discussions, document analysis and field observation. The proposed framework is grounded in concrete experiences in Kenya's flagship smart city, and captures the institutional dynamics of new urban settings in Sub Saharan Africa, as opposed to many of the current smart governance frameworks that are conceptual and/or normative. Therefore, the framework expands on the current research on scholarship in three ways, by illustrating the mechanism by which governance processes between technological innovations and sustainable urban security management. Comparative case studies of several African smart cities, or a mixed method study using a larger number of data sets could be used in future research to explore the relationships found in this study.

Keywords: Urban security management; Smart cities; Konza Technopolis; Governance coordination; Cybersecurity; Community participation

INTRODUCTION

As populations continue to expand in urban areas around the world, governments are facing increasing pressure to deliver safe, efficient and sustainable urban environments. The Urban Age has become a new reality in which cities are growing rapidly, and digital technologies have become crucial to deliver better services, to manage infrastructure and to ensure public safety at a higher level. This transition has helped to bring about the smart city concept which seeks to use information and communication technologies in the governance of cities to improve efficiency, responsiveness and sustainability (OECD, 2020). Smart city is

more than technology. In contemporary views, the connection of digital infrastructure, participatory governance and data driven decision making are central to sustainable urban development (UN Habitat, 2022). Urban security is thus a focal point in the scope of smart city projects, where urban authorities aim to deal with both the old and new security challenges, including crime.

Urban population continues to grow at an unprecedented rate around the world. The United Nations report (UN Habitat, 2022) reveals that the world population is increasingly urban, thus there is a higher demand for housing, transport systems, public utilities and security services. Governments have reciprocated with greater investments in technologies like digital monitoring platforms, automated technologies for emergency response, predictive analytics and integrated surveillance systems to enhance urban management and security (World Bank, 2020). Experience from abroad shows that investments in technology do not necessarily lead to better security outcomes in cities. Advanced surveillance and monitoring technologies have been adopted in many countries, including Singapore, where they have been successfully incorporated into security systems, leading to better emergency response and public safety. However, the advancement of cybercrime and digital vulnerabilities is ongoing and constantly evolving, placing new security threats that demand constant adaptation and institutional preparedness (Singapore Police Force, 2024). These experiences highlight that smart city security is not only about technology, but also governance structures that are able to meet new threats.

In Africa, the fast urbanization process has exacerbated problems of providing infrastructure, inequality and public safety. Growing urbanization has frequently outstripped institutional capacity, leading to a strain on governance systems, and the spread of informal settlements. Poor accountability mechanisms and inadequate service delivery and governance are often associated with public insecurity (Afrobarometer, 2022). Some of the cities in Africa have started implementing aspects of smart city development, but many are still facing problems of access inequity to technology, reduced public participation and governance inefficiencies (Makunike & Chigora, 2022). Urbanisation in Kenya has grown significantly in the past ten years, rising from about 11 percent of the population in 2010 to an estimated 39.4 percent in 2023 (World Bank, 2023). This development has put a strain on the urban infrastructure and security systems, especially in the biggest cities. Theft and burglary and violent crime continue to pose challenges as evidenced in the number of cases reported in the crime statistics, with limited financial resources limiting investments in modern security technologies and infrastructure (National Police Service, 2023). Acknowledging these challenges, the Government of Kenya has adopted smart city development as a priority in national development planning. Technology-driven urban transformation is a key pathway towards economic growth and sustainable development identified in Vision 2030. The Smart Cities Blueprint and the Urban Areas and Cities (Amendment) Act also highlight the need to integrate digital systems into the governance and delivery of urban services (Government of Kenya, 2019). Despite these policy commitments, there are challenges that impact implementation of outcomes including institutional coordination, governance effectiveness, and stakeholder engagement (Konza Technopolis Development Authority, 2023). Konza Technopolis is the biggest smart city project in Kenya, and will be part of the Vision 2030 flagship. The city was designed to be interwoven with advanced information technologies, modern governance systems and sustainable urban planning principles. It has an integrated security system as one of its development framework development priorities and institutional collaboration and data driven urban management (Konza Technopolis Development Authority, 2023). But implementation experiences show that governance challenges remain, such as lack of coordination, variation in technology uptake and involvement of neighbouring communities.

While the effect of governance on the success of smart city projects has been recognised by previous studies, there is a limited number of empirical studies on how governance arrangements impact urban security management in emerging smart cities in Sub Saharan Africa. Much of the existing scholarship has focused on technological innovations and digital infrastructure and smart delivery of services, while there has been relatively little work that has examined how the interplay of institutional coordination, accountability mechanisms, stakeholder participation and organisational capacity shapes security outcomes. Moreover, the evidence that has been created to inform the smart city governance frameworks has come mostly from high income countries with institutional contexts that are significantly different from those of fast-growing African cities. This is critical, especially in Kenya, as Konza Technopolis is the country's flagship smart city

project and one of the biggest technology-driven urban developments in Africa. This work does not view technology as the key to urban security, but examines how governance processes enable or constrain the effectiveness of technology-based systems in a complex institutional arena. The study uses empirical data from policy makers, security practitioners, technology experts and the surrounding community to create an evidence based urban security management framework that is based on observed, rather than prescriptive, governance practices. In this sense, the study advances the existing discussion on smart city governance, going beyond technological capabilities to understand how the quality of governance influences the implementation and sustainability of urban security systems in emerging smart cities.

LITERATURE REVIEW AND RESEARCH GAP

The research field of smart cities has grown substantially in the last decade, with most publications covering the aspects of digital infrastructure, innovation ecosystems and the transformation of public service delivery with the aid of technology. Research in Europe and Asia typically show that urban efficiency benefits from the use of IMSs, data analytics and ITTs, as long as they are implemented in the context of proper governance structures. These, however, are mostly conducted in institutional settings in which governance structures and digital infrastructure are relatively stable and well developed.

Things are more complicated in Africa. Empirical research suggests that poor governance capacity, institutional fragmentation, funding issues, and unequal access to digital services often hinder the expected smart city benefits. Other scholars have also suggested that smart city programmes can deepen inequalities in cities if they are not being managed in a transparent, accountable and participative manner. However, little empirical studies have focused on the specific role of governance arrangements in urban security management in smart cities in Africa. The existing research on Konza Technopolis (KT) has largely focused on the economic transformation, innovation and digital development aspects, while comparatively less focus has been placed on the governance processes that impact security management. As a result, the interdependencies of institutional coordination, accountability, stakeholder relations and technological adoption to shape the security outcomes in the context of emergent smart cities are still not sufficiently understood. To bridge this gap this study aims to create an evidence based framework based on qualitative evidence from stakeholders across various groups who have a role in the governance and operation of Konza Technopolis.

THEORETICAL FRAMEWORK

This study is based on two complementary theories, that are Smart City Governance Theory and Urban Security Management Theory. These viewpoints offer a good starting point for understanding the role of governance systems, technological infrastructure and institutional coordination in urban security in smart cities. The two theories are selected based on the nature of the study that aims to investigate the governance practices and urban security management in Konza Technopolis. Theories can be combined to provide an integrated approach to understanding the relationship between smart city governance and the planning, implementation and management of security systems and the relationship between urban security outcomes and technologically driven urban environments.

Theory of Smart City Governance

Smart City Governance Theory is the outcome of the contemporary governance and smart city research which posits that the achievement of the smart city is not solely dependent on technological advancements, but also on the quality in governance systems that enable the implementation of smart city initiatives. Meijer and Bolívar (2021) claim that the effectiveness of smart cities depends on the existence of clear institutions, responsible governance, participatory decision-making and meaningful involvement of stakeholders. Likewise, Mora et al. (2020) note that governance mechanisms are key to making sure the technological innovations advance sustainable urban development and better service provision. The theory of smart cities considers them to be the complex systems with the participation of more stakeholders, such as government institutions, as well as private sector organizations, technology providers, citizens etc. In these contexts,

governance systems are supposed to enable coordination between actors, as well as accountability and the appropriateness of technology investments for overall development goals. So good governance is the prerequisite to achieve desired urban outcomes.

From this urban security point of view, Smart City Governance Theory is helpful for comprehending the impact of governance arrangements on the deployment and management of security technologies. To support the efficient functioning of smart surveillance, clear institutional responsibilities, effective oversight mechanisms and collaborative governance structures are needed, as well as digital monitoring platforms and integrated command centres. The theory thus provides an explanation as to why having advanced technologies doesn't necessarily lead to better security results. The theory is relevant to this study because it explains the influences that can be observed in the governance dimension on urban security management in Konza Technopolis. Many of these challenges, including institutional coordination, accountability, transparency, and stakeholder engagement, are integral to comprehending how smart city infrastructure contributes to security goals. The theory is used for the analysis of governance practices and processes that affect the effectiveness of technology based security interventions in the city.

Although very useful, the theory has some drawbacks. The smart city governance models have been created in environments of urban settings with high resources, where the institutional systems and technological capabilities are relatively developed. However, in many developing countries, governance problems like weak institutional systems, technical capacity and lack of stakeholder engagement can impair the fulfillment of the theory's assumptions (Giffinger & Kramar, 2022). However, the theory is still significant for smart city governance in emerging smart city environments like Konza Technopolis.

Urban Security Management Theory

In this study urban security management theory is used as a conceptual lens for understanding the organisation, co-ordination and the management of security functions in urban areas in order to maintain their safety, resilience and sustainable development. The concept is based on urban governance, urban resilience studies and security management literature, which places an increased emphasis on urban security as more than just crime prevention; it encompasses the management of risks, emergency preparedness, cyber security, and institutional responses (Foster, 2021). The theory is based on the idea that urban security is a complex process with multiple actors, institutions and technological systems, which are engaged in efforts to mitigate past and future threats. It acknowledges the fact that urban security is growing more complex and demanding in today's context, necessitating coordinated responses from both public and private actors, such as those from governmental and security institutions, emergency responses, technology providers and urban managers. A key part of good security management is the preparedness of institutions to predict risks, respond appropriately and make the best use of resources.

Urban security management is tightly related to the application of digital technologies for surveillance, monitoring, information sharing and emergency response actions in urban environments. Technological systems provide opportunities for real time data collection and analysis, enabling institutions to respond more effectively to security threats. But the theory also recognizes that appropriate security outcomes must be supported by robust institutions and capabilities if technology is to play its role. This study is relevant to Urban Security Management Theory because it deals with the practical issues of security governance in Konza Technopolis. The theory offers a framework to explore the role played by surveillance infrastructure and emergency response as well as interagency cooperation and security planning in the city's safety. It can be used to analyze the organization and management of security functions in a technologically advanced urban environment. The point of view is limited though. It focuses on institutional and technological aspects of security, which may not adequately reflect the social aspects of security such as public perceptions, community trust and informal mechanisms, which lead to security. In addition, the growing dependence on digital infrastructure can lead to new threats arising from cyber threats, data breaches and technological vulnerabilities (Kitchin, 2021). Though these constraints exist, the theory can still be helpful in understanding the functioning of urban security systems in the context of smart cities.

Theoretical Synthesis and Conceptual Perspective

The two theories are taken together to analyse urban security governance in Konza Technopolis in a comprehensive way. Smart City Governance Theory is based on governance structures, institutional processes and stakeholder relationships that impact the implementation and management of smart city systems. Urban Security Management Theory, on the other hand, offers an account of how security work is coordinated and executed in the urban context. Combining the two theories helps to support the urban security perspective that security is not a purely technological question nor is it a governance question. It is not, however, a product of a single governance institution, of a single technological system or of a single security management process, but a result of interactions between them. The Smart City Governance Theory provides an understanding of how the effectiveness of governance affects the deployment and management of technological infrastructure, and the Urban Security Management Theory provides an understanding of how the technological systems contribute to the improvement of the security outcomes by coordinated planning, monitoring and response mechanisms.

Overall, the theories give a good basis for studying the impact of governance practices on urban security management in Konza Technopolis. They provide information that contributes to the study's analysis of institutional coordination, the accountability of all stakeholders, technological integration and security operations, which gives a holistic picture of urban security in the context of a smart city.

METHODOLOGY

Research Design and Case Selection

In this study, qualitative case study was used which followed interpretivist research paradigm. The qualitative approach was deemed suitable, as it aimed to investigate the governance process, institutional arrangement, technological systems and relationships with stakeholder that shape the security outcomes in the context of an emerging smart city environment. Qualitative research offers possibilities of understanding the participants' experience of and interpretation of complex social realities which cannot be measured in quantitative studies with pre-defined variables. Multiple interacting factors affect urban security governance and tend to have a local dimension and qualitative inquiry is therefore better suited for gaining in-depth knowledge on the institutional and operational dynamics (Creswell & Poth, 2018).

The strategy of the case study was chosen due to the ability it provides to analyze current phenomena in their authentic context. Case studies are useful for exploring complex governance processes, in which the boundaries between the phenomenon and the context are not explicitly delineated (Yin 2018). The choice of Konza Technopolis as case study is due to its status as the flagship smart city project in Kenya under Vision 2030 and it's the embodiment of Kenya's aspirations for technology driven urban transformation. Konza is an emerging smart city, which offers a special setting for studying urban governance structures, technological systems and stakeholder relations as influences on urban security management in a fast-changing urban context. The strategic importance of Konza Technopolis in the national development planning process, as well as the focus on integrated governance, digital infrastructure and sustainable urban development, also contributed to its selection. The city is designed to be a model for other smart cities being developed in Kenya and the region. Therefore, the observations of the factors affecting security governance in Konza can be interpreted as having the potential to influence other cities in the developing countries that are grappling with similar urbanisation issues in the implementation of smart cities and security management (Konza Technopolis Development Authority, 2023).

Participants and Sampling

Purposive sampling was used to select the participants who had a first-hand knowledge and experience of urban security governance, smart city implementation and institutional coordination within Konza Technopolis. This was suitable as the study was not intended to explore governance processes from a statistical perspective but rather gain in-depth information from participants. The study was carried out on 36 participants from the 3 counties directly linked to Konza Technopolis namely Machakos, Makueni and

Kajiado counties. Of these, 12 people took part in Key Informant Interviews (KIIs) and 24 people took part in Focus Group Discussions (FGDs). The Key Informant Interviews focused on institutional and technical actors directly involved in urban planning, security management, digital infrastructure and public administration and policy implementation. Four key informants were purposively chosen in each county to be representative of the institutional landscape.

Three Focus Group Discussions (FGD) were held, each in a different county with a total of eight participants in each county. FGD participants included local residents, traders, youth, households affected by the Konza project and small-scale business operators. Their inclusion enabled the study to capture community experiences regarding governance, participation, security and the socio-economic implications of smart city development. Combining institutional and community perspectives strengthened the credibility of the findings through triangulation of viewpoints. Table 1 below summarises the study participants.

Table 1. Distribution of Study Participants

Data Collection Method	Participant Category	Machakos	Makueni	Kajiado
Key Informant Interviews	Institutional and Technical Stakeholders	4	4	4
Focus Group Discussions	Community Members	8	8	8
Total		12	12	12

The distribution allowed for evidence collection from both governance institutions involved in the planning process and the communities that would be impacted by the implementation of Konza Technopolis, as well as to ensure that these two groups had their needs identified. The participation of local actors from three counties also allowed for comparing the governance experiences on a broader scale of the smart city.

Data Collection

To ensure methodological triangulation and strengthen the credibility of the findings, data was gathered through Key Informant Interviews (KIIs), Focus Group Discussions (FGDs), document analysis and direct field observations were conducted. A combination of qualitative methods enabled the study to understand the issues of urban security governance from multiple angles and to cross validate evidence from various sets of participants and documents. A total of 12 institutions which were directly involved in planning, governance, security management and implementation of Konza Technopolis were selected purposively and engaged in Semi-structured Key Informant Interviews. The participants were representatives of national government agencies, county governments, Konza Technopolis Development Authority, security agencies, ICT professionals and urban planning experts. To ensure consistency across the interviews and to give a little room for elaboration on experiences and professional perspectives, interview guides were used, which are semi-structured. Interviews were conducted either in person or via secure video conferencing platforms (Microsoft Teams & Zoom). All interviews were audio-recorded with informed consent of participants and detailed field notes were taken to capture the conversation of each participant.

Three Focus Group Discussions involving twenty-four participants were held in each of the counties of Machakos, Makueni and Kajiado with each FGD comprising of eight participants to get community perspectives. The FGDs convened stakeholders and members of the local community who are impacted by the development of Konza Technopolis, which included local residents, community leaders, youth representatives, traders and other stakeholders. The conversations focused on participants' experiences of governance effectiveness, community engagement, institutional accountability and the role of technology in ensuring urban security. These discussions were facilitated by a trained moderator with a structured discussion guide and notes were taken of non-verbal interactions and contextual observations that were added to the audio recordings.

Document analysis was used as another source of evidence, and it involved the analysis of national policies, legislation, strategic plans, institutional reports, county development plans, security policies and publications of the official documents on smart city development and urban security governance. Information from interviews and focus group discussions were supplemented by documentary evidence to provide context for participants' experience and to corroborate information that came from the interviews.

The physical environment, security infrastructure, institutional arrangements and stakeholder interactions within and around Konza Technopolis were documented through direct observation in the field throughout the data collection process. The researcher used observation notes to make comparisons with the participants' narration to enhance the credibility of the findings. Data collection was continuing until sufficient depth and diversity of data were gathered to fully answer the research questions. The combination of the evidence from the interviews, focus group discussions, documentary sources and field observations strengthened methodological triangulation and the credibility, dependability and confirmability of the study. Table 2 below shows the profile of the study participants.

Table 2: Profile of Study Participants

Category	Institution/Stakeholder	Data Collection Method	Number
Konza Technopolis Development Authority (KoTDA)	Senior management and technical officers	Key Informant Interview	3
Ministry of Information, Communication and the Digital Economy	ICT policy officials	Key Informant Interview	2
National Police Service	Security officers	Key Informant Interview	2
County Governments	Planning and administration officers	Key Informant Interview	3
ICT and Smart City Experts	Technology specialists	Key Informant Interview	2
Community Members (Machakos)	Residents, traders, youth	Focus Group Discussion	8
Community Members (Makueni)	Residents, traders, youth	Focus Group Discussion	8
Community Members (Kajiado)	Residents, traders, youth	Focus Group Discussion	8
Total			36

Data Analysis

Qualitative data were analysed by theming, within a systematic and iterative process. Audio recordings made during the Key Informant Interviews and Focus Group Discussions were transcribed word for word and complete transcripts were obtained for analysis. Field note were used in conjunction with the transcripts to make sure that the context and the non-verbal expression were taken into consideration during interpretation. The data was analyzed by repeatedly reading the transcripts to familiarize oneself with the data and to look for meaningful patterns in relation to the study objectives. These initial codes were then created by providing descriptive labels to parts of text that capture participants' experiences, perceptions, and explanations of urban security governance in Konza Technopolis. Broad categories were then drawn from these similar codes which led to the formulation of themes and sub-themes, as a result of constant comparison of interviews, focus group discussions, documentary evidence and field observations.

These themes were further developed and streamlined as they were reviewed continuously to ensure that the themes are internally consistent and distinct between the categories. In order to cross-check emerging interpretations, support their results, and ensure the findings were credible, documentary evidence and observational data were used to corroborate emerging interpretations and the credibility of the results was strengthened by methodological triangulation. The overall themes were repeated in several groups of participants and were unique in other groups where they led to a broader understanding of the phenomenon studied. A presentation of findings is made up of analytical interpretation and direct quotes from the participants. Quotations use the participant codes to ensure confidentiality and to provide evidence that interpretations are based on the participants' own accounts (e.g. KII-03 or FGD-02). This method gives transparency as the reader will be able to evaluate the connection between the empirical evidence and the results of the study.

Ethical Considerations

All the ethics was adhered to throughout the research process to ensure that the participants were protected, and the research was conducted fairly. The study was voluntary and informed consent was informed before data collection began. The participants were given information about the aims of the study, what their role would be and that they could withdraw from the study at any time without any negative consequences. Confidentiality and anonymity was maintained during the process of research. Interview transcripts and research materials were anonymized to protect the participant's identity. All data collected were used only for academic purposes and were kept securely so that no unauthorised access could be made. These measures were especially significant since some participants mentioned the problems in governance and institutional processes that may be viewed as sensitive in nature. The study also practiced principles of respect, transparency and fairness in interacting with the participants. Special effort was made to allow participants to voice their opinions and experiences without fear of judgment or repercussion. In addition, the researcher was aware of the possible power differentials that could exist during the interviews and focus group discussions, especially when interviewing participants from different institutional and community settings. The ethical principles of the research increased its credibility and trustworthiness (Creswell & Poth, 2018).

RESULTS AND DISCUSSION

It presents and discusses the findings based on the study objectives. The findings are grouped into four broad themes, reflecting the four research objectives: institutional coordination, engagement of stakeholders, technological integration and building an evidence-based urban security management framework. The data collected from the Key Informant Interviews, Focus Group Discussions, documentary analysis and field observations is presented throughout the discussion to illustrate methodological triangulation. Participant quotations are presented with anonymous identifiers to retain the anonymity of the participants, and to demonstrate how the interpretations were drawn from the empirical data.

Institutional Coordination and Urban Security Management

The results showed that the coordination of institutions is a basic factor that determines effective management of urban security in Konza Technopolis. There was a general consensus that the functions of security are shared between various institutions such as national government agencies, county government, KoTDA and security agencies. While these organisations share similar security goals, overlapping mandates, disjointed communication and administrative processes result in some inefficiencies in operations, reported by participants. One of the participants said that: "Security management is more effective when agencies work together. Issues typically occur when agencies are operating separately, with information not always received at the same time. (KII-04).

Another respondent commented that

"Institutional coordination is key to converting real-time information to timely decision-making, while technology provides the information". (KII-08)

Perspectives found in the focus group discussions were the same. One community participant said:

"Residents often know where security problems occur, but they are not always sure which institution should receive the information." (FGD-02)

These results show that the governance system can affect the effectiveness of smart-city security systems. Advanced surveillance technologies can facilitate collection of information, but their efficacy requires cooperation among institutions, a clear division of responsibility, and ongoing inter-agency partnership building. This has been noted in recent research on smart city governance that suggests technological innovation can only bring about sustainable results with integrated governance systems (Meijer & Bolívar, 2021). The study, therefore, concludes that institutional coordination is not just an administrative need but a governance mechanism that helps to transform technological capability into better urban security results.

Stakeholder Participation and Urban Security Management

Stakeholder involvement promotes transparency, facilitates information sharing and fosters public trust in urban security programs, the findings show. Participants noted that security interventions can be more effective if local communities, government bodies and the private sector are engaged in the planning and implementation process and not only after a significant decision has been made. One participant remarked:

"Local communities know their security problems and issues better than anyone else, and their participation makes the process of security planning much more practical." (FGD-01)

A key informant also commented:

"Ownership happens when public participation occurs, communities will cooperate with security agencies." (KII-06)

The results in this study show that stakeholders' involvement positively affects not only legitimacy, but also operational efficiency. The evidence has confirmed the Smart City Governance Theory, which underscores the need for the collaborative governance and citizens participation as key factors in the development of sustainable smart cities (Meijer & Bolívar, 2021). The results also echo the earlier research in Africa that found that participatory governance increases accountability and enhances implementation results in fast-changing urban settings.

Influence of Technology Integration on Urban Security Management

The results show that the use of technology can improve the efficiency of urban security management, which includes the ability to monitor and oversee at a distance, communicate, share information and respond in the event of an emergency. Participants agreed that situation awareness and timely decision making are enhanced by digital technologies. They repeatedly stressed, however, that effective security outcomes could not be achieved without proper governance mechanisms, institutional capacity and operational coordination, which are linked to the technological infrastructure. A key informant stated that although technological investments are also important to the collection and dissemination of security information, institutional readiness also plays a major role.

"Technology provides the information we need, but institutions must have the capacity to interpret it and respond quickly. Without coordinated governance, technology alone cannot solve security challenges." (KII-08)

Another participant in one of the Focus Group Discussions commented that

"The smart systems make people feel safe, however people also want the information to be properly managed by the responsible institutions and the institutions to act upon when there is a problem." (FGD-03)

The study also reveals through document analysis that Kenya's Strategic document for Smart City (2012) and the Konza Technopolis Manual (2016) also promote the use of intelligent technologies and effective governance, not only technological infrastructure, but also institutional accountability and collaboration among stakeholders. Field observations also showed that institutional arrangements for coordination of security operations were accompanied by the deployment of surveillance systems, digital monitoring infrastructure and communication networks. All these results suggest that technology needs to be considered as a facilitating tool, and not a complete solution, to urban security. Effective uses of smart technologies rely on institutional coordination, skilled leadership, agility on accountability systems and ongoing stakeholder engagement. This finding builds on the existing smart city scholarship by adding that governance quality accounts for the impact of technological innovation on sustainable security management in emerging smart cities in Africa.

Development of an Evidence-Based Urban Security Management Framework

The ultimate goal was to propose a viable framework based on the empirical results, combined in a coherent governance model to improve the security in a smart city. The proposed framework was built from the empirical evidence derived from interviews, focus group discussions, documentary analysis and field observations, rather than built on existing conceptual models which are largely focused on either technological innovation or digital infrastructure.

As a result, repeated themes were identified throughout the various sources of evidence, with each component of the framework reflecting one of these themes. The qualitative data was analyzed in order to extract the four interdependent dimensions of governance that all influence the effectiveness of urban security management in Konza Technopolis. The dimensions identified by the participants were mentioned more than once in all the stakeholder groups and therefore are the basis of the proposed dimensions.

The first dimension is institutional coordination and it developed as the main way in which several organisations must act together to ensure the security of the city. Coordinated planning, sharing of information and organizational structures with clear policies and mandates are all things that consistently were identified as being beneficial to the effectiveness of security operations.

The second is stakeholder involvement. The results indicated that the ongoing interaction of government institutions, private sector institutions and local communities increases the degree of accountability, enhances public trust and facilitates the implementation of security programs.

The third dimension is technology integration. Participants identified intelligent technologies as key for surveillance, communication and emergency response but also noted that these technologies will produce sustainable gains if facilitated by competent governance structures and institutional capacities. The fourth dimension comprises adaptive governance and continuous learning. The significance of monitoring, evaluation, policy review and organisational learning in supporting governance systems to respond proactively to emerging security challenges in rapidly changing smart city environments was brought into focus through documentary analysis and participant narratives.

The four dimensions collectively constitute an integrated governance approach, and acknowledge technology as one of various elements of the institutional system, not the only source of urban security. The framework is therefore a feasible model that can support policymakers, urban planners and security agencies in charge of smart city programmes in similar institutional settings.

Derivation of the Proposed Framework

No existing governance model was adapted to develop the proposed Urban Security Management Framework, but rather the empirical evidence gathered while conducting the study was used to inductively develop it. The process of development consisted of three stages. Thematic analysis revealed common governance issues that were shared and discussed throughout the Key Informant Interviews, Focus Group Discussions, documentary evidence and field observations. Initial coding resulted in many ideas that related

to governance, which were then continually refined and expanded as themes emerged across different data sources.

Secondly, the inter-relationships between the key themes were analysed to explore the interactions among governance processes and how they jointly impacted on urban security management. The results consistently pointed towards "institutional coordination" and "stakeholder participation" as dimensions and towards "technology integration" and "adaptive governance" as dimensions, respectively. Last but not least, these interrelationships were combined into an integrated framework that shows the linkage between governance processes and the planning, implementation and sustainability of urban security systems in smart city environments. The framework therefore is evidence-based, as each component is explicitly backed up by empirical evidence gleaned from various sources and not entirely deduced from theory.

Comparison with Existing Smart Governance Frameworks

While the concept of digital transformation, innovation and technological integration are highlighted in various smart city governance models, few explicitly place governance processes as the main drivers of technological contribution to urban security management. The existing frameworks are mostly service delivery-focused, digital infrastructure or urban innovation-focused, while the framework in this study merges institutional coordination, stakeholder involvement, technology integration, and adaptive governance, into one single, integrated governance system. The proposed framework differs from many of the models that have been designed in Europe and North America, which are not designed to accommodate the institutional realities of an emerging African smart city with multiple governance actors, changing governance environments and fast-changing cities. The context-sensitive model also builds upon the current scholarship by offering one that is rooted in empirical data gathered from Konza Technopolis and the surrounding communities.

Institutional Coordination and Urban Security Management

The results have shown a strong institutional coordination as a key element on which effective urban security management is established in Konza Technopolis. Coordination between government agencies, security institutions and technology providers was a recurring theme in the discussions, and was seen as fundamental for bringing technological capacities to bear on successful operations. While advanced surveillance technologies enable the sharing of information, the results show that institutional cooperation is key to whether or not the information is available in a timely fashion that leads to coordinated security responses.

The findings confirm the ideas of Collaborative Governance Theory, which suggests that when dealing with complex public issues, they need to be addressed by coordinating the efforts of various institutional agencies rather than by each one acting on their own. They also strengthen the institutional analysis and development framework, which acknowledges governance mechanisms as influencing factors of collective action and institutional performance. The findings align with findings by Meijer and Bolívar (2021) who state that smart city initiatives are successful in implementing the necessary technologies, but that this is dependent on integrated governance structures. Likewise, Mora et al. (2019) noted that institutional cooperation contributes to building urban resilience by enhancing the coordination of different governance actors. The present study, on the other hand, builds on this literature by providing evidence that institutional coordination directly impacts urban security management in an emerging African smart city where governance systems are still in flux and evolving with the introduction of new technologies.

The study is, therefore, also empirical in that it provides new evidence to show how the quality of governance is the operational mechanism through which smart technologies result in sustainable urban security outcomes. Stakeholder participation was found to be important in improving stakeholders' legitimacy, accountability and sustainability in urban security initiatives. Increased information sharing, greater trust and higher acceptance of security interventions, when engaging communities in planning and implementation. These results align with the participatory governance literature, which states that citizen involvement enhances transparency and the effectiveness of policy. Collaborative decision-making has also

been found in previous studies to be a key element of a successful smart city implementation in terms of building relations between institutions and citizens

However, this study contributes to existing scholarship by proving that stakeholder participation contributes to an extra security role in smart cities. Continued engagement with stakeholders will also help to build intelligence, ensure community ownership of security initiatives and increase institutional responsiveness to new urban challenges in addition to promoting democratic good governance.

Technology Integration and Urban Security Management

The results have shown how technological innovation can contribute to urban security by providing better surveillance and communication/information management. But from the participants' point of view, it was clear that technology is not enough to ensure sustainable security outcomes. Rather, the capacity of the governance is the key to the successful application of technologies that lead to actual enhancements of urban safety. This result is consistent with the approach of Smart City Governance Theory that regards technology as one of the enablers in the governance system. In Europe and Asia, previous research also finds that using digital technologies adds value to urban management under proper institutional frameworks.

In the current study, however, a contextual aspect is added: the importance of governance capacity in the context of smart cities as they develop in Africa, where institutional arrangements still are ongoing and the technological progress is very rapid. This means investments in digital infrastructure need to be matched with investments in institutional coordination, institutional capacity and human resource development.

Development of an Evidence-Based Urban Security Management Framework

The key finding of this research is the creation of the Urban Security Management Framework based on empirical research. The proposed smart governance framework was created inductively from the qualitative evidence collected from interviews, Focus Group Discussions, Documentary Analysis and Field Observation that were derived from the conceptual literature. Thus the framework is different in two essential aspects from previous models. First, it makes governance and technology part of the operational model, instead of assuming technological innovation is the main factor in the development of a smart city. Second, it highlights the institutional nature of an emerging African smart city, which features a multi-governance setting, dynamic governance regimes and intricate governance partnerships. The framework therefore makes a theoretical and practical contribution in offering policymakers a governance model that can guide urban security management in smart city contexts in other parts of Sub-Saharan Africa.

Contribution to Knowledge

This study helps to expand the smart city governance literature in a few ways. First, it offers empirical evidence that shows that governance quality moderates the relationship between technological innovation and urban security management. Unlike previous research, which often has focused on digital technologies, the current research shows that institutional coordination, involvement of stakeholders and adaptive governance are all factors that influence the effectiveness of technology based security systems.

Secondly, the study enriches the Smart City Governance Theory by providing insights into the functioning of governance processes in an emerging African smart city, with multiple governance actors and evolving institutional arrangements. This contextual approach fills a significant European and Asian smart city literature which is largely focussed on smart cities in Europe and Asia.

Third, the paper builds an evidence-based Urban Security Management Framework directly from the qualitative data collected from Konza Technopolis. Thus, the framework not only contributes to the theoretical development but also provides policy makers, who are responsible for planning secure and sustainable smart cities, with guidance.

Policy Implications

The results indicate that policy makers investing in the smart city programme should consider both governance change and the creation of technologies as equally important. Institutional coordination, stakeholder engagement and strengthening institutional capabilities, as well as increased regulatory supervision and investment in institutional capabilities, are all necessary to strengthen the capacity of institutions to guarantee that technological innovations achieve sustainable urban security outcomes.

The proposed framework can hence help the national governments, the county governments, urban planners and security agencies plan for governance systems which can support future smart city development in Kenya and other developing economies in general.

CONCLUSION

This study investigated the impact of governance practices on urban security management in Konza technopolis, and created an evidence based Urban Security Management Framework for sustainable smart city development. The findings show that both technological innovation and the quality of governance systems that coordinate institutions, involve stakeholders, integrate digital technologies and facilitate organisational learning are crucial to effective city security. Hence, governance needs to be seen as the institutional structure on which smart technologies can create sustainable security outcomes. The study confirmed the importance of institutional coordination to improve the relationship between organisations involved in planning, implementing and managing urban security. Good coordination allows for timely information sharing and promotes the effectiveness of operations as well as minimises intra-institutional fragmentation where complementary security mandates exist. The results also suggest that the involvement of stakeholders in a meaningful way can create better transparency, build public trust and create a sense of shared responsibility for urban safety and will foster cooperation among government agencies, private sector organisations and the local communities.

The study also shows that technology integration plays a meaningful role in the security of the city: enhancing the surveillance, communication and emergency response capabilities. Technology can only solve complex urban security challenges, however. It relies on good governance, accountability of institutions and on-going joint efforts amongst stakeholders. The results present further evidence about the complementarity between technology and governance and not competition. The main findings of this study include the development of an evidence-based Urban Security Management Framework as an inductive product of the empirical findings gathered from the Key Informant Interviews, Focus Group Discussions, document analysis and field observations. The proposed framework is based on the actual experiences in the Sub-Saharan Africa's flagship smart city, as opposed to many of the frameworks that have been proposed from a conceptual or normative basis. The framework is thus an extension of existing scholarship, as it elucidates the role of governance processes in the relationship between technological innovation and security management for sustainable cities. The study also has valuable practical implications. The findings offer evidence to guide national and county governments, urban planners, security agencies and smart city authorities to create governance systems that improve the coordination of institutions, the involvement of stakeholders, accountability and adaptive learning, in addition to building digital infrastructure. Incorporating these governance aspects in smart city planning can enhance their long-term efficiency, resilience and sustainability in terms of urban security systems. While the study offers important lessons on governance and urban security management in Konza Technopolis, it has some weaknesses that need to be noted. The study was conducted in one case study and the results might not necessarily be applicable to other smart city contexts. In addition, qualitative design was used, which was more in the formulation of the in-depth understanding rather than the statistical generalisation. This study could be extended in future by comparing the results of the case studies from different smart cities in Africa or by applying a mixed-methods approach to investigate the interrelationships in this study with more data. Further research might also explore the impact of new technologies, such as artificial intelligence, predictive analysis, and digital governance platforms, on urban security in various institutional settings. Finally, the study shows that smart cities can realize sustainable city security by combining effective governance and technological innovation

to drive change, and not with technology alone. The study contributes to the theory of smart city governance by providing an empirically supported Urban Security Management Framework and a practical framework to enhance the urban security management in the rapidly urbanising city of Africa. The framework offers a basis for further policy development, institutional reform and scholarly study for the secure, resilient and sustainable smart city.

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