Sustainable Smart Cities through Collaborative Governance: The Role of Transformative Leadership

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Abstract

This study evaluates the transformative leadership of local administrators in Mahasarakham Municipality within the framework of sustainable smart city planning. The objectives are to assess the strengths and weaknesses of transformative leadership, identify factors influencing its effectiveness in promoting collaborative governance, and examine challenges faced by administrators in implementing smart city initiatives. It further aims to propose strategies to enhance leadership capabilities and develop actionable recommendations for fostering multi-stakeholder collaboration. A mixed-method approach was employed, integrating questionnaires and interviews informed by theoretical frameworks and literature reviews. The study surveyed 400 residents and conducted focus group discussions with 20 participants. Quantitative data were analyzed using SPSS, while qualitative data were examined through content analysis and documentary research. Key findings reveal that transformative leadership, aligned with the smart city framework, is both effective and integral to robust network-based governance. Sustainable city management in Mahasarakham Municipality received high ratings, with strengths including a clear vision, strategic policies addressing urban issues, and responsiveness to public opinions. Weaknesses involve communication gaps between agencies and the public. Factors crucial for effective leadership include inter-agency connectivity and comprehensive data sharing, which require enhanced networking. Challenges center on securing cooperation across sectors to implement smart city policies. Effective smart city development demands inclusive participation, collective problem-solving, and leveraging stakeholder potential.

Keywords: Smart city development, Sustainable urban planning, Local government leadership, Public administration, Inter-agency collaboration, Urban innovation, Stakeholder engagement.

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Introduction

A smart city represents a modern urban development approach that integrates digital technology to enhance the livability, quality of life, and sustainability of urban environments. Smart cities aim to improve public infrastructure and services, making them more accessible, efficient, and secure while also minimizing environmental impact and energy consumption, thereby promoting economic growth. According to Chulalongkorn University (n.d.), smart cities comprise seven key components: Smart Economy, Smart Mobility, Smart Energy, Smart Living, Smart Environment, Smart People, and Smart Governance. The global trend towards developing sustainable smart cities is driven by rapid urbanization, which places increasing demands on limited resources such as space, energy, and water, complicating urban resource management (Jiang & Wang, 2020).

Utilizing technology and innovation in urban development provides opportunities to address urban challenges, particularly in learning and skill development for new technologies, ensuring sustainable development. Creating sustainable smart cities enhances preparedness for future changes, reduces disaster impacts, and mitigates potential risks. The sustainable development of smart cities is crucial for national and global urban development, fostering sustainable societies and economic advancement. The utilization of technology and innovation in urban development is crucial for addressing the challenges faced by modern cities. Developing smart cities emphasizes learning and skill development, enabling citizens to adapt to and effectively use new technologies. Furthermore, it focuses on building sustainable societies and preparing for potential disasters and risks. Sustainable smart city development also promotes economic growth and enhances the quality of life. By leveraging technologies such as IoT, Big Data, and renewable energy systems, cities can improve operational efficiency, reduce pollution, and elevate the overall quality of life for their residents sustainably (Jiang & Wang, 2020).

Thailand has been pursuing smart city development since 2003, with Phuket and Khon Kaen leading the initiative to improve quality of life and economic conditions through technology and innovation, aligning with the Thailand 4.0 agenda. Effective smart city development requires clear conceptual frameworks, a deep understanding of local issues and needs, and collaborative system design to address specific problems and achieve targeted outcomes. In addition to technology, sustainable smart city development necessitates improvements in human resources, urban areas, technology, and legal frameworks. the development of smart cities that leverage digital technology to enhance urban management efficiency and improve the quality of life for citizens. Effective smart city development requires clear conceptual frameworks, an understanding of local issues and needs, and system designs that address specific problems. The challenges faced by countries in developing smart cities include leadership, governance, citizen support, investment, human capacity, smart device heterogeneity, and resource management, particularly energy systems. The article emphasizes the importance of intelligent energy systems in smart cities, which utilize artificial intelligence (AI), the

Internet of Things (IoT), and big data to tackle various challenges. It explores the status of smart energy systems, energy generation and storage, infrastructure, and energy modeling. The authors critique existing energy modeling approaches and propose a preliminary framework for successful energy systems that integrate AI, IoT, and big data. Sustainable smart city development not only addresses urban challenges but also promotes economic growth and enhances the quality (Jiang & Wang, 2020).

The importance of sustainable smart city development in Thailand is underscored by economic growth, population increase, and challenges such as traffic congestion, environmental issues, and natural disasters. Leveraging technology and innovation to address urban problems and enhance city development is essential for creating a sustainable future. Smart cities not only enhance urban efficiency but also strengthen societal resilience and stability. those highlighted in the sustainable smart city initiatives are crucial for navigating these complexities. Effective implementation requires robust conceptual frameworks, tailored solutions to local needs, and collaborative system designs. Challenges encountered in this journey encompass leadership dynamics, governance frameworks, public support, investment sustainability, human capital development, and the integration of diverse smart technologies.

Research by Noori, de Jong, Janssen, Schraven, and Hoppe (2021) highlights that while national and local governments worldwide invest in smart city development to address climate change, air pollution, and congestion, there remains a lack of practical guidance. Their work emphasizes the need for comprehensive models to inform policymakers and analysts, thereby facilitating informed decision-making and effective smart city planning, as exemplified by the "Smart Dubai" case study. Further research by Whalley et al. (2008) on the sustainable leadership development and learning within communities underscores the importance of leadership in successful urban development. Their study on the National Professional Qualification in Integrated Centre Leadership (NPQICL) program in the UK revealed significant insights into the professional development of leaders and the impact of such initiatives on public policy and local praxis. Key takeaways include the necessity of a clear vision and goals, the importance of inter-agency collaboration, and the role of innovative approaches in fostering sustainable urban environments.

Local administrators play a critical role in managing urban areas and developing sustainable smart cities. Their responsibilities encompass strategic planning, policy implementation, and resource allocation aimed at improving urban livability and resilience. Effective governance at the local level is essential for integrating technological innovations and fostering community engagement in smart city initiatives (Jiang & Wang, 2020). Local administrators facilitate collaboration between public and private sectors, ensuring that urban development strategies align with environmental sustainability goals and address local challenges such as infrastructure maintenance and citizen welfare. Moreover, their leadership is instrumental in navigating regulatory frameworks and mobilizing resources to support innovative urban projects that enhance economic growth and quality of life (Jiang & Wang, 2020).

The focus on transformative leadership in this study is based on its pivotal role in addressing the complex and multifaceted challenges of sustainable smart city development. Unlike traditional leadership styles, transformative leadership emphasizes vision, innovation, and the ability to inspire and empower diverse stakeholders, making it particularly suited to contexts where rapid technological advancements and dynamic governance structures intersect. This leadership style enables local administrators to mobilize resources effectively, foster trust among stakeholders, and build collaborative networks that are essential for implementing integrated, technology-driven urban solutions. By prioritizing transformative leadership, this study seeks to highlight how this approach can overcome traditional bureaucratic constraints, enhance adaptive capacity, and drive strategic initiatives that align with sustainability principles. Furthermore, transformative leadership has been identified in existing literature as a critical enabler of collaborative governance, as it fosters stakeholder engagement, promotes shared goals, and ensures accountability in complex urban systems.

Local administrators must present and support innovative urban development ideas, ensure clear visions and goals, foster collaborations among stakeholders, and prioritize public services. Effective leadership involves understanding local needs, designing appropriate systems, and leveraging technology and innovation to create sustainable, resilient urban environments. Transformative leadership uniquely positions local administrators to bridge gaps between technology, governance, and community priorities, ensuring that smart city initiatives are inclusive, adaptive, and sustainable in the long term. Sustainable smart city development not only addresses current urban challenges but also prepares cities for future growth and stability, benefiting both society and the economy.

Mahasarakham Municipality, established under the 1953 Municipal Act and amended in 2019, serves as a local government body for medium-sized cities. It is tasked with diverse administrative and management duties aimed at ensuring sustainable urban development. Guided by the vision "Mahasarakham: A City of Learning and Happiness," the municipality is pivotal in fostering community development and enhancing the quality of life. The municipality promotes smart city initiatives by integrating technology and innovation to improve service efficiency and urban management. Key efforts include enhancing educational quality in municipal schools, establishing early childhood development centers, upgrading public parks, promoting community economy and tourism, and developing the "Rak Mueang Mahasarakham" LINE OA application for public services (Mahasarakham Municipality, 2023).

Mahasarakham Municipality was selected as the study area due to its strategic role as a regional hub in Northeastern Thailand, renowned for its emphasis on education, innovation, and sustainable urban management. The municipality’s commitment to smart city development aligns with Thailand’s national agenda for sustainable development and offers a unique context for exploring transformative leadership in collaborative governance. Specifically, its medium-sized urban status allows for the examination of governance dynamics that are distinct from larger metropolitan areas while remaining scalable and adaptable for other similar-sized municipalities. Additionally, Mahasarakham Municipality’s

proactive initiatives, such as the development of technological tools like the "Rak Mueang Mahasarakham" application, and its focus on enhancing community well-being, provide a rich case for studying how local leadership can bridge traditional governance models with innovative, technology-driven approaches. These factors make Mahasarakham Municipality an ideal context to investigate the transformative leadership needed to advance sustainable smart city initiatives.

This study, “Strategies of Local Administrators' Transformative Leadership in Collaborative Governance for a Sustainable Smart City: A Case Study of Mahasarakham Municipality,” aims to fill a critical research gap by exploring the role of local administrators in smart city development. While existing studies on smart cities often focus on technological advancements or policy frameworks, limited attention has been given to the leadership dimensions required to operationalize these strategies effectively. Transformative leadership, in particular, remains underexplored in the context of smart city initiatives, especially in medium-sized municipalities like Mahasarakham, which face unique challenges distinct from larger metropolitan areas. This gap in knowledge limits our understanding of how leadership styles can drive collaborative governance and ensure the sustainability of urban development initiatives.

The objectives of this study are to evaluate the current level of transformative leadership among local administrators, identify the strengths and weaknesses of this leadership within the sustainable smart city framework, and explore the factors influencing its effectiveness in promoting collaborative governance. Specifically, the study addresses “why” transformative leadership is essential by examining its role in fostering innovation, stakeholder engagement, and resilience in urban management. Furthermore, it investigates “how” this leadership style can overcome barriers such as inter-agency coordination issues, resource limitations, and varying stakeholder priorities, which are prevalent in medium-sized municipalities like Mahasarakham.

Additionally, the study seeks to examine the obstacles and challenges faced by administrators in implementing transformative leadership in smart city initiatives, propose strategies to enhance leadership skills and capabilities, and develop recommendations for leveraging this leadership to foster multi-stakeholder collaboration. The findings are expected to provide valuable insights and guidelines for stakeholders to improve organizational management and adapt to evolving challenges. By addressing this research gap, the study aims to contribute to the broader discourse on urban governance by showcasing the critical role of transformative leadership in achieving sustainable and inclusive smart city outcomes.

Smart Cities Development and Governance

The development of smart cities is an increasingly important area of study as urban areas seek to address complex challenges such as demographic shifts, climate change, and economic constraints. This literature review evaluates existing research on smart city concepts, focusing on transformative

leadership and collaborative governance as pivotal elements for sustainable smart city development. Smart cities integrate technology and governance to enhance urban living conditions. Transformative leadership is crucial for fostering collaboration and innovation in this context. This review synthesizes interdisciplinary perspectives to provide a comprehensive understanding of how smart city initiatives are shaped and implemented.

White (2016) explored the global imagination of smart cities, highlighting the gap between global interest and local implementation strategies. The study emphasizes the need for localized solutions to address specific urban challenges, such as demographic changes, climate impacts, and budgetary constraints. Similarly, Mora et al. (2021) examined the theoretical foundations for sustainable smart cities, stressing the importance of co-design in aligning smart city technologies with local practices. Their work underscores the necessity of interdisciplinary collaboration in creating adaptable and sustainable urban environments. Mouton and Burns (2021) analyzed the digital aspects of smart city development, warning of potential inequalities reinforced by technology. They argued that smart city investments might replicate colonial patterns of control and exploitation, particularly affecting underdeveloped communities. This theme of equity is also present in the work of Cai and Zhang (2023), who evaluated the impact of smart cities on public service delivery through pilot projects in China. Their findings indicate that while smart technologies can enhance efficiency, their benefits are not universally guaranteed, highlighting the variability in outcomes across different contexts. Wang and Zhou (2023) investigated the environmental consequences of smart city projects in China. Their study revealed that such investments could positively impact environmental quality, such as reducing greenhouse gas emissions and increasing green spaces, though these effects vary with economic development levels. In the realm of urban transport, Pan, Zhou, Piramuthu, Giannikas, and Chen (2021) explored the use of smart city technologies to improve urban freight transport sustainability. They proposed strategies like alternative energy vehicles and efficient logistics management to reduce emissions, contributing to sustainable urban development. Baraniewicz-Kotasińska (2022) reviewed different conceptual frameworks for understanding smart cities, including technological, managerial, social, and sustainable development approaches. Her study highlighted the importance of integrating these perspectives for holistic smart city development. Finally, Hu and Zheng (2021) compared smart city projects in the US and China, focusing on governance models and public impact. They found significant differences: US cities employ participatory governance, while Chinese cities use a hierarchical model with strong government involvement, reflecting varied approaches to smart city development.

The literature reveals a multifaceted understanding of smart cities, with transformative leadership and collaborative governance emerging as critical components. Studies emphasize the importance of localized, context-specific approaches and highlight both the potential benefits and challenges of smart city technologies. There is a consensus on the need for interdisciplinary collaboration and inclusive participation to address urban challenges effectively. This review highlights

the complex interplay between technology, governance, and urban sustainability in smart city development. Transformative leadership is essential for fostering collaborative governance, addressing urban challenges, and ensuring the successful implementation of smart city initiatives. Future research should continue to explore these dynamics, focusing on inclusive and adaptive strategies to enhance urban resilience and sustainability.

Change Leadership Change Leadership and Collaborative Governance in Sustainable Smart Cities

The development of smart cities represents a significant shift in urban planning and governance, aiming to address complex challenges such as demographic shifts, climate change, and economic constraints through the integration of advanced technologies and innovative governance models. Central to this transformation is the role of change leadership, which emphasizes the ability of leaders to drive collaborative efforts and foster sustainable urban development. This literature review evaluates existing research on change leadership and collaborative governance, highlighting their pivotal roles in the sustainable development of smart cities.

Cheyne (2004) studied transformative political leadership among New Zealand mayors, emphasizing the evolving role of leadership within the context of new public management. The research highlighted the importance of collaboration between government and non-governmental networks, as well as citizen and community engagement, in enhancing local governance. Purdue (2005) examined community leadership cycles and the integration of alliances within new local governance systems. The study found that the success of local governance models depends significantly on community participation across various geographical and administrative levels, highlighting the necessity of multi-level collaboration. Woods et al. (2021) analyzed leadership objectives in UK schools, comparing four educational districts: Scotland, Wales, England, and Northern Ireland. The study identified four leadership objectives—relational, institutional reform, cloaking, and space creation—demonstrating variations in leadership emphasis across the districts. These findings illustrate the contextual differences in educational leadership within the UK's devolved governance structures. Steyvers et al. (2008) compared the transformation of local political leadership in Europe, noting a trend towards management-oriented leadership. The study emphasized the increasing empowerment of individual leaders and the challenges this poses to traditional notions of local leadership roles and conditions. Shea and Harris (2006) investigated gender differences in local political leadership in America, revealing distinct leadership styles between female and male leaders. Their findings suggested that female leaders often exhibit a higher sense of responsibility and concern for policy issues and candidate gender, potentially influencing the future of party politics in the United States. In terms of strengths, weaknesses, opportunities, and challenges of leadership, Shaaban (2023) analyzed leadership challenges, strengths, and weaknesses, emphasizing the need for continuous self-assessment, skill development, and

adaptability to evolving team needs and environments. Kaiser and Overfield (2011) focused on the overuse of strengths in leadership, cautioning that excessive reliance on personal strengths can become weaknesses, potentially undermining team and organizational effectiveness. Washington (2022) used SWOT analysis to examine opportunities for improving and expanding the programs of First-Generation College Bound, Inc., a subsidiary of My Brother's Keeper (MBK). The study highlighted the importance of situational leadership in identifying areas for engagement and support, offering insights into effective program management. Coman and Ronen (2008) emphasized the strategic importance of focusing on core strengths and weaknesses through SWOT analysis, using tools like the core-competence tree and current-reality tree to link these elements to actionable plans. Olaoye and Potter (2024) discussed data-driven decision-making in identifying strengths and weaknesses within schools, demonstrating how educational leaders can use data analytics to enhance institutional practices and outcomes.

In summary, the literature reveals a multifaceted understanding of change leadership, with collaborative governance emerging as a critical component in the development of sustainable smart cities. Studies emphasize the importance of localized, context-specific approaches and highlight both the potential benefits and challenges of smart city technologies. There is a consensus on the need for interdisciplinary collaboration and inclusive participation to address urban challenges effectively. This review highlights the complex interplay between leadership, governance, and urban sustainability in smart city development. Effective change leadership is essential for fostering collaborative governance, addressing urban challenges, and ensuring the successful implementation of smart city initiatives. Future research should continue to explore these dynamics, focusing on inclusive and adaptive strategies to enhance urban resilience and sustainability.

Sustainable Development in Smart Cities

The concept of sustainable development is integral to the planning and implementation of smart cities. Sustainable smart cities aim to balance technological innovation with environmental stewardship, social inclusion, and economic viability. This literature review examines various studies related to sustainable development within smart cities, highlighting theoretical frameworks, practical applications, and the challenges of implementing sustainable practices. Mora et al. (2021) investigated the interdisciplinary theoretical perspectives on the transition to sustainable smart cities. Their study connects the theoretical foundations of smart city development with fundamental assumptions that support the management of change towards sustainability. By detaching the concept of smart cities from purely business-driven visions, this research enhances understanding of the complexities involved in achieving sustainable urban transformation. Van den Buuse, van Winden, and Schrama (2021) explored the balance between exploration and exploitation in sustainable urban innovation, particularly within smart cities. They emphasized the potential of technological innovations to address urban sustainability challenges. The study also highlighted the importance of scaling successful pilot projects and the need for stakeholder engagement to achieve significant impacts. Noori et al. (2021) developed an import-

export model for smart city development, providing a conceptual understanding of smart cities by detailing various aspects and using these insights to create a model. This approach helps policymakers and analysts design informed strategies, offering a clearer view of the choices and challenges faced during planning and implementation. The model, inspired by "Smart Dubai," can be utilized in decision-making processes. Laenens, Mariën, and Walravens (2019) focused on inclusive participation in smart city development. They argued that increasing participation is crucial for informing policymakers about the impacts of digital growth on daily citizen activities. The study emphasized that policymaking processes must be open and willing to consider recommendations and proposals from all stakeholders to ensure successful and inclusive smart city development. Banerjee, Mandal, De, and Maiti (2023) presented a model for quality of life (QoL) in sustainable smart cities using Social-IoT and structural entropy. Their model highlights the careful coordination between intelligent APIs and foundational devices, addressing security risks and technical challenges. The successful deployment of smart city applications requires appropriate security measures for IoT devices. The empirical QoL model provides quantitative metrics to estimate the sustainability of smart cities through device parameters. Du, Zhang, and Mora (2021) examined strategic planning for smart city development, focusing on spatial inequalities in basic urban services in large cities. Their study analyzed four types of residential amenities—grocery stores, subways, buses, and green spaces—and other essential facilities. The research, which focused on New York City, highlighted environmental injustices and the "geography of epidemics" issues in communities of color. Bhattacharya, Bhattacharya, Mclellan, and Tezuka (2020) proposed a sustainable smart city development framework (SSCDI) for developing countries, using three smart cities in India as case studies. The framework includes multiple layers of indicators capturing social, economic, environmental, cultural, and lifestyle dimensions. This index-based approach provides an overview for planning sustainable urban development and evaluating performance, aiming to create sustainable cities with a high quality of life for residents.

In summary, the literature emphasizes the multifaceted nature of sustainable development in smart cities, involving theoretical and practical considerations. The integration of technology, stakeholder engagement, and strategic planning is essential for achieving sustainability. These studies highlight the challenges and opportunities in creating smart cities that balance innovation with sustainability, ensuring inclusive and resilient urban environments.

Strategic Management and Local Governance

Strategic management plays a crucial role in the effectiveness and sustainability of local governance. This literature review examines various studies on strategic management practices, leadership, and governance within the context of local government. The focus is on how strategic management and leadership influence the development and implementation of policies aimed at enhancing social, economic, environmental, and cultural well-being. Local governance plays a pivotal role in ensuring effective public administration and sustainable development. Furthermore, this

literature review further examines the theoretical concepts regarding local governance, focusing on leadership, citizen participation, and the implementation of policies that promote social, economic, environmental, and cultural well-being within communities. Cheyne (2004) explored the transformation of political leadership among New Zealand mayors within contemporary local governance. The study found that successful local political leadership aligns with new public management principles, emphasizing citizen and community engagement. Effective leaders collaborate with communities and promote policies that enhance social, economic, environmental, and cultural well-being both presently and in the future. They possess strong visions and the skills to manage the increasing complexities of local governance, particularly through partnerships with key stakeholders, which are essential for sustainable local development. Kim (2018) investigated collaborative leadership and financial sustainability in local governments in South Korea. The study, which collected data from local revenue officers and secondary sources, found that collaborative leadership positively impacts the subjective perception of financial sustainability but has a negative effect on the objective financial sustainability (net debt) of local governments. Martin and Spano (2015) studied performance management in local governments in Victoria, Australia, and Sardinia, Italy. Their comparative analysis revealed that new public management (NPM) is becoming a strength in Italian local government structures, leading to comprehensive data for strategic decision-making. Continuous development of organizational performance management systems is crucial for addressing strategic issues. Eitel (2012) focused on international collaboration in developing local leadership through partnerships between the United States and Ireland. The study highlighted the benefits of study tours and policy learning, which allowed Irish local government leaders to improve their systems and apply policy insights from major U.S. cities. Bentley, Pugalis, and Shutt (2017) examined leadership and governance systems, discussing the limitations of leadership scope in place-based development within the UK. They introduced a three-dimensional concept of leadership, governance, and central-local relationships, using the analytical tools of 'acceptability' and 'feasibility' to describe governance mechanisms that affect the autonomy of urban and regional development leadership. Kim (2008) studied e-government leadership and innovation in South Korean local governments. The research emphasized the importance of clear vision and goals for e-government, effective communication, and appropriate administrative systems for successful e-government innovation. Training staff and clear leadership vision positively impacted employee enthusiasm. Noda (2017) analyzed the relationship between trust in gubernatorial leadership and citizen participation in Tokyo's metropolitan governance. The study found that genuine participation positively influences trust, whereas normative participation correlates with critical attitudes towards the government. The greatest impact on trust comes from unclear citizen demands, suggesting that trust is built more through relationships among citizens than between citizens and the government. Teng-Calleja et al. (2017) examined change in local governments in the Philippines, analyzing data from 55 leaders across nine local government units (LGUs). The study identified vision, LGU leadership, and citizen participation as key drivers of change. The holistic approach to reforms included structural improvements, cultural change, human resource development, and policy planning, transitioning from

outdated government services to transparent, professional, and efficient public services. Broussine and Fox (2002) investigated new concepts of leadership in local government, focusing on the role of women in modern councils. The study found that traditional views of leadership, which emphasize operational management, remain prevalent. However, these views may conflict with the new approaches needed for improvement, suggesting that the leadership skills required for local government transformation may not be fully utilized, highlighting the potential of both male and female leaders. Bochel and Bochel (2010) reviewed local political leadership and the improvement of local government in the UK. Through literature review and interviews with 30 local leaders in England, Scotland, and Wales, the study assessed leadership roles and perspectives. Differences were noted, particularly in the relationship between structural decision-making changes and political power sources.

In summary, the literature emphasizes that effective local governance hinges on strategic leadership, citizen participation, and continuous performance management. Successful local governance requires leaders who can engage communities, implement comprehensive policies, and adapt to the complexities of urban administration. The studies reviewed highlight the need for strong visionary leadership, collaborative efforts, and stakeholder engagement to foster sustainable development and enhance the well-being of local communities. Moreover, it further underscores the critical role of strategic management and leadership in local governance. Effective strategic management involves continuous performance evaluation, collaboration, clear vision, and stakeholder engagement. These elements are essential for developing sustainable policies that address the complex challenges of local governance, ensuring social, economic, environmental, and cultural well-being.

Local Technology Management in Smart Cities

Effective management of technology at the local level is critical for the successful implementation and sustainability of smart cities. This literature review examines various studies related to local technology management, highlighting how innovative technologies are adopted, utilized, and managed to enhance urban living and governance. Aurigi and Odendaal (2021) explored new concepts of sustainable smart cities within social contexts, emphasizing the importance of place-based approaches to enhance the social sustainability of smart cities. They argued that such perspectives are often overlooked in favor of framing cities and citizens as inherently "smart" and beneficiaries of advanced technology. This oversight can lead to reduced flexibility and resilience in urban environments. Smith and Martín (2020) investigated the use of techno-political platforms for urban democracy in Madrid and Barcelona. Their analysis showed that digital platforms facilitate citizen engagement by allowing residents to discuss urban issues, propose plans, and suggest policies to city officials. These techno-political platforms, built on open and shared resources, are crucial for fostering civic participation and collective action. Yigitcanlar, Kankanamge, and Vella (2021) conducted a systematic analysis of smart city concepts and technologies in Australia using Geo-Twitter. Their study revealed that innovation, sustainability, and management are the most popular smart city concepts, while IoT, AI, and

autonomous vehicle technologies are the most prevalent. They noted a balanced perspective on the importance of both concepts and technologies, with Sydney, Melbourne, and Brisbane standing out as prominent smart cities. The systematic Geo-Twitter analysis proved useful for examining perceptions and usage of smart city concepts and technologies, offering insights for smart city policy development. Wu, Jiang, Li, and Zhang (2021) mapped the knowledge domains of smart city development for urban sustainability (SCDUS) through an informatics science study. They analyzed 965 journal articles using visualization techniques such as VOSviewer, CiteSpace, and Carrot2 to create a dynamic representation of current SCDUS research. Key findings included the prominence of terms like "ICT," "smart energy grid," and "smart growth," and the identification of main research clusters: information technology, energy and environment, urban transportation, and urban policy, planning, and development. The study highlighted future research trends, such as improving the quality of urban big data, developing smart cities in developing countries, and promoting smart technologies.

In summary, the literature underscores the vital role of local technology management in the successful deployment and sustainability of smart cities. Studies emphasize the need for place-based approaches, citizen engagement through digital platforms, and the balanced integration of smart city concepts and technologies. Effective local technology management involves continuous innovation, strategic planning, and stakeholder participation to address urban challenges and enhance the quality of urban life.

Politics Literature Review

The study of political leadership and governance within local governments reveals the complexities and evolving dynamics that shape effective administration. This literature review examines various studies focusing on the roles and challenges of political leaders in local governments, the integration of smart governance concepts, and the changing nature of leadership styles. The aim is to provide insights into how local governance adapts to new management principles, technological advancements, and increased citizen participation. Bergström, Magnusson, and Ramberg (2008) conducted a study on the complexity of leadership in local government in Sweden. The study found that new management concepts aim to change the roles of local government politicians and managers. These concepts have been adapted to fit into the traditional roles of parliament members, which are built on detailed knowledge and strong participation. Current leadership is increasingly fraught with conflicts, making consensus difficult to reach. However, adept managers who can handle complexity are often found in the local government sector. The article discusses experiences from Sweden regarding the intricate relationship between politics and administration, suggesting that this relationship may be managed through negotiation. Gornik (2020) studied the management of smart government under the evolving concept of smart cities, focusing on the transition from traditional city management. Using the concept of Smart Governance within urban development processes, Gornik (2020) analyzed baseline guidelines for spatial and social understanding from geographical research documents, interdisciplinary

studies, and expert interviews. The study highlighted Japan's strong academic role in smart urban planning, particularly in Kashiwa-no-ha, where debates continue between old and new indicators and innovative culture within the city. However, the developmental phase of Kashiwa-no-ha has hindered the full implementation of Smart Urban Governance indicators. Cheyne (2004) explored changing leadership in local politics, specifically the newly elected mayors of New Zealand in contemporary local governance. The study found that recent local elections have drawn significant attention to local politics. Leadership in New Zealand is discussed in the context of the latest theories on local governance and evolving leadership styles. The requirements for leadership are evolving based on the roles of local governments. Generally, local governments are shaped by emerging groups of citizens and management, emphasizing increased collaboration. Governance activities extend beyond the "local government" institution to incorporate private development institutions and networks of institutional stakeholders, highlighting the growing need for facilitation. The local political leadership model indicates that managing relationships with these networks is crucial, as community participation and involvement are integral to local governance. These elements now complement local governance, underscoring the inseparability of local political leadership and representative democracy. In summary, the literature emphasizes that political leadership in local governance is complex and evolving. Bergström, Magnusson, and Ramberg (2008) highlight the challenges of new management concepts in Sweden, where conflict and consensus-building are key issues. Gornik (2020) underscores the importance of integrating smart governance into urban development, with Japan's Kashiwanoha serving as a case study for the ongoing debates and implementation challenges. Cheyne (2004) focuses on the evolving nature of leadership in New Zealand's local politics, where increased citizen collaboration and network management are crucial. Collectively, these studies highlight the need for adaptable, visionary leadership that can navigate the complexities of modern local governance, integrate technological advancements, and foster community participation to enhance governance outcomes.

Maha Sarakham Municipality

The structure of municipal governance in Thailand has undergone a series of adaptations and evolutions in response to the evolving needs and demands of local communities (Mahasarakham Municipality, 2023b). This transformation is notably exemplified in the case of Maha Sarakham Municipality. On February 14, 1936, as officially documented in the 27th Phang Mueang Ban Chart Road, Tambon Talat, Maha Sarakham District, Maha Sarakham Province, the status of Maha Sarakham Municipality was elevated to that of Maha Sarakham City Municipality. This change in status signified a significant milestone in the development and governance of Maha Sarakham, reflecting the region's growth and the evolving responsibilities of its local administration.

Conceptual Framework

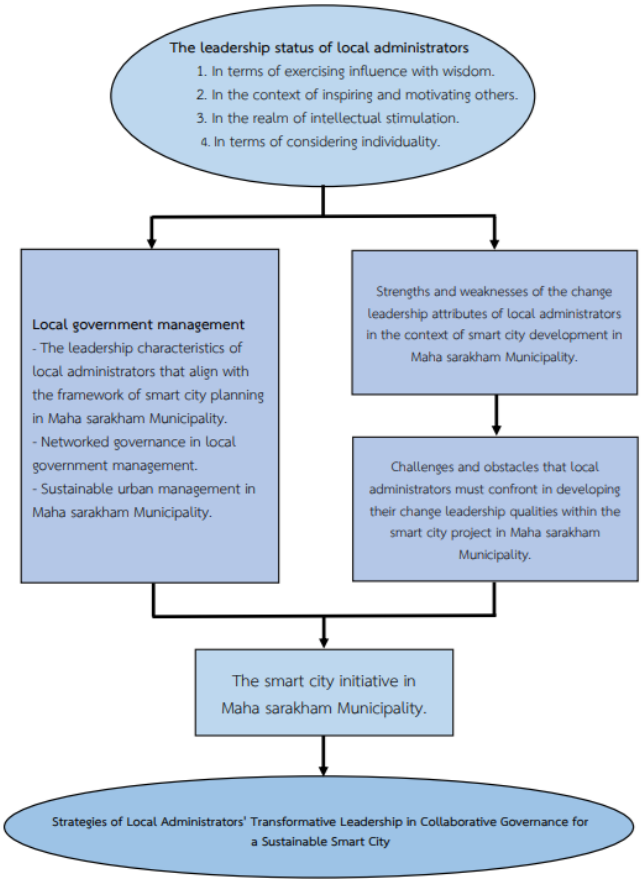

Figure 1. Conceptual Framework

Research Methodology

This study adopted a mixed-method approach, integrating both quantitative and qualitative analyses to evaluate the current level of transformative leadership among local administrators, identify the strengths and weaknesses within the sustainable smart city framework, and explore the factors influencing its effectiveness in promoting collaborative governance. Additionally, the study examines the obstacles and challenges faced by administrators in implementing transformative leadership in smart city initiatives, proposes strategies to enhance leadership skills and capabilities, and develops recommendations for leveraging this leadership to foster multi-stakeholder collaboration.

Convenience sampling was selected for this research due to its practicality and efficiency in collecting data from a diverse cross-section of Mahasarakham Municipality residents. As the study aimed to capture insights from individuals directly impacted by local governance and smart city initiatives, convenience sampling allowed the researchers to engage respondents who were readily available and willing to participate. This method was particularly appropriate given the exploratory nature of the study, where the primary goal was to identify general trends and perceptions rather than to test specific hypotheses.

While convenience sampling has limitations, such as potential biases in respondent selection, steps were taken to mitigate these issues. Efforts were made to include participants from varied demographic backgrounds (e.g., age, occupation, and duration of residence) to ensure a representative cross-section of the population. Additionally, the sample size of 400 respondents, determined using Yamane's (1973) formula with a 0.05 margin of error, enhances the reliability of the findings, making them generalizable to the broader population of 46,828 residents. Using Yamane's (1973) formula with a 0.05 margin of error, a sample size of 397 was determined. This approach ensures statistical validity by maintaining a confidence level of 95 percent, meaning that the sample accurately represents the population within an acceptable range of variability. To further enhance reliability and account for any incomplete responses, 400 questionnaires were distributed using convenience sampling. This method allowed the study to include a diverse cross-section of respondents while remaining practical and feasible within the study's scope. The sample size aligns with standard practices for large populations, ensuring that findings are robust and generalizable to the broader population of Mahasarakham Municipality.

For qualitative data, 20 residents were selected from four focus groups, ensuring diversity in occupation and age, with all participants residing or working in the municipality. The qualitative sample was intentionally smaller, as it aimed to provide in-depth insights and complement the broader trends identified in the quantitative analysis. Together, these methods ensure a comprehensive understanding of transformative leadership and its impact on sustainable smart city governance.

Research tools included questionnaires and interviews developed from theoretical frameworks based on literature reviews. The data collection process was systematic. Initially, questionnaires and interviews were created, defining relevant document study points using documentary research methods. These tools were then validated by experts. Field data collection followed, utilizing the validated tools. Upon collection, data were meticulously checked for completeness and accuracy. Detailed data analysis was performed using predetermined statistical methods.

Quantitative data from 400 questionnaires were analyzed using SPSS for Windows, calculating means and standard deviations to interpret the data. Qualitative data from 20 interviews were analyzed through content analysis, aligning with the study's objectives and categorizing research questions. The reliability of the tools was tested using Item-total Correlation and Cronbach's Alpha Coefficient. Data analysis included frequency distribution, percentages, means, and standard deviations, presented in tables with descriptive summaries and study conclusions.

Data collection was conducted over a six-week period, ensuring comprehensive coverage of the study's target demographic. Collected data underwent rigorous verification processes to ensure accuracy and completeness. Qualitative data were analyzed through content analysis methods, assessing content validity, and categorizing data to align with established research hypotheses. Additionally, multivariate

regression analysis was employed to quantify the influences of local and national factors on electoral outcomes.

The specified model is given by:

$$Y = \beta 0 + \beta 1 X1 + \beta 2 X2 + \beta 3 X3$$

Y is the dependent variable representing sustainable urban development.

$\beta 0$ (Intercept): The baseline value of Y when all independent variables ($X1$ $X1$ to $X6$) are zero.

$\beta 1$ to $\beta 6$ (Coefficients): These coefficients correspond to the impact of each independent variable on Y. Each coefficient quantifies the expected change in Y for a one-unit increase in the respective X X variable, while keeping all other variables constant.

$X1$ Represents the local administrator's leadership

$X2$ Represents the network coloration

$X3$ Represents the smart city

ϵ is the error term, representing unobserved factors that affect the sustainable urban development not captured by the model.

The analysis aimed to bridge the understanding of factors influences on sustainable urban development, leveraging both statistical data and qualitative insights. This robust methodology facilitated a nuanced analysis of the Mahasarakham municipality.

Result

The figure 2 illustrates the demographic composition of the 400 participants surveyed in Mahasarakham Municipality. The data includes key variables such as age, gender, education level, occupation, and income, providing insights into the diversity and representativeness of the sample. This demographic analysis establishes the context for understanding participant responses regarding leadership qualities and smart city initiatives, ensuring that the findings are grounded in the perspectives of a varied and relevant population. By presenting this profile, the figure contributes to answering research questions about leadership effectiveness and public engagement within the smart city framework.

This bar chart provides a comprehensive analysis of the research sample group, covering various factors such as gender, age, marital status, education level, occupation, and monthly income. The chart highlights the highest percentages in each category, offering clear insights into the demographic and socioeconomic distribution of the sample. The gender distribution reveals that the female population

(52.75 percent) surpasses the male population (42.75 percent), with a small proportion identifying as other genders (4.50 percent). This gender imbalance could reflect societal roles and participation rates, emphasizing the need for inclusive policies and programs that address the needs of all gender groups, especially the underrepresented. The age distribution shows that the 36-40 years age group (30.50 percent) is the most prevalent, closely followed by the 30-35 years age group (28.50 percent). A predominantly young adult population indicates a dynamic and potentially adaptable community. Therefore, policies should focus on promoting innovation, education, and employment opportunities catering to this demographic. In terms of marital status, the majority of the sample group is married (53.25 percent), with singles making up 35.50 percent. The high proportion of married individuals suggests a need for family-oriented services and support systems. However, the significant minority of single individuals also requires targeted social and economic policies to ensure their needs are met. The education level distribution indicates that the largest segment holds a bachelor's degree (47.00 percent), with primary education (23.75 percent) being the second most common. This suggests a relatively educated population, advantageous for implementing advanced and technical smart city solutions. Nonetheless, the substantial percentage with only primary education highlights the necessity for continuing education and vocational training programs to uplift those with lower educational backgrounds. The occupation distribution shows that municipal employees (28.50 percent) and private business owners (20.75 percent) are the most common occupations. The significant number of municipal employees suggests that public sector engagement is crucial for governance strategies. Private business owners are also key stakeholders, indicating a need for policies that support local businesses and entrepreneurship. Regarding monthly income, the highest proportion of the sample group earns between 5,001 – 10,000 Baht (32.75 percent). This income distribution suggests a middle-to-lower economic status for a significant portion of the population. Consequently, strategies should focus on economic development, job creation, and income enhancement to promote financial stability and growth. In conclusion, this analysis provides valuable insights into the demographics and socioeconomic conditions of the sample group, essential for formulating strategies for transformative leadership and collaborative governance. The data suggests a need for inclusive, innovative, and supportive policies addressing the diverse needs of Mahasarakham Municipality's residents. By focusing on education, economic development, and inclusive governance, local administrators can drive sustainable growth and enhance the community's quality of life.

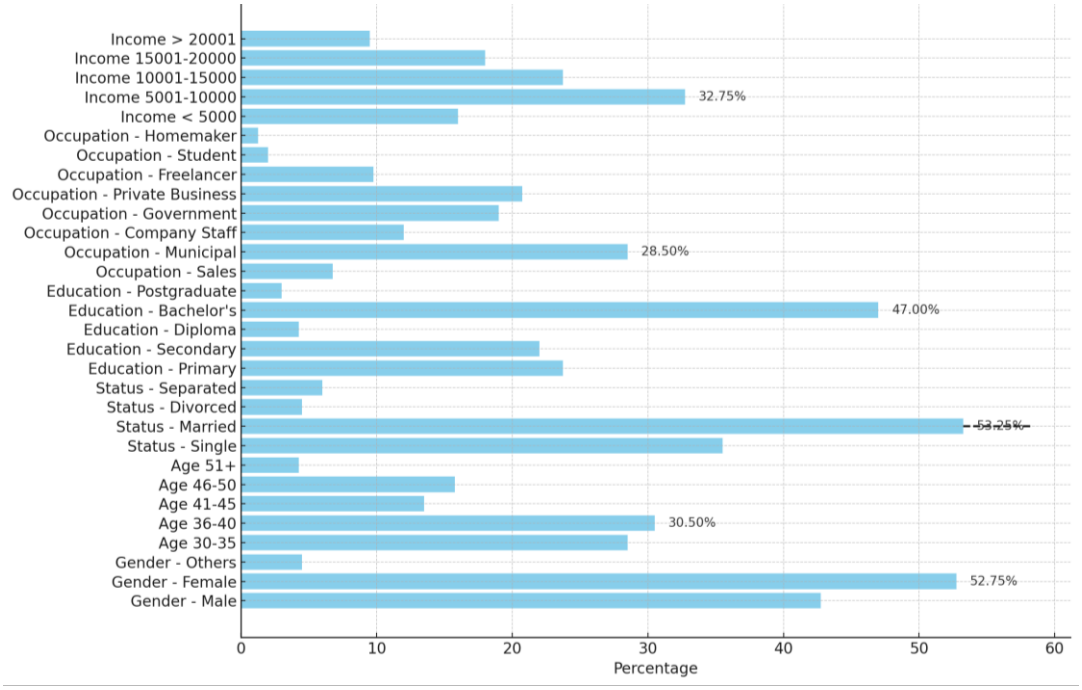

Figure 2. Demographic Profile of Research Sample Group

The Leadership Qualities of Mahasarakham Municipality's Local Administrators Aligned with the Smart City Framework

The analysis of the figure 3, which presents data on the leadership qualities of local administrators in Mahasarakham Municipality aligned with the smart city framework, provides a comprehensive overview of their performance across various dimensions of transformative leadership. The data, based on responses from 400 participants, reveals a high overall alignment with the smart city framework (mean = 4.22, S.D. = 0.397), indicating strong leadership capabilities.

Idealized Influence scores a mean of 4.20 (S.D. = 0.453), reflecting that local administrators are perceived to have a strong and admirable vision, exerting a significant positive influence on their followers. Inspirational Motivation, with a mean of 4.18 (S.D. = 0.499), is the lowest among the dimensions but still indicates a high level of effectiveness. This suggests that while administrators are capable of inspiring and motivating their teams, there is slightly less impact in this area compared to others.

Intellectual Stimulation has a mean score of 4.24 (S.D. = 0.461), highlighting a robust capacity to encourage innovative thinking and problem-solving among followers. This suggests that administrators effectively foster an environment where creativity and critical thinking are valued. Individualized Consideration, scoring the highest with a mean of 4.25 (S.D. = 0.431), indicates that local administrators are highly effective in addressing the individual needs and potentials of their followers, promoting personal development and tailored support.

These findings indicate that Mahasarakham Municipality's local administrators exhibit a well-rounded and high level of transformative leadership, with particular strengths in individualized consideration and intellectual stimulation. The slightly lower score in inspirational motivation, while still robust, highlights an opportunity for targeted development to further enhance their leadership impact. This analysis underscores the administrators' preparedness to lead transformative initiatives within the smart city context, directly addressing the research question on the effectiveness of leadership in advancing sustainable and collaborative governance.

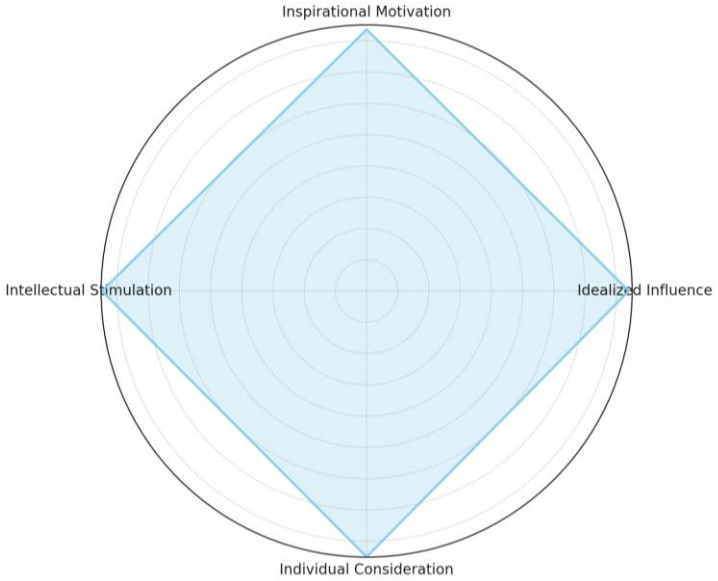

Figure 3. Transformative Leadership Dimensions and Their Alignment with the Smart City Framework in Mahasarakham Municipality

Network-Based Management in Local Administration

This figure presents the mean scores and standard deviations for key dimensions of network-based management within local administration, highlighting their alignment with the smart city planning framework.

The data indicates a consistently high performance across all evaluated aspects of network-based management. Participation scored a mean of 4.19 with a standard deviation of 0.466, indicating a high level of involvement from stakeholders. Shared Goals, Communication, Interpersonal Relationships, and Knowledge Exchange and Learning all achieved very high mean scores, ranging from 4.21 to 4.29, with relatively low standard deviations. This suggests not only a strong agreement on these aspects but also a consistent experience among participants. The overall score of 4.23 with a standard deviation of 0.395 further reinforces the effectiveness of network-based management in this context.

Despite the high scores, the slightly higher standard deviations in some areas, such as Shared Goals and Interpersonal Relationships, hint at variability in experiences that might warrant closer examination. Addressing these variations could help in achieving even more consistent outcomes and enhancing the effectiveness of network-based management practices.

These findings emphasize the critical role of network-based management in supporting transformative leadership and smart city governance. Addressing identified variability through enhanced communication strategies and stakeholder alignment could lead to even greater consistency and effectiveness in future initiatives, directly contributing to the research question on optimizing local governance for smart city development.

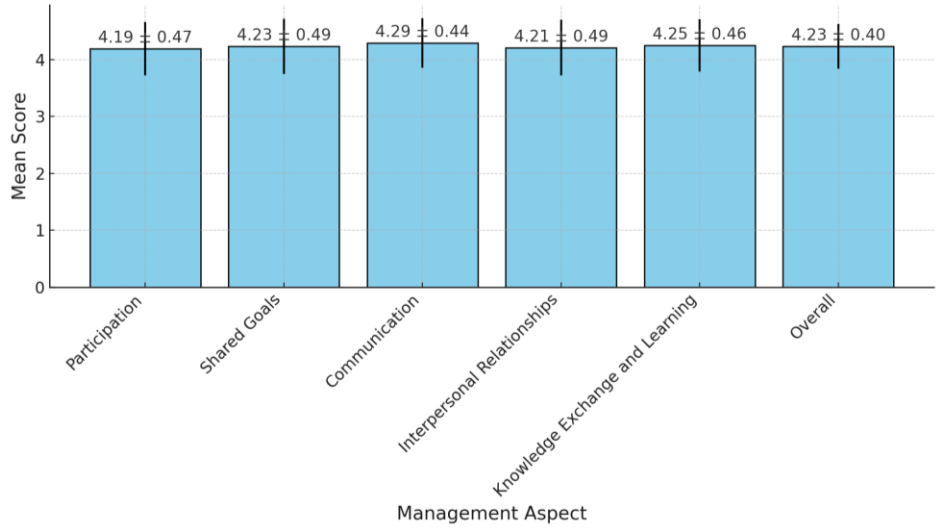

Figure 4. Effectiveness of Network-Based Management Dimensions in Local Administration Aligned with Smart City Planning

The Evaluation of Maha Sarakham Municipality as a Smart City.

This radial chart illustrates the evaluation of Maha Sarakham Municipality's performance across key dimensions of smart city management. Each axis represents a specific aspect, including Smart Individual Consideration, Smart Environment, Smart Governance, Smart People, Smart Mobility, and Smart Energy, with corresponding mean scores and standard deviations.

The data indicates high performance across all aspects of the Smart City initiative. The "Smart Individual Consideration" aspect stands out with the highest mean score of 4.25 and the lowest standard deviation of 0.431, indicating not only excellent performance but also consistency in addressing individual needs. Other aspects, such as "Smart Environment," "Smart Governance," and "Smart People," also score well, with mean values above 4.0, though they exhibit slightly higher variability, as indicated by their standard deviations ranging from 0.730 to 0.779.

"Smart Mobility" and "Smart Energy," with mean scores of 3.97 and 3.99 respectively, reflect areas where performance is slightly lower and variability is higher (standard deviations of 0.858 and 0.804), suggesting room for improvement. The overall mean score of 4.07, with a standard deviation of 0.698, reflects a generally high level of performance but also highlights the need for more consistent outcomes across all aspects.

Targeted efforts to reduce variability in aspects like Smart Mobility and Smart Energy, along with sustaining high performance in Smart Individual Consideration, could enhance the municipality's overall smart city profile. This aligns with the research question on optimizing smart city governance for sustainable urban development.

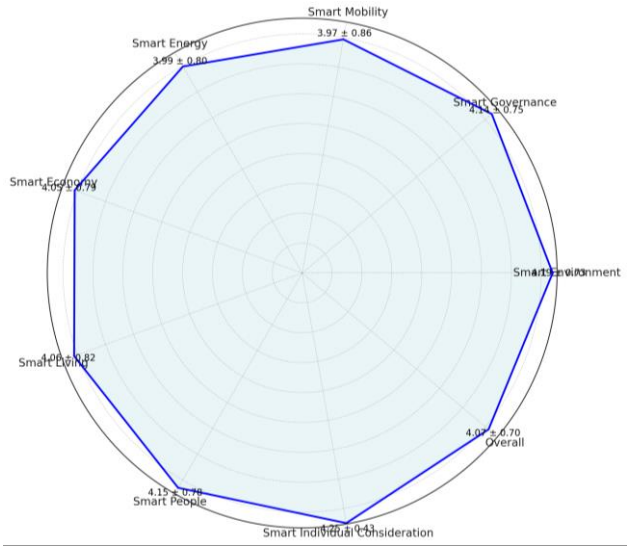

Figure 5. Evaluation of Maha Sarakham Municipality's Performance Across Smart City Dimensions

Sustainable Urban Management in Maha Sarakham Municipality

This horizontal bar graph illustrates the performance of different dimensions of sustainable urban management in Maha Sarakham Municipality. Each bar represents a specific management aspect, with mean scores and standard deviations clearly displayed.

The data reveals strong performance across different dimensions of sustainable urban management. The social aspect stands out with the highest mean score of 4.24 and a standard deviation of 0.444, indicating effective and consistent social management practices. The economic and physical aspects also perform well, both with mean scores above 4.0, though their higher standard deviations (0.737 and 0.725) suggest some inconsistency that may need to be addressed.

Environmental and administrative aspects, while still rated highly, show slightly lower mean scores (4.03 and 3.96) and higher variability (standard deviations of 0.807 and 0.876), highlighting areas

with more significant differences in performance. The overall score of 4.09 with a standard deviation of 0.649 reflects a generally strong but varied performance in sustainable urban management.

The overall mean score of 4.09 (S.D. = 0.649) indicates a generally strong but varied performance across all dimensions of sustainable urban management**.** To enhance sustainability outcomes, efforts should focus on reducing variability in economic, environmental, and administrative aspects while maintaining the municipality's strengths in social and physical management. These insights provide actionable directions for refining urban management practices, directly addressing research questions on optimizing sustainability in urban governance.

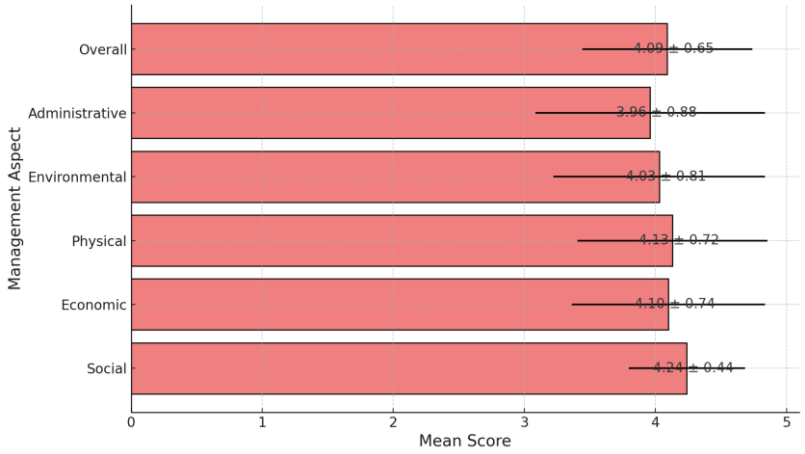

Figure 6. Performance Across Dimensions of Sustainable Urban Management in Maha Sarakham Municipality

Regression Analysis of Factors on Sustainable Urban Management

The regression analysis results provide a detailed view of how the variables Leadership Quality (X1), Network-Based Management (X2), and Smart City (X3) predict Sustainable Urban Management (Y). Here's a comprehensive analysis:

Table 1. Summary of Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.934	.873	.872	.232

Predictors: X1 (Leadership Quality), X2 (Network-Based Management), X3 (Smart City)

Table 2. ANOVA for Regression Model

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	146.868	3	48.956	907.013	<.001
Residual	21.374	396	.054		
Total	168.242	399			

Dependent Variable: Y (Sustainable Urban Management)

Table 3. Coefficients

Model	Unstandardized Coefficients	Standardized Coefficients	t
	B	Std. Error	Beta
1 (Constant)	-0.145	0.131	
X1 (Leadership Quality)	0.045	0.058	0.027
X2 (Network-Based Management)	0.173	0.058	0.105
X3 (Smart City)	0.815	0.018	0.876

Dependent Variable: Y (Sustainable Urban Management)

The regression results provide several insights and critical points relevant to the topic of "Strategies of Local Administrators' Transformative Leadership in Collaborative Governance for a Sustainable Smart City in Mahasarakham Municipality":

Strong Predictive Power: The model demonstrates strong predictive power, as indicated by the high R Square value (.873). This suggests that the combination of Leadership Quality, Network-Based Management, and Smart City initiatives effectively predicts Sustainable Urban Management.

Significance of Predictors:

Smart City (X3): This variable has the strongest impact (B = 0.815, $p < 0.001$), highlighting the critical role of smart city initiatives in sustainable urban management. The high Beta value (0.876) underscores its importance.

Network-Based Management (X2): This predictor is also significant (B = 0.173, p = 0.003), indicating that effective network-based management contributes substantially to sustainable urban management.

Leadership Quality (X1): Although positively related, Leadership Quality shows a non-significant effect (B = 0.045, p = 0.438). This suggests that while leadership is important, its direct impact might be less critical when combined with other variables.

Constant Term: The constant term (-0.145) is not statistically significant (p = 0.268), indicating it does not have a significant standalone impact on Sustainable Urban Management. This is expected, as the primary focus is on the influence of the predictors.

The findings align with the research topic, demonstrating that transformative leadership strategies in local administration, particularly through smart city initiatives and network-based management, significantly enhance sustainable urban management. The strong influence of smart city initiatives reflects the importance of technological integration and innovation in urban development.

Network-based management's significance emphasizes the need for collaborative governance, aligning various stakeholders towards common sustainability goals.

Transformative Leadership: While direct leadership quality (X1) shows a non-significant impact, its role may be more indirect, influencing other factors such as organizational culture and stakeholder engagement, which are not directly measured in this model.

Collaborative Governance: The significant effect of network-based management (X2) highlights the importance of collaboration among various sectors and stakeholders in achieving sustainable urban management.

Smart City Initiatives: The overwhelming impact of smart city initiatives (X3) confirms that embracing technology and innovative solutions is crucial for sustainable urban development.

The regression analysis reveals that while all predictors contribute to sustainable urban management, smart city initiatives have the most substantial impact, followed by network-based management. Transformative leadership plays a supporting role by enhancing collaboration and creating an environment conducive to innovation and sustainability. These findings suggest that local administrators should prioritize smart city initiatives and strengthen collaborative governance through network-based management to drive sustainable urban development. Efforts to enhance leadership quality should focus on indirect effects, such as improving stakeholder alignment and fostering a culture of innovation.

Strategies of Local Administrators' Transformative Leadership in Collaborative Governance for a Sustainable Smart City

Transformative leadership plays a crucial role in the development and governance of sustainable smart cities. Local administrators must adopt strategies that enhance various factors such as network collaboration and smart city initiatives to meet the goals of sustainable urban development. This study utilizes a qualitative approach to understand and analyze these strategies and suggests potential solutions.

The qualitative data suggest that while there is a strong strategic vision for transforming Mahasarakham into a smart city, there are varying degrees of engagement and effectiveness across different sectors. The government's top-down approach is efficient in policy formulation but may lack comprehensive stakeholder engagement, particularly with marginalized groups. The private sector's focus on practical applications of technology highlights the benefits of innovation but underscores the need for robust infrastructure to support these advancements sustainably. Public perceptions reflect

approval of the transformative leadership but also hint at disparities in how these initiatives impact different community members.

From the perspective of government agencies, the Mayor of Mahasarakham is seen as a proactive leader with a strong focus on smart city development. The mayor's clear policies aim to accelerate the city's transformation into a smart city. New initiatives include leveraging technology to enhance public service delivery and improve urban management efficiency. This strategic approach demonstrates a commitment to addressing urban challenges through innovative solutions.

In contrast, the private sector highlights the practical application of technology, using online resources to support community development. Businesses emphasize the use of applications to facilitate social activities, reflecting a collaborative effort to integrate technology into everyday life. However, this perspective also points to a reliance on technological tools without necessarily addressing the underlying infrastructure and systemic issues that might impede long-term sustainability.

The public perceives the leadership as visionary, appreciating the use of technology and data to drive urban development. The leader's willingness to adapt and modernize based on both historical and current data showcases a dynamic approach to governance. Nonetheless, there are concerns about the inclusivity and accessibility of these technological advancements for all community members, indicating a potential gap between leadership vision and on-the-ground implementation.

> *"In the present, Maha Sarakham Municipality is interested in developing comprehensive data in the form of collecting data from various agencies. As a service provider, we have clear policies to drive Maha Sarakham towards a smart city. Although local government organizations have limitations in many aspects, as we are the closest unit to the people, we have policies or new guidelines in place to be implemented in our work to bring about sustainable development and benefit the people the most. For example, adjusting the service process to respond to citizen complaints more quickly, and transitioning internal document work within the organization to digital platforms instead of paper. These initiatives efficiently address urban issues and bring about tangible results in problem-solving."* (Interviewee 4, 2024, from the perspective of academics)

> *"From the perspective of the administrators, if we look at the mayor of Maha Sarakham Municipality, they are considered to be a relatively high-level leader. This can be seen from their involvement in setting indicators, particularly in urban planning to move towards becoming a smart city. This is already stated in our local development plan, and frameworks for indicators are established. We believe that there is leadership in terms of driving changes in urban planning towards smart cities."* (Interviewee 3, 2024, from the perspective of governmental agencies)

In summary, the transformative leadership in Mahasarakham Municipality is characterized by a strong vision for smart city development and a proactive approach to leveraging technology for efficient governance. However, to achieve sustainable and inclusive urban development, it is crucial to address the potential gaps in stakeholder engagement, infrastructure development, and equitable access to technological benefits. This comprehensive understanding of the leadership dynamics provides valuable insights for refining strategies to foster a truly sustainable smart city.

Strengths and Weaknesses of Local Administrators in Mahasarakham Municipality

The analysis reveals a leadership profile with strong strategic vision, extensive networking, and openness to collaboration and innovation. However, frequent leadership changes disrupt continuity and delay policy implementation, significantly impacting governance effectiveness. The management challenges noted by the private sector further emphasize the need for stability and efficient operations.

From the government perspective, the Mayor is praised for his readiness to learn and extensive networking abilities, effectively establishing strategies and policies for city development. However, frequent leadership changes lead to delays in policy implementation, causing discontinuities that hinder staff adaptation and progress.

In the private sector view, the leader's strong connections and willingness to collaborate with other agencies are commendable. Yet, significant management challenges persist, affecting operational efficiency despite these connections.

The public perceives the leader as visionary and receptive to feedback, highlighting his commitment to inclusive governance. However, the practical application of this vision may face obstacles due to inconsistent leadership and communication gaps.

The Mayor is seen as a knowledge-seeker and an innovator, using technology to drive development. Nonetheless, there is criticism regarding the stability and consistency of his initiatives, which are often disrupted by leadership transitions.

> *"The strength lies in the mayor's willingness to learn and the extensive network available to assist. Whether it's from the government or private sector, this is one of the mayor's strengths as a leader. As for weaknesses, if we consider lack of experience in governance as one, since the mayor has just taken office. However, can this weakness be addressed? Noticeably, the mayor is quite open to new ideas and attempts to learn, whether through studying, training, or seeking advice from experienced individuals. They are receptive and open-minded, willing to listen and gather input from various sectors to overcome any weaknesses."* (Interviewee 3, 2024, from the perspective of governmental agencies)

"Our strength lies in the fact that you, as a new generation leader, understand and embrace advanced technology. This is the strength of Maha Sarakham. Our weakness lies in the fact that achieving a smart city status cannot be done by one person alone. The people need to be informed and involved for sustainability. If leaders move forward but the followers do not, the desired outcomes envisioned by the administrators will not materialize. Both leaders and citizens, or stakeholders, must move forward together to foster collaboration and effectively address the sustainable development of a smart city." (Interviewee 7, 2024, from the perspective of the private sector)

"In terms of strengths, it should align with the recent statement where you have innovative ideas and aspire to introduce the concept of a smart city for the people within the Maha Sarakham Municipality. Regarding weaknesses, I see it as the lack of networks and supporting agencies to assist the Maha Sarakham Municipality in its efforts to engage external organizations to collaborate." (Interviewee 9, 2024, from the perspective of the general public)

While the local administrators in Mahasarakham Municipality demonstrate strengths in strategic leadership, networking, and innovation, the frequent changes in leadership and resulting discontinuities pose significant challenges. Addressing these issues by ensuring stable and consistent leadership could enhance policy implementation and urban development, leveraging the existing strengths to achieve sustainable progress.

Influential Factors on the Effectiveness of Transformative Leadership in Collaborative Governance for Sustainable Urban Development in Mahasarakham Municipality

The analysis reveals that effective transformative leadership in Mahasarakham Municipality relies heavily on robust inter-agency connectivity, comprehensive data management, and strong collaborative networks. While there are significant strengths in strategic vision and technological adoption, challenges remain in ensuring consistent leadership, effective communication, and practical implementation of collaborative efforts.

From the government's perspective, the key factor is inter-agency connectivity, especially regarding data sharing and comprehensive information collection. Effective network management and fostering mutual understanding and awareness of changes are also crucial. However, bureaucratic inertia and frequent administrative changes can impede these efforts.

The private sector emphasizes strong connections and collaboration with other agencies as strengths. Yet, the challenge lies in ensuring these collaborations translate into efficient and cohesive

action plans. There is often a disconnect between strategic partnerships and practical implementation, which can undermine the overall effectiveness of initiatives.

The public recognizes the importance of multi-faceted networks and shared understanding, but there is often a gap in effective communication and engagement, which can lead to public skepticism or resistance. Ensuring transparent and inclusive processes is essential to gaining public trust and support.

The readiness and determination of local administrators to embrace change and utilize technology are highlighted as positive factors. However, the success of these initiatives hinges on rigorous management and sustained collaboration among all stakeholders. There is a risk that technological solutions may be implemented without sufficient consideration of local contexts and stakeholder needs, potentially leading to suboptimal outcomes.

> *"The key to forming important networks is everyone's participation, involvement in brainstorming, collaborating, and collectively creating various developments, whether it's a smart city or anything else. It can make everyone feel like they're part of the process, contributing to the development in line with the policies or desires of the community. There's a high chance of success when everyone has the opportunity to participate and collaborate."* (Interviewee 7, 2024, from the perspective of governmental agencies)

> *"In terms of effective influence on the leadership dynamics of managers in network governance, the impactful aspect is collaborative work that addresses potential impacts beforehand, particularly in legal matters and the distribution of authority within the local context, which may be somewhat limited. Even though there may be a decentralization of power, in some cases, it may not extend to certain areas. Therefore, if we don't have the authority, it doesn't mean we don't have the responsibility. We, as individuals close to the community, see the problems that need to be addressed. We need networks in the public, private, and civil society sectors. Our mayor has initiated Memorandums of Understanding (MOUs) with various sectors to assist in city development and ensure sustainability."* (Interviewee 9, 2024, from the perspective of the general public)

To enhance the effectiveness of transformative leadership in Mahasarakham Municipality, it is crucial to address the challenges of bureaucratic inertia, ensure consistent and stable leadership, and foster genuine collaboration and communication across all sectors. By strengthening inter-agency connectivity and data sharing, and ensuring that technological solutions are appropriately tailored to local contexts, the municipality can better achieve sustainable urban development.

Challenges and Issues Faced by Local Administrators in Mahasarakham Municipality's Smart City and Sustainable Development Projects

The analysis reveals that the key challenges for local administrators in Mahasarakham Municipality revolve around managing the impacts of urban development, ensuring inclusive benefits, and maintaining transparent and participatory governance. Government efforts need to focus on enhancing staff capabilities and fostering a culture of accountability. The private sector must prioritize effective collaboration, while public engagement requires clear communication and a thorough understanding of diverse community needs.

From the government perspective, one of the primary challenges is the potential disruption to the daily lives and livelihoods of residents caused by developmental changes. For instance, market or infrastructure developments might not benefit all community groups equally. Addressing these issues requires a commitment to good governance and transparency, emphasizing participation and accountability from all stakeholders. This includes enhancing the dedication and preparedness of staff, promoting education to improve administrators' knowledge and skills, and creating support networks for inter-agency knowledge exchange.

In the private sector, success hinges on effective collaboration and communication. While there is a recognition of the importance of partnerships, the challenge lies in ensuring that these partnerships are productive and aligned with the municipality’s goals.

From the public’s viewpoint, understanding and communication are crucial for decision-making and implementation. Ensuring that decisions are communicated effectively and that there is a clear understanding of the community's needs can help mitigate resistance and foster cooperation.

> *"Promoting the development and skills of local administrators, including instructors of additional courses related to management and change in rapidly evolving social and economic contexts in the era of intelligence, creates a supportive environment for knowledge sharing among local administrators within the municipal area. This includes networks or online platforms where administrators and focal points can share experiences and knowledge, fostering technological and managerial innovation within municipalities. For instance, data analysis supports multifunctional systems, collaborative efforts between municipalities and other oversight agencies provide knowledge and experience in governance and transformation. Central hubs should induce movement and local community support for smart city initiatives. Clear control and operational plans should be established to measure the success of smart city projects and monitor adjustments and strategy improvements as described. Increasing*

public awareness and effectiveness in smart city operations through good communication systems for listening to public opinions and needs." (Interviewee 4, 2024, from the perspective of governmental agencies)

"At present, there shouldn't be issues with leadership, but the challenge lies in the collaboration of the public to address development issues. Sometimes, citizens lack knowledge of technology, relying on tools or personnel from the municipal government of Maha Sarakham municipality to drive successful urban development. The most crucial aspect is the municipal workforce, which must educate and involve the public, ensuring understanding of the technology being developed for ongoing progress." (Interviewee 7, 2024, from the perspective of the private sector)

"The problem, obstacle, and challenge lie in the potential impact of changes in Maha Sarakham municipality, which could affect the way of life and livelihoods of fellow citizens. For instance, the development of fresh markets or various construction projects might not benefit certain groups of people, leading to criticism or resistance. The solution lies in adhering more closely to ethical principles, enhancing transparency, utilizing legal and ethical principles effectively, and increasing participation and responsibility. With greater transparency and enhanced participatory processes, issues can be addressed more effectively." (Interviewee 2 , 2024, from the perspective of academics)

To overcome the challenges in managing smart city projects, Mahasarakham Municipality must emphasize good governance, transparency, and stakeholder participation. Strengthening staff skills and readiness, fostering effective public-private partnerships, and ensuring clear communication with the public are essential steps. Addressing these areas can help mitigate the negative impacts of development and ensure that the benefits of smart city projects are distributed equitably across the community.

Based on the SWOT analysis, a set of strategic recommendations has been developed to address the strengths, weaknesses, opportunities, and threats faced by Mahasarakham Municipality. These strategies are categorized into proactive strategies (SO), internal development strategies (WO), external collaboration strategies (ST), and internal adjustment strategies (WT). The goal is to leverage existing strengths, capitalize on opportunities, address internal weaknesses, and mitigate external threats to promote sustainable and innovative urban development. The following table outlines these strategic recommendations in detail:

Table 4. Strategic Recommendations based on SWOT Analysis

Strengths	Weaknesses	Opportunities	Threats
S1: Expertise and experience	W1: Budget and resource constraints	O1: Implementation of Smart City systems	T1: Conflict with local traditions and culture
S2: Effective roles and tools development	W2: Staff education and skills	O2: Government policies supporting health projects	T2: Insufficient communication
S3: Collaboration with private sector and community	W3: Adaptation to technology	O3: Renewable energy technologies	T3: Legal and regulatory constraints
S4: Innovation in management	W4: Adoption of new technologies	O4: Development of public spaces and facilities	T4: Resistance to new technologies
S5: Clear goals and strategies	W5: Facing complex problems	O5: Online services for citizens	T5: Political conflicts

The SWOT analysis for Mahasarakham Municipality has led to the development of several strategic recommendations aimed at leveraging strengths, addressing weaknesses, seizing opportunities, and mitigating threats.

Proactive strategies focus on utilizing existing strengths to capitalize on opportunities. These include leveraging expertise in IoT and AI for urban management to improve the quality of life, promoting renewable energy such as solar power to reduce environmental impact, and collaborating with the private sector and community to develop public spaces. Additionally, implementing online services for tax payments, permit applications, and issue reporting will streamline processes, while developing health policies and accessible medical services will enhance public health.

Internal development strategies address weaknesses by making use of opportunities. Attracting investments to increase the budget and resources for local projects is crucial. Training medical and community health service providers through educational innovation will improve service delivery. Adopting renewable energy technologies and training personnel will ensure efficient use of technology. Developing modern public facilities will encourage public participation, and improving operational efficiency with online services will reduce complexity.

External collaboration strategies mitigate threats by leveraging strengths. Fostering transparency and public involvement through effective communication is essential. Increasing operational efficiency using technology will help reduce legal limitations. Collaborating with the private sector and public to manage political conflicts and effectively communicating to build understanding and acceptance of new

technologies are also key strategies. Aligning development projects with legal requirements will enhance management efficiency.

Internal adjustment strategies focus on addressing weaknesses and mitigating threats. Training personnel to adapt to technological changes will reduce resistance. Improving budget and resource management efficiency is vital. Developing effective internal communication systems will ensure alignment with urban development goals. Developing strategies to manage conflicts arising from urban changes will help minimize impacts on local traditions and cultures. Finally, creating transparent management processes will build public trust and acceptance.

These strategic recommendations aim to promote sustainable and innovative urban development in Mahasarakham Municipality by addressing key internal and external factors comprehensively.

Table 5. Recommendations on Strategies for Mahasarakham Municipality

Strategy Type	*Strategy Description*
Proactive Strategies (SO)	
SO1 *S1, S4 + O1*	Smart City Innovation for the Future: Leverage expertise in IoT and AI for urban resource management to enhance quality of life.
SO2 *S2 + O3*	Sustainable Energy and Smart Tools for the Future: Promote renewable energy use, such as solar lighting, to reduce environmental impact.
SO3 *S3 + O4*	Partnerships for Public Benefit: Collaborate with the private sector and community to develop public spaces and improve living environments.
SO4 *S4 + O5*	Smart Online Services: Implement online services for convenience and streamlined processes, such as online tax payments and permit applications.
SO5 *S5 + O2*	National Health Vision and Strategy: Develop clear health policies and accessible medical services to improve public health.
Internal Development Strategies (WO)	
WO1 *W1 + O1*	Smart City Development and Increased Budget: Attract investment to increase budget and resources for local projects.
WO2 *W2 + O2*	Educational Innovation and Workforce Development: Utilize government policies to train medical and community health service providers.
WO3 *W3, W4 + O3*	Transition to Technological Innovation: Adopt renewable energy technologies and train personnel to use new technologies efficiently.
WO4 *W5 + O4*	Innovative Public Spaces: Develop modern public facilities to create a positive environment and encourage public participation.
WO5 *W3, W4 + O5*	Efficient Online Services: Improve operational efficiency with online services to reduce complexity and enhance convenience.

Table 5. Recommendations on Strategies for Mahasarakham Municipality (continued)

Strategy Type	*Strategy Description*
External Collaboration Strategies (ST)	
ST1 *S1, S5 + T2, T4*	Transparency and Public Participation: Foster transparency and public involvement through effective communication.
ST2 *S4 + T1, T3*	Technology and Innovation for Management: Increase operational efficiency using technology, reducing legal and regulatory limitations.
ST3 *S3 + T5*	Private and Public Collaboration for Conflict Management: Collaborate to reduce political conflicts and support urban development.
ST4 *S2 + T4*	Managing Resistance with Effective Tools: Communicate effectively to build understanding and acceptance of new technologies.
ST5 *S5 + T3*	Future-Oriented Goals and Strategies: Align urban development projects with legal requirements to enhance management efficiency.
Internal Adjustment Strategies (WT)	
WT1 *W2 + T4*	Skills and Education for Change Preparedness: Train personnel to adapt to technological changes, reducing resistance.
WT2 *W1 + T3*	Efficient Budget and Resource Management: Improve management efficiency to mitigate legal and regulatory impacts.
WT3 *W3 + T2*	Effective Internal Communication: Develop systems to ensure understanding of urban development goals, reducing resistance.
WT4 *(W5 + T1)*	Conflict Management Strategies: Develop mechanisms to manage conflicts from urban changes.
WT5 *(W4 + T5)*	Create transparent management processes and systems to build trust and acceptance from the public, reduce political conflict impacts, and increase project success.

Discussion

The analysis of leadership practices among local administrators within the smart city planning framework of Maha Sarakham Municipality indicates a high level of effectiveness overall ($\bar{x}$ = 4.22, S.D = 0.397). Breaking down the results by specific dimensions, the highest average scores were observed in individual consideration ($\bar{x}$ = 4.25, S.D = 0.431) and intellectual stimulation ($\bar{x}$ = 4.24, S.D = 0.461). The lowest scores were recorded in inspirational motivation, suggesting potential areas for development. These findings align with Nanus (1987), who asserted that successful leaders direct their followers creatively, fostering organizational and societal development. Leaders are tasked with setting operational direction, building external relationships, and exemplifying best practices. Yukl (1994) further noted that leadership involves the integration of individuals and resources to achieve group goals, while

Burns (1978) highlighted the reciprocal influence between leaders and followers, with transformational leaders elevating followers' concepts and values towards higher ideals such as justice and peace.

Data on network management in local governance, evaluated through mean ($\bar{x}$) and standard deviation (S.D), reveal a high overall effectiveness ($\bar{x}$ = 4.23, S.D = 0.395). Within specific aspects, the highest average scores were in communication ($\bar{x}$ = 4.29, S.D = 0.436) and knowledge exchange ($\bar{x}$ = 4.25, S.D = 0.459), with the lowest scores in participation ($\bar{x}$ = 4.19, S.D = 0.466). These findings are consistent with Schermerhorn (2002), who emphasized that strategy is a crucial plan for organizations to set direction and achieve goals. Robbins and Coulter (2007) further noted that strategic management involves planning, organizing, leading, and controlling, alongside analyzing internal and external environments to formulate strategies. Sirintano (2013) asserted that strategic management requires environmental analysis, strategy formulation, implementation, and control, along with aligning personnel with the right attitudes, skills, and expertise, and developing staff to perform efficiently and retain high-potential employees.

The analysis of data on sustainable urban development, using mean ($\bar{x}$) and standard deviation (S.D.), shows that overall sustainability practices are effective ($\bar{x}$ = 4.09, S.D. = 0.649). Specific dimensions reveal that social aspects received the highest average score ($\bar{x}$ = 4.24, S.D. = 0.444), followed by physical aspects ($\bar{x}$ = 4.13, S.D. = 0.725), with the lowest scores in management aspects ($\bar{x}$ = 3.96, S.D. = 0.876). These findings resonate with the concepts of Zachary (1995), emphasizing developments in economy, ecology, quality of life, and management. The National Economic and Social Development Board (2000) Indicated that a livable city development must cover three main aspects, including public participation in resource management. Kammanatsanayakorn (1998) highlighted that a livable city must ensure safety, clean air and water, good sanitation, suitable housing, no poverty, and recreational spaces. Sustainable city development necessitates public participation to prevent resource degradation and create urban sustainability.

The assessment of Maha Sarakham Municipality's smart city initiatives, using mean ($\bar{x}$) and standard deviation (S.D.), indicates a high overall effectiveness ($\bar{x}$ = 4.07, S.D = 0.698). When categorized by specific dimensions, the highest average scores were observed in smart environment ($\bar{x}$ = 4.19, S.D = 0.730) and smart citizens ($\bar{x}$ = 4.15, S.D = 0.779). The lowest scores were in smart mobility ($\bar{x}$ = 3.97, S.D = 0.858), suggesting areas for improvement. These findings are consistent with Meijer and Bolívar (2016) and Wongkittiphat (2022), who stated that a smart city must integrate technology, resources, human capital, and governance to enhance efficiency, improve quality of life, and promote citizen participation. Raksaphon and Phosingsri (2021) further noted that the smart city concept aims to address

urban problems by focusing on infrastructure, human capital, and planning and management. Effective urban development must consider the city's size, population, resources, and citizen participation to solve problems efficiently.

This result of the study investigates the strengths and weaknesses of change leadership among local government administrators in the context of sustainable smart city development in Maha Sarakham Municipality, Thailand. Findings reveal that strengths include visionary leadership with clear concepts, the formulation of responsive strategies and policies, and a willingness to engage with public feedback. Weaknesses, however, are identified in inadequate interdepartmental communication and citizen engagement, inconsistent with the National Strategic Plan for Urban Development (2017-2037) (National Council for Peace and Order, 2017). Drawing upon Teng-Calleja et al.'s (2017) research on successful local government transformations in the Philippines and Pierce and Newstrom's (2000) emphasis on effective communication and visionary leadership, this study aims to explore factors influencing the effectiveness of change leadership within a collaborative governance framework to foster sustainable smart city development. Key factors identified include interagency linkage and community involvement, supported by competent personnel and comprehensive data management, aligning with Burns's (1978) emphasis on understanding employee needs and maximizing their potential. Strategies proposed to enhance leadership skills include fostering interagency collaboration, personnel development, leveraging information technology for efficiency, and promoting community and private sector involvement. Furthermore, addressing challenges such as a lack of intersectoral cooperation, limited communication outreach, outdated governance systems, and service inequality, the study advocates for strategic planning to reduce spatial disparities, modernize governance systems, and improve public infrastructure. Recommendations underscore the importance of multi-stakeholder cooperation, problem-solving, and feedback integration to unleash the collective potential for sustainable urban development. Additionally, investing in personnel development and information technology utilization is proposed to enhance operational efficiency, cost-effectiveness, and decision-making agility in serving the public, consistent with Mitmek (2016) and Meemana (2017) emphasis on local technology integration and Chaiprasert's (2022) focus on sustainable quality of life through technology and innovation-driven urban planning.

Despite the comprehensive nature of the study, several limitations should be noted. First, the use of convenience sampling, while practical for engaging local stakeholders, may limit the generalizability of findings to other municipalities or regions with differing characteristics. Second, the study's sample size of 400 respondents, although statistically adequate, may not fully capture the diversity of perspectives within the total population of 46,828 residents. Third, reliance on self-

reported data in surveys and focus groups could introduce response biases, as participants may overstate their engagement or satisfaction with smart city initiatives. Finally, the cross-sectional nature of the study restricts the ability to assess long-term impacts of transformative leadership and smart city policies.

Future research should address these limitations by employing probability sampling methods to improve representativeness, increasing sample sizes for greater diversity, and conducting longitudinal studies to analyze changes over time. Additionally, incorporating more objective data sources, such as urban performance metrics or independent evaluations, could enhance the robustness of the findings.

Recommendations

This study provides actionable recommendations based on empirical findings to bolster local government leadership for sustainable smart city development, focusing on Maha Sarakham Municipality, Thailand. The following practical suggestions are distilled from the research outcomes:

Visionary Leadership and Tech Savvy Integration: Local administrators should embody visionary leadership, embracing a forward-thinking outlook that incorporates cutting-edge technologies into local development strategies. They must actively mentor subordinates, fostering their technological acumen and encouraging innovative problem-solving. Regular feedback sessions should be instituted to ensure continuous engagement and foster a culture of collaboration.

Strategic Network Governance Management: Define clear objectives and collaborative targets for seamless cooperation with relevant agencies in local governance initiatives. Establish robust coordination mechanisms to ensure alignment and coherence in pursuing shared goals. Regular information exchange sessions should be conducted to facilitate mutual understanding and coordinated action, supplemented by expert consultations to enhance stakeholder knowledge.

Prioritized Sustainable Urban Management: Place citizen safety and asset security as top priorities in urban governance endeavors. Develop and execute infrastructure plans that cater to community needs, with a focus on delivering tangible benefits to residents. Encourage active community involvement in preserving and promoting local heritage, arts, and cultural identity.

Actionable Smart Municipality Initiatives: Implement comprehensive public infrastructure management practices to enhance resident convenience and promote environmental sustainability. Advocate for the adoption of renewable energy sources like solar power to reduce the municipality's carbon footprint. Launch skill development programs to address local unemployment issues and promote inclusive growth. Facilitate public education campaigns to raise awareness and foster the effective utilization of technology for ongoing urban development efforts.

Actionable Recommendations for Policymakers and Local Governments: Policymakers should prioritize capacity-building programs for local administrators, focusing on leadership development and technical training in smart city governance. These programs should be supported

by national funding mechanisms to ensure scalability and consistency across municipalities. Local governments should establish multi-stakeholder task forces to integrate public, private, and community perspectives in decision-making processes, ensuring inclusivity and shared accountability. In addition, local governments should develop performance monitoring frameworks to assess the effectiveness of smart city initiatives regularly. Metrics such as citizen satisfaction, infrastructure efficiency, and environmental impact should be tracked and used to guide policy adjustments. Policymakers can foster inter-municipality collaboration platforms to share best practices, tools, and resources, enabling municipalities to learn from one another's successes and challenges.

Digital Transformation and Public Engagement: Promote the integration of digital tools for citizen engagement, such as mobile applications and online platforms, to encourage transparent governance and real-time feedback. Ensure that all technological innovations are accompanied by public education campaigns to bridge digital literacy gaps, particularly for underserved populations. Policymakers should provide grants or subsidies to municipalities to adopt these tools effectively and inclusively.

Long-Term Urban Planning: Adopt a long-term urban planning framework that aligns with the municipality's vision and integrates environmental sustainability, economic resilience, and social inclusivity. This framework should include zoning policies that promote smart infrastructure, renewable energy usage, and mixed-use developments. National and local governments should work collaboratively to ensure the coherence of these frameworks with broader regional and national goals.

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