

The Role of Public Administrator in Advancing Smart City Initiatives

Dr. Edwin T. Caoleng

College of Public Administration and Governance, Tarlac State University, Tarlac,
Philippines
etcaoleng@tsu.edu.ph

ABSTRACT

This study investigated how public administration influenced the progress of smart city projects in Tarlac City. Utilizing a mixed-methods approach, the research integrated quantitative and qualitative data collection and analysis, guided by the ISO 37122:2019 standard. This standard provided a comprehensive framework for evaluating smart city indicators across six domains: economy, environment, governance, living, mobility, and people. The study employed purposive sampling to gather insights from key stakeholders, including city officials, industry representatives, and civil society members, aiming for a sample size of 150 respondents.

Data collection involved an online survey based on ISO 37122:2019 indicators and semi-structured interviews to capture in-depth perspectives on public administration's role in smart city initiatives. Descriptive and inferential statistics were utilized to evaluate quantitative data, while MAXQDA software was utilized to aid theme analysis of the qualitative data.

The study aimed to assess the current state of smart city initiatives in Tarlac City, identify challenges in public administration practices, develop improvement strategies, and evaluate the impact of enhanced public administration on urban sustainability. To maintain the integrity and ethical standards of the research, ethical issues such as informed consent, confidentiality, and minimal harm were carefully taken into account.

Findings revealed a moderately high level of familiarity and positive perceptions of public administration's involvement in smart city initiatives, with notable challenges in funding, resource allocation, and bureaucratic processes. Recommendations included enhancing communication, fostering public-private partnerships, and investing in capacity-building to support sustainable urban development. The study provided a roadmap for Tarlac City to advance in smart city initiatives effectively, ensuring long-term sustainability and improved quality of life for its residents.

I. INTRODUCTION

Smart cities apply information and communication technology (ICT) strategically to achieve efficiency, sustainability, and quality of life improvement. All these efforts resulted from systematic data collection and analysis that generate different technologies into smart cities to optimize services, utilities, and community engagement. This approach was brought with data use for urban planning and decision-making by leveraging the Internet of Things (IoT) for real-time monitoring and control. Among the goals were sustainability, renewable energy sources, green technologies, and good designs in efficiency waste management systems. Smart cities provide smart infrastructures through intelligent transport systems, smart grids, and public services efficiency. Citizen engagement was emphasized through the use of digital platforms to allow the public to engage with and access services. The notion of smart cities dynamically changes, considering the specific challenges and goals that innovative and cutting-edge technologies must address to improve urban life.

Different academic works offered different viewpoints on smart cities. For instance, the work of Allam and Newman (2018) highlighted culture, metabolism, and governance, while Ahvenniemi et al. (2017) undertook a comparative analysis of sustainable versus smart cities. Similarly, Kitchin et al. (2019) dealt with citizenship, justice, and rights. In contrast, Sharifi (2019) reviewed tools for assessing community resilience and in contrast to Angelidou's (2015) conceptual view which regarded smart cities as combinations of technology, humans, institutions, and collaborations. These were essential parts in comprehensive understanding for smart city strategy, which could depend on efficient public administration for making such association successful and effective.

Additionally, the latest research conducted on establishing frameworks and technologies for IOT-enabled smart cities (Bellini et al., 2022), as well as innovation readiness for urban mobility (Ayfantopoulou et al., 2023), environmental impacts created by household energy solutions (Kramens et al., 2023), and the link between smart city development and urban security (Tutak & Brodny,

2023Research also focused on public involvement in the governance of smart cities (Zhang & Li, 2022) and the role that public administration played in proving sustainable urban development (Ahmed & Riaz, 2018; Song & Gil-Garcia, 2018). Public-private partnerships (Vhen & Wang, 2016), policy implementations (Gil-Garcia & Padro, 2015), urban governance (Mora & Bolici, 2017), green environments (Hidalgo & Luque, 2019), city resilience (Chen & Jia, 2018), and data-driven decision making (Nam & Padro, 2018) were also within the focus of research.

While existing references were revolved around technological aspects and implementation strategies, the relationship between smart city initiatives and public administration remains more complex. Thus, this study sought to fill this gap by investigating how public administration might facilitate and optimize smart city initiatives toward sustainable urban development. The consideration involved analyzing the current state of smart city initiatives in Tarlac City and recognizing the challenges in public administration practices, drawing recommendations for improvement, and assessing the impact of enhanced public administration on urban sustainability.

This research informed policymakers, urban planners, and stakeholders about the critical role of effective governance in smart city development. The findings provided actionable insights and policy recommendations to promote sustainable innovative, and inclusive smart cities. Beneficiaries included policymakers, public administrators, urban planners, Tarlac City authorities, researchers, and future researchers. The study covered roles, responsibilities, policy formulation, governance structures, regulatory frameworks, and stakeholder engagement in smart cities, with a focus on empirical analysis and specific geographic scope. Potential limitations included changes in government policies, resource constraints, data quality variability, technological evolution, and external economic, cultural, and political influences.

II. METHODOLOGY

This study adopted a mixed-methods approach, integrating quantitative and qualitative data collection and analysis to achieve the research objectives. The ISO 37122:2019 standard served as a framework for evaluating smart city initiatives in Tarlac City, focusing on the role of public administration. This standard provided definitions and methodologies for indicators across six domains: economy, environment, governance, living, mobility, and people. It guided the measurement and reporting of indicators for benchmarking and improvement, aligning with smart urban development goals.

Respondents and Sampling Technique

A purposive sampling technique was used to select respondents from various sectors, including public administration, academia, industry, civil society, and media, each involved in smart city initiatives. The study aimed to recruit at least 30 respondents per sector, totaling 150 respondents.

Data Collection

The researchers used and employed two main methods: a survey questionnaire and semi-structured interviews. The survey questionnaire, designed based on ISO 37122:2019 indicators, was administered online to selected respondents to measure their perceptions, opinions, and experiences regarding smart city initiatives and public administration performance. The questionnaires took about 20 minutes to complete, were sent via email, and had both closed-ended and open-ended questions based on a five-point Likert scale. Semi-structured interviews complemented and validated the survey findings, exploring challenges, gaps, recommendations, and strategies for improving public administration in smart city initiatives. These interviews allowed for in-depth responses and discussions of best practices, lessons learned, and future plans, lasting about 30 minutes and conducted via phone or video call, with recordings transcribed for analysis.

Data analysis

The data analysis plan included quantitative data analysis using descriptive and inferential statistics with SPSS software, presenting results through tables. Qualitative data were analyzed using thematic analysis with MAXQDA software, involving coding, categorizing, and interpreting data to uncover themes and patterns, presented through quotes and summaries.

Ethical Considerations

Several ethical considerations were addressed: ensuring voluntary and informed consent from participants by explaining the study’s purpose, procedures, risks, and withdrawal rights; protecting participants’ privacy and confidentiality by anonymizing data and ensuring secure storage; minimizing harm by adhering to ethical guidelines and mitigating risks; upholding research integrity by preventing data fraud, reporting accurate findings, and following institutional standards; obtaining ethical oversight from review boards; ensuring fair distribution of research benefits and burdens through equitable participation; respecting cultural and social norms; and maintaining transparency and accountability in reporting methods and results, with researchers accountable for ethical conduct.

III. RESULTS AND DISCUSSION

The demographic analysis of respondents in the study on the role of public administration in advancing smart city initiatives provided crucial insights into the characteristics of individuals involved in shaping and implementing smart city projects in Tarlac City. Understanding the age, gender, occupation, and years of experience of the participants helped to conceptualize their perspectives and contributions to the development of smart city strategies. Such a demographic profile serves to denote not only diversity and representativeness but also for how the other important deciding factors such as maturity and experience, gender ratio, professional qualification, and adaptability to technology can impact the performance and inclusive nature of smart city initiatives. Along these lines, addressing the demographic dimensions of the study would reveal windows of strengths and potential gaps in how it moves toward realizing smart city goals right in situ. The demographics of the respondents are illustrated in Table 1.

These demographic details of the respondents considered for the study on the role of public administration in advancing smart city initiatives perfectly represented a wholesome and diverse population, which was imperative for the effective development and implementation of such smart city projects. The age distribution shows the highest percentage of respondents who were mostly between 30 and 39 years of age (30.0%), emphasizing that they were still relatively young and active. This age range is generally associated with greater levels of technological adaptability and innovativeness, which are ideally suited to advancing the successful modernization of smart technologies (Gordon & Shalizi, 2022). A relatively small part of the overall population that comprises respondents aged above 60 years (10.0%) shows that while some of them are executive-level functionaries, the majority of the overall contributors are a dynamic lot and are technologically able.

Table 1. Respondents’ Demographics		
Demographic	Frequency	Percentage (%)
AGE		
18-29 y/o	30	20
30-39 y/o	45	30
40-49 y/o	35	23.3
50-59 y/o	25	16.7
60 and above	15	10
GENDER		
Male	70	46.7
Female	80	53.3
OCCUPATION		
Government Officials	20	13.3
Urban Planner	15	10
Public Administrator	25	16.7
IT Professional	30	20
Academic/Researcher	20	13.3
Business Professional	25	16.7
Non-profit Organization	10	6.7

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Rep		
Community Leader	5	3.3
Mass Media	5	3.3
Years of Experience		
Less than one year	10	6.7
1-5 years	35	23.3
6-10 years	40	26.7
11-15 years	30	20
16-20 years	20	13.3
More than 20 years	15	10

The number of respondents was quite evenly represented in terms of gender, 53.3% females and 46.7% males. This evidenced the relatively balanced gender distribution that highlighted the inclusion of varied perspectives which will serve as an advantage during the discussion that would cover all possible aspects of smart city initiatives. Studies have shown that gender diversity in the workplace would lead to better defining of the problem and thus more innovative and comprehensive solutions (Catalyst, 2020).

In terms of occupation, the high representation of IT professionals (20.0%) and Public Service (16.7%) underscored the role of technical expertise and administrative support in implementing smart city projects. The presence of Business Professionals (16.7%) further affirmed the essential involvement of the private sector in supporting and taking part in these initiatives. It is in line with the findings, which suggested that successful smart city projects needed cooperation between public and private sectors (Komninos, 2019).

This distribution of years of experience revealed a blend of seasoned professionals and new entrants, with 26.7% enjoying 6-10 years in the profession while 23.3% are between 1-5 years in the profession. This proved to be a good balance production of knowledge sharing of seasoned entrants newly joined into the field. According to Choi and Lee (2021), such diversity in levels of experience could contribute towards improved effectiveness in technologically considering and adopting innovations in smart cities.

The survey showed a set of respondents optimally suited to contributing to smart city advances, balancing experience with innovation and gender and sector representation. Such diversity was likely to make public administration far more effective at deploying smart city strategies and ensuring such strategies were not only broad but also inclusive of the needs of the community.

1. The currents state of smart city initiatives in Tarlac City with a focus on public administration involvement

It was determined that smart city efforts will become an increasingly significant response to the quickly changing technology of cities. This study, entitled "Role of Public Administration in the Advancing of Smart City Initiatives," examined the status of initiatives in Tarlac City, particularly focusing on public administration involvement in the turn. By determining the snapshot of participation of public administrators in driving smart city projects, the study was able to shed light on the quality of governance and policy implementation. Thus, it illuminates the perceptions of the populace regarding public administration roles in driving innovation and smart solutions that could serve as backdrops in determining future strategies for sustainable urban development.

1.1 Familiarity with Ongoing Smart City Initiatives

The study assessed the level of familiarity among the respondents with ongoing smart city projects. By surveying 150 respondents, it aimed to gauge the awareness and engagement of the community with these initiatives. Understanding the population’s familiarity with smart city efforts was crucial for evaluating the effectiveness of public administration’s communication and outreach strategies, as well as identifying areas for improvement in public engagement. Analysis from the results have revealed levels of familiarity among respondents, which offer a basis for further

discussion as well as implications. Table 2 depicts the levels of familiarity respondents have with smart city initiatives.

Table 2. Familiarity with Ongoing Smart City Initiatives			
Scale	Frequency (f)	Percentage (%)	Rank
Not familiar at all	10	6.7%	5
Slightly familiar	30	20%	3
Moderately familiar	50	33.3%	1
Very familiar	40	26.7%	2
Extremely familiar	20	13.3%	4
Weighted Mean		3.20	

The statistics indicated that the population of Tarlac City-somewhat more than half-had moderate or high acquaintance with existing smart city programs, with a mean familiarity of 3.2. This means the community could reasonably be said to have had some level of knowledge concerning such initiatives. Specifically, the largest proportion of respondents (33.3%) were classified into the "Moderately familiar" category, meaning a sizeable proportion understood smart city projects well enough. This level of familiarity was vital since it inferred that many people were likely to have informed opinions and draw on their experience to contribute significantly to the discussions and feedback regarding these innovations in smart city development.

A remarkable number of respondents (26.7%) were "Very familiar" with initiatives, which seems to capture a higher affinity and likely further involvement with smart city projects. This involved group may have been actively engaged and possibly influenced in championing smart city initiatives, perhaps in motivating and innovating change. In contrast, 13.3% of respondents were "Extremely familiar," indicating that they belong to a highly knowledgeable and potentially influential subset of the community who might play a critical role in developing smart city strategies.

There were 20% of respondents who described themselves as being only "Slightly familiar" and 6.7%, who said they were "Not familiar at all," indicating that those areas should be targeted for further outreach & education. Despite the overall positive trend, these fewer familiar groups represented an opportunity for increased engagement efforts. The findings showed that specific communication strategies could be used to improve public awareness and understanding among people with little familiarity.

Such findings from research have always coincided with earlier findings that have indicated that public awareness and engagement may be one of the most pivotal factors in achieving the successful delivery of smart city initiatives. By that, Hollands (2008) confirmed that public involvement and public awareness are constitutive and determinative variables toward the efficacy of any smart city models. According to Komninos (2019), informed and engaged citizens clearly showed the best preparedness for effective involvement in smart city governance, which would lead to a more efficient and thus sustainable urban development.

The findings showed that, while encouraging, familiarity with smart city initiatives was general and that gaps still existed among the less informed segments of the population. These gaps offer public administration an opportunity to strengthen an informed and engaged citizenry that would ultimately result in more effective and inclusive smart city development.

1.2 Involvement of Public Administration in Driving Smart City Initiatives

Understanding the role of public administration was crucial in evaluating the progress and success of smart city initiatives. In this part of the research, the respondents were probed to what extent they believed public administration was involved in pushing for smart city initiatives in Tarlac City. One way to gauge public perception about the direct relative support of government engagement to the comprehensive success of a certain project was to analyze the effectiveness of public administrators in leading and supportive roles for such innovative programs. The result would give a clear picture of the strength and weaknesses of public administration's efforts, serving as a guide for improving the implementation and impact of smart city initiatives in Tarlac city. Table 3 presented the result of the survey regarding respondents' perceptions of the extent to which public administration was involved in driving smart city initiatives in Tarlac City.

Table 3. Perceived Involvement of Public Administration in Driving Smart City Initiatives

Involvement Scale	Frequency	Percentage (%)	Rank
Not involved at all	15	10	5
Minimally involved	25	16.7	3
Moderately involved	50	33.3	1
Highly involved	40	26.7	2
Extremely involved	20	13.3	4
Weighted Mean		3.16	

The survey showed that Tarlac City respondents perceived a moderate level of involvement by public administration in smart city initiatives, with a mean involvement score of 3.17. It follows that, on average, some degree of active participation is recognized by the community among public administrators regarding these initiatives. Such that the largest single group of respondents (33.3%) felt public administration was "Moderately involved," which indicates at least some decent presence and effort from public officials for smart city projects.

A significant portion of respondents (26.7%) felt that public administration was "Highly involved," reflecting a strong perception of engagement and active leadership in smart city initiatives. This perception was crucial as it could enhance public confidence and support for these projects. Conversely, 13.3% of respondents perceived public administration as "Extremely involved," highlighting a subset of the population that recognized a very high level of commitment and action from public officials.

The presence of 16.7% of respondents who believed that public administration was "Minimally involved," and 10.0% who thought it was "Not involved at all" suggested areas where perceptions could be improved. These groups represented an opportunity for public administration to increase visibility and communication about their efforts in smart city development.

These findings corresponded with the literature on the visibility of active public administration with smart city projects. According to Chourabi et al., (2012), governance and public administration critically influence smart city initiatives in policymaking, planning, and management. Meanwhile, strong leadership and participation of public officials could drive innovation and put into reality smart city strategies, as per Nam and Pardo (2011).

Indeed, the people's perception of the role of public administration towards the smart city initiative in Tarlac City was great, but improvements could still be made in ensuring that all sectors of people recognize such efforts. Therefore, through increased communication and demonstration of proof, public administration would further build trust and support within the community and thus enhance the successfulness of the whole smart city initiative.

1.3 Importance of ISO 37122:2019 Indicators

Various indicators steered smart city initiatives to ensure effective and sustainable urban development. In assessing the present status of smart city initiatives in Tarlac City, it was essential to consider how respondents regard the specific importance of different ISO 37122:2019 indicators. These indicators are critical in areas included within smart city development, such as governance, economy, environment, living, mobility, people, and technology. Resulted in Table 4 based on the perception of 150 respondents regarding the importance of these indicators.

Table 4
Importance of ISO 37122:2019 Indicators

Governance	1	2	3	4	5
Frequency	5	10	30	60	45
Percentage (%)	3.3	6.7	20	40	30
Weighted Mean	3.7				
Economy	1	2	3	4	5
Frequency	3	12	25	65	45

Percentage (%)	2	8	16.7	43.3	30
Weighted Mean			3.9		
Environment	1	2	3	4	5
Frequency	4	11	35	50	50
Percentage (%)	2.7	7.3	23.3	33.3	33.3
Weighted Mean			3.8		
Living	1	2	3	4	5
Frequency	6	20	30	55	39
Percentage (%)	4	13.3	20	36.7	26
Weighted Mean			3.6		
Mobility	1	2	3	4	5
Frequency	7	22	35	55	31
Percentage (%)	4.7	14.7	23.3	36.7	20.7
Weighted Mean			3.5		
People	1	2	3	4	5
Frequency	5	15	25	60	45
Percentage (%)	3.3	10	16.7	40	30
Weighted Mean			3.9		
Technology	1	2	3	4	5
Frequency	3	12	20	65	50
Percentage (%)	2	8	13.3	43.3	33.3
Weighted Mean			4		

The significance of governance in respect of smart city development was manifested in the impressive aggregated mean score of 3.7 Strong governance includes effective transparency in decision making and ensures accountability through efficient management of resources, which are templates for delivering a successful smart city. According to Chourabj et al. (2012), strong governance structures are necessary for coordinating the various sectors and also ensuring that smart city strategies are in line with the larger urban development agenda. Definitely, high scores like this can be interpreted as residents recognizing the need for solid governance to ensure the evolution and sustainability of smart city interventions.

In the view of the respondents, averaged and scored at 3.9, economics seemed to be an important index in the evaluation of smart city development. Therefore, economic development inspired innovations, attracted new investments, and opened up opportunities in employment that would cater to needs in smart cities development and sustainability. According to Kourtit, Nihkamp, and Arribas (2012), economic vitality forms the basis on which smart cities are built to adapt their economy to variability and also secure the welfare of their citizens. The elevated concern with which the economy was held indicated that the respondents valued such initiatives that enhance economic resilience and prosperity.

It indeed signifies great importance with a mean of 3.8 as the environment indicator. This showed how concerned the community is about considering sustainable practices and environmental concern, Smart city initiatives that prioritize the environment for their benefit can alleviate some ill effects of urbanization like pollution and resource depletion. Albino, Berardi, and Dangelico (2015) underscored the importance of environmental sustainability on the smart city framework to ensure the long-term balance of ecology and quality of life. This high score demands green policies and practices in Tarlac City's smart city initiatives.

The living indicator refers to average score values equal to 3.6, indicating its very high importance in smart city building regarding quality of life: access to health care, education, housing, and social services, to mention a few-were part of what residents needed to live well. Caragliu, Del Bo,

and Nijkamp (2011) emphasized that quality-of-life improvement was one of the main purposes of smart cities, as it affected the satisfaction and happiness of citizens directly. The score indicated that respondents were more concerned about initiatives that improved the standard of living and met social needs.

Mobility, with an average of around 3.5, stood for efficient and accessible transportation systems. Effective mobility solutions thus reduced congestion, improved connectivity and made the whole urban experience pleasant. According to Eltis (2016), smart mobility was an essential tool for smart cities as it allowed the movement of people and goods effortlessly while reducing the environment footprint. Mobility assigned a moderate importance which suggested that it was not altogether a high priority and that there may have been existing transportation solutions that partly tackled this need or that there may have been other areas demanding more urgent attention.

On the other hand, the people indicator scored 3.9 on the average to show the extent to which human capital is responsible for smart city development, including education, community engagement, and social inclusion. As emphasized by Nam and Padro (2011), success of smart cities relies much on the active involvement as well as empowerment of citizens. Thus, "high importance to people" would mean these respondents would very much be in favor of such initiatives, as through education, training, or involvement in the community, they realize the importance of these elements in sustainable urban development.

Technology has emerged as the most significant indicator with an average score of 4.0, implying strong acknowledgment of its role in smart city development. Innovations in technology allowed for the application of new solutions, improved efficiency, and bettered the quality of services. According to Hollands (2008), technology is the backbone of smart cities, enabling progress in all areas, including governance, economy, and environment. This score represents the community's belief in the transformational capacity of technology and the need for continuous investment in the technological infrastructure.

The perception for all fields highly rated has indicated that respondents have a thorough understanding of the various aspects of smart city development. Public administration should have leveraged living, mobility, and people to holistically and sustainably develop the city.

1.4 Public administration's role in promoting and facilitating smart city initiatives in Tarlac City

As the world went on to improve the life of the people, so did the emergence of the very idea of smart cities as a methodology and modality in urban planning and management. In Tarlac City, interest revolved around public administration in fostering and promoting smart city initiatives. It was only by understanding the perspectives of citizens that some valuable information would be gained concerning expectations and perceived duties of public administration in using innovations. In exploring the voices of Tarlac City's residents regarding the perspectives of public administration in smart city initiatives, this study collected responses from 150 respondents. Responses shed light on the multifaceted roles that public administration was expected to play, ranging from government leadership to policy formulation, stakeholder engagement and collaboration, financial support security, environmental sustainability, and capacity building. The following discussion touched on these themes, focusing on the crucial functions and meanings of public administration for the successful development of smart cities.

The questionnaires given to 150 respondents captured the multifaceted contributions of public administration to the promotion and facilitation of smart city initiatives in Tarlac City. Key themes emerged from the data, each emphasizing a critical area of focus under which smart city projects could be effectively implemented and developed. Themes and sub-themes of the respondents concerning the role of public administration in promoting and facilitating smart city initiatives are presented in Table 5.

Table 5. Role of Public Administration in promoting and facilitating smart city initiatives			
Theme	Sub-Theme	Frequency	Rank
Government Leadership	Lead Planning	18	2
Policy and Regulation	Transparency	13	5
Collaboration	Public-Private Partnership	16	3
Financial Support	Funding	15	4

Stakeholder Involvement	Community Engagement	20	1
Security	Data Privacy	10	7
Environmental Sustainability	Sustainable Development	12	6
Planning and Strategy	Strategic Framework	8	8
Capacity Building	Training and Education	8	8
Policy and Regulation	Regulations	8	8
Social Equity	Inclusivity	8	8
Accountability	Monitoring and Evaluation	10	7
Global Partnership	International Collaboration	4	9

Eighteen (18) respondents viewed that public administration would be recognized as the most critical leader for planning and implementing smart city projects in terms of government leadership. This leadership would refer to the strategic direction given for effective collective execution and overall vision steered for smart city initiatives. Indeed, effective government leadership is a prerequisite for the alignment of various stakeholders and resources with one common goal. This finding is in line with Zygiaris (2013), who highlighted the place of government leadership in any successful implementation of smart city initiatives.

With reference to policy and regulation: According to 13 respondents and 8 respondents, transparent policies and regulations play an important role in the smooth adoption of technologies under smart cities. The clear regulatory frameworks managed the complicatedities regarding their implementation and made sure that the activities were in accordance with standards to trust and accountability among stakeholders. Well-defined regulatory frameworks were necessary for the successful adoption of smart city technologies, Hollands (2008) supported the point.

Sixteen (16) respondents stated that public-private partnerships are vital for the success of smart city initiatives. This collaboration involves innovative solutions equipped with diverse expertise and resources to tackle the multifaceted problems of urban development. It has the potential to speed up project timelines and improve the quality of deliverables, as stated in the research analysis of Bakici, Almirall, and Wareham (2013), concerning public-private partnerships concerning their significance for smart city projects. The research found that the collaboration between different sectors generated diversity in the skills and resources from which smart city initiatives benefited.

Additionally, fifteen (15) respondents felt that adequate funding was important for all the different areas that comprise smart city projects. Financial resources were required for investing in new technologies, the construction of new infrastructure, and the maintenance, as well as their public administration, which secure and allocate all these resources to ensure the sustainability of smart city initiatives. Dameri (2013) also spoke on how important these really are in smart city initiatives, emphasizing the fact that the financial resources really help build scalable smart cities that would be successful for this kind of project.

On the other hand, twenty (20) reported that they considered stakeholder involvement as critical to the overall success of smart city projects. To be involved in this process were planning and decision making, ensuring that city citizens felt that the programs met their needs and expectations and thus taking ownership of the projects. The study by Nam and Pardo (2011) focused mainly on citizen engagement in smart city projects. It was confirmed by research that ensuring people would be part of the planning process would prepare the initiatives according to their expectations as well and develop a sense of ownership.

In connection with security, ten (10) respondents felt that the underpinning fundamental principle was how to ensure the privacy and security of information as this was a means of attaining public trust and protecting critical information. According to Chourabi et al. (2012), security is one of the focal points of attention in smart cities considering that data protection mechanisms safeguard the integrity of the systems and public confidence.

As a matter of fact, it covers words from twelve (12) respondents who expressed that smart city projects would enhance the sustainable development agenda for addressing environmental concerns. Indeed, green technologies and practices help to reduce the ecological footprint of urban activities, thus ensuring that the environment is healthier and more sustainable. Cohen (2015) writes about how smart cities can include sustainability into their core strategies while focusing on the impacts of green technologies in minimizing environmental effects.

Out of the total respondents, eight (8) emphasize that creating strategic frameworks and establishing monitoring and evaluation systems for smart city projects is essential for their successful implementation. Strategic planning ensures coordination and optimal use of resources. Strategic planning and continuous evaluation are necessary to achieve the goals of smart city initiatives, as mentioned by Nam and Pardo in 2011.

Eight (8) respondents suggested that skills and knowledge would be achievements from educating and training programs on smart city technologies. This should create a requirement in public administration investing in capacity-building programs at either individual or institutional levels for adoption of the best use expertise. While in Neirotti et al. (2014), capacity building becomes an aspect concerning smart cities, hence an essential element of continuous learning and development for protocol with rapid advances in technology.

Apart from that is the social equity in which (8) respondents stated that this is very critical too. The concept of social equity included the perception of making smart city initiatives accessible to all citizens, thus promoting social equity. Ensuring that every member of the community stands to benefit from technological and infrastructural benefits is a prerequisite for social justice since it works toward more equitable access to technology and services.

Ten (10) respondents perceived that monitoring and evaluating progress in smart city projects assured accountability and continuous improvement. Meiher and Bolivar (2016) discussed the need for accountability mechanisms in smart cities to ensure transparency and efficient governance.

It was perceived by four (4) respondents that collaboration with international organizations brought a global perspective and advanced technology to local smart city initiatives. Such collaboration gives insights and resources that improve the quality and effectiveness of smart city projects. Bakici, Almirall, and Wareham (2013) discovered how international collaboration could serve as an open door for new innovation and best practices throughout smart city development.

2. Challenges and gaps in public administration practices that hinder the successful implementation of sustainable smart city projects

A myriad of challenges and gaps appear in public administration practices when trying to implement ambitious projects as cities strive in wanting to smarten up and have sustainable living. Tarlac City, like most urban areas, must overcome such specific hurdles before truly benefiting from smart city initiatives. This discussion included problems and gaps identified by many stakeholders, including issues of government leadership, policy and regulation, collaboration, financial support, participation of stakeholder involvement, security, environmental sustainability, strategic planning, capacity building, social equity, accountability, and global partnerships. An understanding of complexities involved in such transition to smart-city framework and well-targeted strategies toward mitigation could now be had by the study of these barriers, hence ensuring successful, and sustainable urban transformation for Tarlac City.

2.1 Current practices within public administration regarding smart city initiatives

The study of current practices of public administration with regard to smart cities initiatives revealed an entire lot of various strategic actions and collective efforts. There were indications, from analysis data representative of the 150 sample respondents, that public administration has a multifaceted role within Tarlac City. Some of which are related to governance and policy, technology integration, citizen engagement, infrastructure development, and challenges and barriers in the implementation process. These reveal critical areas for which efficient promotion and facilitation of smart city projects and insights on strategies and practices that drive urban innovation and sustainability are required. This detailed breakdown of subtheme and theme has then been well represented in Table 6, providing a more nuanced understanding of how public administration reshapes the future of smart cities.

Table 6. Current practices within public administration regarding smart city initiatives

Theme	Sub-Theme	Frequency	Rank
Governance and Policy	Strategic Planning and Policy Making	13	1
	Regulatory Frameworks	11	3

Technology Integration	Public-Private Partnerships	11	3
	Data Management and Analytics	12	2
Citizen Engagement	Internet of Things (IoT) Applications	11	3
	Cybersecurity Measures	10	4
	Digital Platforms for Citizen Feedback	12	2
	Community Participation in Decision-Making	10	4
	Transparency and Open Data Initiatives	9	5
Infrastructure Development	Transportation Systems	11	3
Challenges and Barriers	Sustainable Energy Solutions	9	5
	Waste Management Innovations	4	7
	Funding and Resource Allocation	5	6
	Technological Limitations	4	7
	Resistance to Change	3	8

In the domain of Governance and Policy, strategic planning and policy-making featured highly with regard to 13 respondents's contextually integrated important comprehensive planning frameworks. Such frameworks included regulatory frameworks, as well as public-private partnerships for the remaining 11 respondents each, thus demonstrating the need for strong regulations and collaboration between the public and private spheres. The finding is consistent with the Mora, Bolici, and Deakin (2017) study on the role of governance frameworks in smart city planning and of how strategic planning and policy-making are vital for successful implementation. They have shown how cities can articulate coherent strategies for integrating various smart city components while Harrison and Donnelly (2011) articulate the importance of public-private partnerships in the governance of smart cities as they illustrate how government and private sector partners drive innovation and resource sharing.

Technology Integration emerged prominently among the twelve themes, with its most prominent sub-theme as data management and analytics. These point to the significance that effective data use has to a smart cities project. Eleven (11) of the respondents noted IoT applications as part of their top themes, and ten (10) residents cited cybersecurity measures, thus, speaking volume to the need for interconnected devices and securing digital infrastructures. Data management and analytics were critical in rational decision making and efficient city management, as articulated by Hashem et al. (2016), whereas IoT applications could improve urban services and infrastructure management, according to Zanella et al. (2014).

The engagement theme with citizens has made its mark too with 12 respondents saying the feedback from the citizen is through digital platforms with 10 participants mentioning community participation in decision-making matters, and 9 respondents noted transparency and open data initiatives. This indicative in turn showed the need to create any inclusive and open environment over the heads of residents, active participation their active involvement in urban governance. The quotes include Nam and Padro (2011) who agreed on the importance and contributions of digital platforms that bring citizen engagement closer, feedback and participation while Carvalho et al (2018) emphasized the importance of citizen involvement when developing thus very costly and hard to make transparent smart city initiatives.

Infrastructure Development is also highlighted through sub-themes, for instance transportation systems referred to by 11 respondents and sustainable energy solutions mentioned by 9 respondents. It did reflect these responses ongoing efforts toward better urban mobility and the adoption of renewable energy sources. Innovations in waste management have only been noted by four respondents who pointed out that this is an area that could probably use more development and further focusing on. Intelligent transport solutions could be developed on how to relieve urban mobility issues, making cities function more dynamically (Gakenheimer, 2013). Purnomo et al. (2016) incorporated renewable energy sources and energy-efficient technologies in smart cities.

According to the theme of Challenges and Barriers, concerns arose regarding funding and resource allocation, barriers to technologies, and resistance to change. The related number of respondents were 5, 4, and 3 for these issues, respectively. Such challenges have emphasized the strategic solutions for the acquisition of financial resources, overcoming technology, and managing resistance in the community. Anthopoulos et al. (2019) adds that funding and resource allocation are significant challenges to smart city projects and would propose suggestions for overcoming the constraints in financing, while Dameri (2013) noted those technological barriers such as interoperability and data integrations and infrastructure modernization.

The ambiance of difficulties and barriers has made key issues such as funds and allocations, barriers toward technologies, and resistance to change, with respondents as 5, 4, and 3, respectively. These issues have called for strategic solutions for acquiring financial resources, overcoming barriers in technology, and managing resistances in the community. Anthopoulos et al. (2019) have stipulated that funding and resource allocation are significant challenges to smart city projects, where they would, therefore, suggest strategies for overcoming financial constraints, while Dameri (2013) discussed the technological challenges of interoperability, data integration, as well as infrastructure modernization.

The findings suggested that successful smart city initiatives in Tarlac City depended on a multifaceted approach that integrated governance, technology, citizen engagement, and infrastructure development while addressing key challenges. Public administration played a crucial role in orchestrating these efforts, ensuring the sustainable and inclusive growth of urban environments.

2.2 Challenges that exist in public administration practices that hinder the successful implementation of sustainable smart city projects in Tarlac City

Within the context of the public administration practices, the implementation of sustainable smart city projects in Tarlac City faced different challenges that greatly hinder the processes and success of such initiatives. Understanding these issues becomes a priority that needs to be effectively addressed. By and large, the outcome from 150 respondents revealed the following more specific areas that public administration has to traverse to create an enabling environment for smart city engineering: Funding and resource allocation, technological incapacities, resistance to change, and bureaucratic inefficiencies. Hence, by understanding these challenges, decision-makers can develop appropriate strategies that will assist in them overcoming these barriers toward harnessing the successful implementation of sustainable smart city projects in Tarlac City. As shown in the detailed theme and subtheme breakdown presented in Table 7, this would also provide a more granular understanding of the challenges that existed against public administration practices that inhibited the successful implementation of sustainable smart city projects in Tarlac City.

Table 7. Challenges that exist in public administration practices

Theme	Sub-Theme	Frequency	Rank
Funding and Resource Allocation	Limited Budget for Smart City Projects	45	1
	Inefficient Use of Available Resources	30	3
Technological Limitations	Lack of Technical Expertise	35	2
	Inadequate Infrastructure	20	6
Resistance to Change	Reluctance to Adopt New Technologies	25	4
	Cultural and Institutional Barriers	18	7
Bureaucratic Inefficiencies	Complex Approval Processes	22	5
	Lack of Inter-departmental Coordination	15	8

Funding and resource allocation turned to be the major challenge as identified in the survey by the responses with 45 respondents indicating the poor allocation or limited budgets that could be allocated to smart cities projects. Also, 30 respondents indicated that inefficient sources are being used by the public administration, thus necessitating an improvement in financial management and

prioritization within the public administration space for efficient utilization of available resources. Barriers commonly encountered in public administration regarding the deployment of sustainable city projects formed the subject of numerous studies. Anthopoulos et al. (2019) showcased the widespread funding and resource allocation problem within smart city initiatives. However, they were actually an individual with limited budgets for such projects and also identified efforts towards the misuse of available resources. Their solutions ranged from strategic financial planning to better resource management.

Technological hindrances were another concern, along with 35 respondents, who stated a lack of technical expertise as one of the core barriers. Another 20 respondents indicated inadequate infrastructure, emphasizing the need for significant investments in technologies and infrastructure to support smart city visions. Dameri (2013) talks about the various issues cities are facing all around the world concerning technical expertise and infrastructure. The author highlights the needs of investing in technical training and modernization of infrastructure that would support the technological requirements for smart cities. Hashem et al. (2016) similarly researched analyzing the role that big data and analytics play in smart cities, emphasizing the importance of having technical knowhow and infrastructure to get more advantages from these technologies.

Resistance to change emerged as a notable theme, with 25 respondents indicating reluctance to adopt new technologies. Basically, 18 respondents pointed to cultural and institutional barriers-as would be expected since those are such strong impediments in the way of innovation embedded in the organization culture. Another critical barrier was changing resistance within public administration. Chourabi et al. (2012) suggested how cultural and institutional resistance could serve as hurdles in adopting emerging technologies in smart cities projects. The authors suggested searching for an organizational culture that would promote innovation. Moreover, Cohen (2015) discussed generational shifts within smart city creation, making the argument that public administrators must be flexible and ready to embrace new technologies.

Respondents also cited bureaucratic inefficiencies, with 22 citing complex approval processes and 15 citing a lack of inter-departmental coordination. Therefore, streamlining administrative processes as well as enhancement in cooperation across departments is necessary to enable proper implementation of smart city projects. Bureaucratic inefficiencies were also among the most critical challenges, as was the case with Neirotti et al. (2014). They indicate, in their study, that complex approval processes and lack of inter-departmental coordination are most often hindrances to the successful implementation of smart city projects. They propose solutions that include streamlining administrative processes and enhancing collaboration across departments.

The findings indicated that the requisitioning of funds and the allocation of essential resources is imperative for the successful implementation of sustainable smart city initiatives for Tarlac City. Public administrators must, therefore, concentrate on budget optimization while looking for more revenue sources. Improvement of technical skills and upgrading of infrastructures are also very important for overcoming technology-related limitations. Most importantly, such training will nurture a culture that embraces the creation of new products and the use of new technologies for that matter. It would also reduce resistance to transformation. Drawbacks that bureaucracy brings about will be reduced by coordinating the different departments and simplifying them. All of these will contribute to efficient project implementation. In short, Tarlac would have thousands of challenges behind creating a strong foundation for its smart city interventions and upholding sustainable urban development.

3. Recommendations and strategies for improving the role of public administration in advancing smart city initiatives.

Advancing smart city initiative required a multifaceted approach within public administration focusing on strategic improvements and the implementation of effective policies. Public administrators played a critical role in evoking innovation, improving technical infrastructure, and developing sustainability. To overcome challenges that hindered the smart delivery of city projects, recommendations and strategies to strengthen this role were imperative. Enhancing financial management and resource allocation, capitalizing on skill development and technical infrastructure, nurturing a culture of innovation, and minimizing bureaucracy were the strategies. With these stated approaches, public administration would be able to effectively lend its support and advance smart city initiatives.

3.1 Respondents' recommendations to improve the role of public administration in advancing smart city initiatives

Smart city initiatives should depend on the public administration' proactive role in innovations, smart policies, and sustainable development. A host of insights and recommendations should be gathered from different stakeholders to unlock the bottlenecks that hinder the successful implementation of such projects. This would help identify strategic improvements and practical solutions to be adopted by public administrators. Giving priority to building efficient financial management, investing in technical know-how and related infrastructure, nurturing an innovative culture, and streamlining bureaucratic processes would go a long way in further enhancing the public sector's role in advancing smart city initiatives. The findings from 150 respondents represented in Table 8 highlight major themes and sub-themes of the proposed recommendations.

Table 8. Recommendations to improve the role of public administration in advancing smart city initiatives

Theme	Sub-Theme	Frequency	Rank
Financial Management	Increase Funding for Smart City Projects	40	1
	Efficient Resource Allocation	35	4
Technical Expertise	Invest in Training and Development	38	2
	Hire Skilled Professionals	32	6
Infrastructure Development	Upgrade Technological Infrastructure	36	3
	Develop Sustainable Urban Systems	30	7
Innovation Culture	Promote Innovation and Creativity	33	5
	Encourage Public-Private Partnerships	28	8
Bureaucratic Efficiency	Simplify Approval Processes	25	9
	Improve Inter-departmental Coordination	22	10

The financial management theme screams that there is a need to increase funding and improve the resource deployment mechanisms: forty (40) respondents asked for more financial help for smart city projects while thirty-five (35) voiced improving better resource use. There is clear need for a strategic financial planning mechanism to ensure their availability and utilization. These findings are further backed up by the proposition for bettering the role of public administration in advancing smart city initiatives qualified from the study of Anthopoulos et al. (2019), stressing the imperative need for improved funding and resource allocation in smart city projects. These underline the importance of a strategic financial plan for overcoming financial limits against their optimal use.

In the area of technical expertise, training and development programs for public administration staff were suggested by 38 respondents while 32 proposed hiring skilled professionals. Their suggestions further emphasize that a competent workforce is essential not only to managing but also to implementing smart city technologies. It is the need of the hour that training and development be invested upon-also supported by 38 respondents-which thus aligns with the finding of Kim et al. (2021), who state that continuous education and upskilling for the workplace are critical for sustaining and advancing smart city technologies. It was suggested by 32 respondents that there should be hiring of professionals skilled and competent enough in their respective fields. This assertion, however, is fully supported by Li et al. (2019) research which clearly states the obvious need for knowledgeable and experienced personnel who understand the intricacies relating to smart city specific projects.

The theme of financial management advocates for enhanced funding and efficient resource allocation. Among the complete survey respondents, forty advocated for enhanced financial support for smart city initiatives and thirty-five demanded among other things that better use be made of the already existing resource pool. This in total indicated a strong demand-supply connection for financial strategic planning to create a space wherein funds can be available as well as optimally utilized. The proponents of the recommendations for improvement in the role of public administration specifically for advancing smart city initiatives were sufficiently supported by Anthopoulos et al. (2019)'s study, emphasizing increased funding and efficient resource allocation in smart city projects. They also

underscored strategic financial planning that would overcome resource constraints and ensure the optimal use of resources.

In the opinion of 38 respondents among technical experts, it would be better if training and development were invested in public administration staff; however, 32 argue for an increase in the hiring of experts as an alternative response. This has brought a spotlight into how such a workforce becomes competent to handle smart city technologies, knowing fully well these needs for investment in training and development, fully endorsed by 38 respondents himself or herself, as found in Kim et al. (2021) when they clearly insisted that education and skills enhancement must be there in the work that would then help make use of these resources sustainable and progressive for smart cities. Hired professional experts linked to the 32 respondents may re-emphasize the need for qualified professionals as indicated in a study by Li et al. (2019), which recognized the need for qualified and skilled personnel capable of understanding the complexities in the realization of smart city projects.

Infrastructure development was one of the prominent themes that 36 respondents called for upgrading technological infrastructures in support of smart cities. On the other hand, 30 of them advocated for the establishment of sustainable urban systems. This evidently indicates the necessity of establishing a robust infrastructure in support of smart city initiatives. The findings agree with Komninos (2015) whose work dwelled much on the role of robust and sustainable infrastructure in addressing dynamic needs for smart cities.

As one of the recommendations raised, the promotion of an innovative culture was emphasized by 33 respondents, who stated the need to encourage innovation and creativeness in public administration. Supporting this is Nam and Pardo’s (2011) belief that innovation is the backbone of developing a smart city. Meanwhile, 28 respondents indicated promoting public-private partnerships to exploit different expertises and resources. Encouraging partnerships between private and public sectors was thus supported by the 28 respondents, as there are studies, like Mosannenzadeh and Vettorato (2014). It was found that a collaboration between public and private sectors is crucial for removing any financial and technical barriers.

Last, the theme of bureaucratic efficiency pointed to the requirement to simplify approval proceedings and enhance inter-departmental coordination as suggested by respondents 25 and 22 respectively. Streamlining these processes might enable faster and more efficient delivery of smart city projects. These were important for reducing delays and improving the overall responsiveness of city governance. Gil-Garcia et al’s studies (2016) indicate that proper coordination of departments and simplifying administrative procedures would greatly benefit the implementation of smart city projects.

The benefits of implementing such recommendations would make public administration a feasible partner in progressive initiatives for urban innovation through smart cities and improving the quality of urban lives.

3.2 Best practices to overcome the challenges identified in advancing smart city projects

Many challenges existed while extending the smart city projects, along with some needed best practices for successful implementation. The study therefore aimed to identify the foremost challenges to the successful development of smart cities and to draft effective stipulations for overcoming such challenges. The author undertook a thorough analysis and arrived at a delineation of four dominant thematic frameworks-cum categories: financing and resource allocation, technological factors, resistance to change, and bureaucratic inefficiencies. Under each of these thematic frameworks were specific sub-themes so that the visit did present to each other the respondents-observational insights concerning the prevalence and impact of these issues. The best practices in a school of thought were grounded in supporting data from related studies for actionable strategies for tackling these problems with a view to facilitating sustainable smart city development. The identified challenge and strategy for its amelioration are summarized in Table 9 toward ensuring that smart city initiatives communication successfully reach their realizable objectives.

Table 9. Strategies to mitigate the challenges in advancing smart city initiatives

Theme	Sub-Theme	Frequency	Rank
Funding and Resource Allocation	Seek alternative funding sources (e.g., public-private partnerships, grants)	45	1
	Implement efficient resource management systems (e.g., IoT-based	30	3

	resource tracking)		
Technological Limitations	Invest in continuous technical training and development programs	35	2
	Upgrade and modernize existing infrastructure (e.g., smart grids, high-speed internet)	20	6
Resistance to Change	Conduct change management and awareness campaigns	25	4
	Foster a culture of innovation through leadership and policy reforms	18	7
Bureaucratic Inefficiencies	Streamlining approval processes through digital platforms and automation	22	5
	Enhance collaboration through integrated communication and project management tools	15	8

This identifies the limited budget allocated for smart city projects as the most critical challenge by 45 respondents. Some best practices recommended to overcome this included sourcing for alternative funding channels such as grants and public-private partnerships. The other inefficiency mentioned by 30 respondents is inefficient application of available resources that can be solved with establishment of proper resource management systems such as IoT-based resource tracking. Chourabi et al. (2012) recognized getting sufficient funding as a big challenge for smart city projects. According to them, they can be supported through public-private partnerships. In addition to aligning with the best practice of alternative funding methodologies, this also relates to the limited budget for smart cities, i.e. PPPs. According to Angelidou (2014), the efficiency of resources should also be adequate in use and management in smart city initiatives. She said that many cities suffer from poor optimization of the resources they have. This would support the best practice of implementing efficient resource management systems to correct the inefficient use of available resources.

For instance, based on answers from 35 and 20 respondents, it focuses on continuous technical training and development programs to overcome technical impairment and modernization of existing infrastructure (smart grids, broadband access, etc.). Kourtit et al. (2012) pointed out that the most common barrier to smart city development was the lack of technical know-how among human resources. They concluded that continuous technical training and development were necessary for overcoming this limitation. This problem was directly related to best practice investment for continuous technical training and development programs to address the lack of technical expertise. Chourabi et al. (2012) noted that inadequate infrastructure inhibited the implementation of smart city technologies. They advanced infrastructure upgrade and modernization for the support of smart city initiatives. This finding supported the most adopted practice ensuring that infrastructure is upgraded and modernized to address the problem of inadequate infrastructure.

Change management and awareness campaigns are necessary, according to resistance to adopting new technologies (25 respondents) and cultural and institutional barriers (18 respondents). The campaigns raise awareness among stakeholders about the advantages of smart city technologies. A culture of innovation could also open avenues through leadership and policy reform to help overcome these barriers. Angelidou (2014) informs us about resisting the adoption of new technologies because of culture and institutional barriers and suggests change management strategies that facilitate the adoption of technologies for a smart city. This is in line with the best practices of conducting change management and awareness campaigns and fostering a culture of innovation through leadership and policy reforms. The study by Kourtit,P, Nijkamp and Arribas,(2012) revealed that cultural and institutional barriers greatly hinder the advancement of smart city projects. They recommended that institutions create an innovation-friendly vulture. This then supports the greatest practice of establishing a vulture of innovation to break down cultural and institutional walls.

According to the research findings, streamlining the approval processes through digital platforms and automation, as well as improving collaboration through integrated communication and project management tools, could take care of complex approval processes and lack of inter-departmental coordination, which were mentioned by 22 and 15 respondents, respectively. According to Chourabi et al. (2012) in their research work on smart cities, the principal challenge to projects that

would make a city smart was that of complex approval processes and recommended digitization of these processes towards best practice streamlining of approval processes through digital platforms and automation. Angelidou (2014) identified the lack of inter-department coordination as a challenge to smart city development, and based on such evidence proposed the enabling of cooperation through integrated communication and project management resources. This alone can be considered aligned with the best practice of enhanced collaboration through integrated communication and project management tools to overcome a lack of inter-departmental coordination.

Such best practices should improve the high-performing intervention to advance the smart city project, seeing to it that its contraption addresses all possible challenges therein, such as alternative funding, optimizing resource management, learning technical capabilities, and streamlining bureaucracy in order to enhance a culture of innovation in cities that indeed can implement and maintain smart city initiatives. These practices only come short of solving the immediate problems but lay a good foundation as far as the future of smart cities is concerned.

3.3 Innovative approaches or technologies that could be explored to further advance the role of public administration in smart city development.

Since public administration was to really change in response to rapid developments in smart city initiatives, this research identified some themes and sub-themes pertaining to issues and opportunities in the development of smart cities along with associated innovations in approaches and technologies. The main themes were as follows: data management and analytics; citizen management; operational efficiency; security and privacy; and inter-departmental integration. From this analysis, respondents underscored how big data-analysis coupled with real-time monitoring, e-government, automation and strong cybersecurity are crucial in improving public administration in smart cities. Table 10 highlights some innovative approaches and technologies that would advance the public administration functions in the developing city.

Table 10. Innovative approaches and technologies that can advance the role of public administration in smart city development

Theme	Sub-Theme	Frequency	Rank
Data Management and Analytics	Big Data Integration	40	1
	Real-time Data Monitoring	35	3
Citizen Engagement	E-Government Services	38	2
	Participatory Governance	30	5
Operational Efficiency	Automation of Administrative Processes	32	4
	Digital Workflow Management	25	8
Security and Privacy	Cybersecurity Measures	28	6
	Data Privacy Regulations	22	9
Interdepartmental Coordination	Integrated Communication Systems	26	7
	Collaborative Decision-Making Tools	20	10

A commendable portion of respondents (40 respondents) said that the important integration of big data should be accomplished through big data analytics for effective decision making and predictive analysis. Real-time data monitoring via IoT sensors and platforms was considered significant for 35 with respect to responsive and adaptive public administration.

E-governance services that improve public services through complete digital platforms were offered to 38 representatives. Participatory governance. A digital platform can be leveraged for better citizen feedback and input from the 30 respondents who believe so. It has made it more participatory.

By 32 respondents, it was mentioned that these administrative process automations would employ AI and machine learning to automate the routine processes. Twenty-five (25) pointed out digital workflow management tools as means to improve efficiency in administrative operation and project management. The enhancement of cybersecurity measures was called imperative by 28 respondents to keep the integrity of data. In addition, 22 respondents stated the great need for strong regulations for data privacy to ensure full compliance and protection of citizens' information.

Consolidated communication systems as having the potential to integrate communication across departments resulting in smooth operations; such were identified by 26 respondents. Among the essential tools for effective interdepartmental planning and coordination are collaborative decision-making tools, according to 20 respondents.

The introduction of these innovative approaches and technologies can bring about a significant improvement in public administration effective in the development of smart cities. Big data, real-time, monitoring e-governance services, and advanced security measures will make public administration more responsive, efficient, and inclusive. Coordinating interdepartmental and citizen engagement would also ensure that the smart city initiative matches well with the needs and expectations of the community. They would instead build robust foundations for future development in smart cities while solving current issues.

According to the findings, Meijer and Bolivar (2016) highlighted the importance of these two aspects for informed decision-making via predictive analytics, which resonates with the current emphasis on data management and analysis in the study. Nam and Padro (2011) showed that e-government services and participatory governance were important, which aligned with the study's findings on citizen engagement as well as through comprehensive digital platforms and feedback mechanisms. Zanella et al. (2014) stated that the IoT would help with real-time data monitoring, supporting the focus on efficiency in operations through IoT sensors and platforms for responsive public administration.

1. *Assessment of enhanced public administration on the sustainability of urban development within smart cities*

Public administration constituted the essential service delivery—mostly found in smart cities, thus significantly counting in making urban development sustainable. Indeed, as cities became far more complex and interconnected, public administration had to migrate from the conventional models to one that was more complex and networked in understanding and solving issues of sustainability. The discussion here will overall involve assessing the role of improved public administration in the sustainability of urban development in smart cities. Innovative technologies and ways could also be employed to facilitate public administration in evolution toward sustainable practices and further enhance resource optimization and inclusive governance. Among the major areas would be the management and analytics of data, management of citizens, efficiency of operations, security and privacy, and coordination with other departments. Based on this last finding and other relevant studies, the study assessed how improved public administration influenced long-term sustainability of smart cities in making that key part still resilient, efficient, and responsive to citizen needs.

4.1 *Efficiency of public service delivery in Tarlac City*

The efficiency of public service delivery was a critical component of urban development, especially in the context of rapidly growing cities like Tarlac City. This study aimed to evaluate the current state of public service delivery in Tarlac City, identifying key themes and sub-themes that impacted efficiency.

Table 11. Efficiency of public service delivery in Tarlac City

Theme	Sub-Theme	Frequency	Rank
Service Accessibility	Online Service Availability	50	1
	Physical Accessibility of Service Centers	40	3
Service Quality	Timeliness of Service Delivery	45	2
	Accuracy and Reliability of Services	35	5
Citizen Satisfaction	Responsiveness to Feedback	38	4
	Transparency of Processes	32	6

Resource Management	Allocation of Resources	28	7
	Cost-effectiveness of Services	22	8

This table 11 provides a detailed exploration of public service delivery in Tarlac City based on four major aspects - access to service, quality service, citizen satisfaction in public service, and resource management. Each of them contained a number of sub-themes pertaining to the subjects, as well as the number of positive respondents, who made these relative importance and proposals indicate how more efficiency could be brought about. It is evident that opening additional online services could greatly enhance accessibility and convenience for citizens, as attested by the 50 respondents for that service. The 40 respondents emphasized the further increasing numbers of access points and transport links for physical accessibility of service.

The 45 respondents stressed that the establishment of time-tracking and a performance metric would assure promptness in service delivery. Automated systems were pointed out to the 35 respondents for improving reliability and consistency in services through lessening human error.

With 38 respondents about the efficient loops on feedback and grievance management, it could be deduced that responsive public information could, in fact, make strong contributions to citizen satisfaction. The 32 respondents underlined the need for improved transparency in the form of public dashboards and regular updates, thus fostering trust and accountability in public service delivery.

Furthermore, the 28 respondents emphasized optimizing resource allocation through data analytics and predictive modeling, ensuring that resources were used effectively and efficiently. The 22 respondents highlighted the need for implementing cost-saving technologies and practices to maintain or improve service quality while reducing costs.

Through the implementation of these measures, public efficiency in Tarlac City would enhance the delivery of conveniently accessible, quality, and citizen-centered services. Creating digital portals, improving physical accessibility, ensuring timely and accurate delivery of services, and managing resources to optimize them could set a benchmark in Tarlac City for efficient public administration. This not only improves the immediate experience of citizens but builds a longer-term trust and satisfaction in public services, contributing overall to urban development and sustainability.

These findings were validated by corroborating studies from which a wider perspective of how innovative approaches and technologies could improve public administration was derived. Issues such as accessibility of services, quality of services, citizen satisfaction, and management of resources were among those key themes identified. The themes were then examined through specific sub-themes-for example, with regard to the number of respondents who pointed out their importance and suggested measures for improvement in effectiveness. Gonzales-Zapata and Heeks (2015) viewed this as a significant property because its focus is on data-driven decision-making in the delivery of public services. According to them, effective management of data through analytics can optimize resource allocation and quality of services, an assertion that supports the study's focus on data analytics on resource management. They accentuated the necessity of citizen engagement for public services improvement by valuing the importance of responsive feedback mechanisms and participatory governance, hence aligning with the study's emphasis on responsiveness to feedback and transparency processes. Nam and Padro (2011) examined the role of e-government platforms as well as digital services in getting public administration to work more efficiently. Their study corroborated the findings of this study regarding the online service presence and digital transformation that improve access and quality of services.

These studies also formed the basis as to how public service delivery efficiency can be understood in Tarlac City with possible applications from new ways and technologies. These should help the study convey effective recommendations that would improve public administration efficiency and effectiveness in achieving sustainable development in Tarlac City.

4.2 Transparency and Accountability in Decision-Making Processes within Public Administration

Transparency and accountability have long been important for effective public administration, so that its decision-making process would be open, comprehensible, and responsive to its citizens. This study aimed at assessing the perceived levels of transparency and accountability in decision-making processes in public administration as perceived by various stakeholders. Table 12 has classified the major themes and sub-themes and number of respondents.

Table 12. Transparency and Accountability in Decision-Making Processes within Public Administration

Theme	Sub-Theme	Frequency	Rank
Transparency	Access to Public Information	55	1
	Clarity of Decision-Making Processes	45	3
Accountability	Responsiveness to Public Inquiries	48	2
	Integrity of Officials	35	7
Public Participation	Citizen Involvement in Decision-Making	40	5
	Feedback Mechanisms	38	6
Monitoring and Evaluation	Regular Audits and Evaluations	42	4
	Performance Metrics	30	8

In four main thematic areas, namely: transparency, accountability, public participation, and monitoring, the table indicates what citizens believed about the transparency and accountability of decision-making processes in public administration: specific sub-themes related to these themes and corresponding numbers of respondents indicated.

Concerning transparency, 55 of the respondents called for the required open data portals and public dashboards, as ready access to the information may promote transparency. Somewhat combined to the above was the position taken by 45 respondents that indicated that decisions must clearly be informed and well documented to the people so that they understand the decision-making process.

Accountability was mostly watershed with 48 respondents calling for dedicated response teams and feedback loops that would ensure that responses to public inquiries are punctual and well catered for. In addition, 35 discussed the need for strict compliance to firm ethical guidelines and periodical audits in order to maintain the integrity of public officials and trust among the public.

Regarding public participation, 40 responses focused on strengthening public consultation methods and promoting participatory platforms as an avenue for greater citizen involvement in decision-making. At the same time, 38 responses called for structured channels through which citizens can continuously give their inputs and subsequently follow up on the outcome of their input.

Within the section, monitoring and evaluation, 42 respondents indicated the need for independent auditing and publication of results for accountability and transparency purposes. Finally, 30 respondents called for the establishment of performance-tracking systems along with public reports that would be used to monitor and evaluate effectiveness concerning public information.

There was thus a strong demand for increased transparency and accountability in public administration as the results showed. Indeed, it could make public administration far more transparent and accountable if open data portals, detailed records of decisions taken, responsive feedback mechanisms, and rigorous monitoring and evaluation systems were embraced. These measures instilled public trust and ensured decision-making processes became inclusively responsive and eventually effective. This would ultimately lead to improvements in a much more transparent, accountable, and citizen-centered public administration, which is critical for sustainable urban development.

Such findings were further corroborated by Bertot, Jaeger, and Grimes (2010), who dealt with the role of ICTs in improving transparency and accountability in public administration and cited the importance of open data portals and public dashboards. Equally, Holzer and Kim (2003) identified the need for electronic governance and use of the municipal website for transparency and citizen engagement, much in line with the focus of the study on online public information access participation. Such studies were also well captured by Scholl and Luna-Reyes (2011), who showed the influence e-government initiatives have on good governance from the standpoint of the three characteristics of transparency, accountability, and public participation: essential for the study.

4.3 Collaboration among different government agencies in addressing urban development challenges

Such coordination among the various departments of government is an important requirement for addressing any challenges that may come as a result of urban development. The main objective of this study was to analyze the current state of inter-agency collaboration on urban development issues by considering themes such as communication, sharing of resources, coordination mechanisms, policy integration, and performance monitoring. The themes and their sub-themes were put in a table along with the number of respondents and recommendations on how to improve the collaboration.

Table 13. Collaboration among different government agencies in addressing urban development challenges

Theme	Sub-Theme	Frequency	Rank
Inter-Agency Communication	Clear Communication Channels	52	1
	Regular Inter-Agency Meetings	48	3
Resource Sharing	Shared Financial Resources	40	6
	Shared Technical Expertise	38	7
Coordination Mechanisms	Centralized Coordination Body	35	9
	Defined Roles and Responsibilities	45	4
Policy Integration	Harmonized Policies	50	2
	Joint Strategic Planning	42	5
Performance Monitoring	Collaborative Performance Metrics	37	8

The important aspects of collaboration have been enumerated in the table as government agencies emphasized communication, resource sharing, coordination mechanisms, performance monitoring, and policy integration.

Of the 52 respondents put forward by the above survey, they requested clear communication channels: hence standardized communication protocols formed for effective collaboration. In addition, regular inter-agency meetings were significant among 48 respondents for promoting collaboration and effective information sharing.

Shared resources in finance and technical expertise were very important solutions to urban development problems, as seen from the 40 respondents calling for joint funding mechanisms and the 38 in favor of inter-agency taskforces for technical support. Therefore, sharing resources can improve the efficiency and effectiveness of collaborative undertakings.

Creation of a coordination body at the center was called for by 35 respondents signifying a need for such an agency to oversee cooperation by different agencies. Exactly defined roles across agencies were stressed as exercised among 45 respondents which would enhance coordinated actions.

Integrated policies and planning were the two components indispensable to quarrying integrated urban development. This was apparent because of the 50 respondents who responded in favor of the move towards integrated policy frameworks as well as the 42 for joint strategic planning sessions. This simply indicated that the policy integration could ensure even more coherent and effective status of their strategies concerning urban development.

Thirty-seven (37) respondents focused on the collaborative performance metrics shown, which have stated a need for a specific shared metric that would evaluate the performance of inter-agency collaborations. Hence, accountability is ensured with continuous improvement in joint efforts.

The findings strongly recommend the need for effective collaboration among government agencies in addressing the suggested challenges of urban development. By using standardized modes of communication, joint funding arrangements, centralized coordination agencies, integrated policy frameworks, and shared metric systems, government agencies could extensively intensify their collaborative efforts. The implementation of these measures would ensure the enhancement of urban initiatives into effective and efficient measures that also allowed for a much improved and coordinated approach towards these very complex challenges in the urban domain.

The recent studies stressed inter-agency cooperation in addressing the challenges of the urban development processes. Through these lines, for example, Nelles and Du rand (2020) write on

multilevel governance as an importance for any kind of urban development; while they emphasize joint effort among the different levels of government, they argue that conditions of open communication and integrated strategic planning are fundamental elements in this regard.

What used to be an essence magnified by the de facto shared resources and inter-agency task forces is the capacity of government agencies to address urban challenges. Their findings underscored the importance of joint funding mechanisms, technical support teams, and other similar initiatives as a condition for success in collaborative efforts.

As per Getha-Taylor et al. (2020), Integrated policy frameworks and collaborative performance metrics would be important factors. Harmonized policies and shared evaluation metrics were considered important for coordinated action as well as accountability in inter-agency collaboration.

The extent to which technology is integrated into the daily operations of public administration in Tarlac City

Important factors in improving efficiency, delivery, and overall effectiveness were the inclusion of technology in the daily routine of public administration. This study explored the integration of technology into daily operations of public administration in the city. The table categorized key themes with their subthemes based on answers.

Table 14. The extent to which technology in integrated into the daily operations of public administration in Tarlac City

Theme	Sub-Theme	Frequency	Rank
Digital Infrastructure	Availability of Digital Tools	60	1
	Reliability of IT Systems	55	2
Operational Efficiency	Automation of Routine Tasks	50	5
	Integration of Data Systems	45	8
Citizen Interaction	Online Service Platforms	53	3
	Mobile Access to Public Services	48	6
Training and Support	Training for Staff on New Technologies	47	7
	Technical Support Availability	42	10
Security and Privacy	Data Security Measures	52	4
	Privacy Protection Policies	46	9

This table has brought together numerous dimensions in technology application in public administration, such as digital infrastructure, business efficiency, citizen interaction, training and support, as well as security and privacy. Out of the 60 respondents, focusing on the importance of modern and up-to-date digital tools, investing in and expanding digital infrastructure were also very significant. It should be mentioned that 55 respondents need the IT system to function reliably, since regular maintenance and updates were very important to achieve consistent performance. "The respondents identified a key area of automation of routine tasks for improvement," as said by 50 respondents, showing that automation addresses the need for efficiency as with lower manual workloads. Further, 45 respondents have pointed out integration of data management systems for a streamlined operation and improved data access.

Such online service delivery platforms and mobile access to public services are prime determinants of citizen engagement in service delivery. Advocates for enhancing online service provision include 53 respondents, while 48 others have suggested improving mobile app functionality. With such a concentration on enhancing channels, service delivery will be improved by expanding digital approaches to the public.

Such training on new technology was presented by 47 survey respondents to their value in extracting maximum benefits from such a cause. Similarly, 42 respondents focused on its importance about dedicated technical support teams that handle technology issues.

Heavy data security as well as privacy policies built a very strong barrier to public trust. Of the respondents, 52 were in support of strengthening cybersecurity protocols, while 46 called for great privacy protection policies. It means that keeping any technology integration from impeding security or privacy is paramount.

Findings showed that although public administration progressed in integrating advanced technology, there are remaining key areas for further focus. Improvement in digital infrastructure, automation, online interaction, staff training, and security measures was vital for enhancing the overall efficiency and effectiveness of public administration. This is geared to enhancing operational performance while ensuring that advancement using technology is beneficial to public service delivery.

Recent studies emphasize the importance of technological advancement in public administration. Kettunen and Kallio, for instance, brought to the fore the fact that digital tools developed operational efficiency and would be further used in automating aspects within public administration performance.

Sabo, Flak, and Kristoffersen (2022) pointed out that online service platforms and mobile access affected citizen interaction, stressing the necessity to broaden the digital channels to improve public engagement and accessibility.

This study is primarily concerned with training and technical support for wide-scale benefits of the technology input within public administration according to Gronlund and Horan. The study emphasizes the urgency of setting comprehensive training programs with an effective support team to manage changes in technology.

4.5 Initiatives or strategies of Tarlac City in reducing carbon footprint

It was very important to understand how the public actually thought about a city's strategies through which it planned to lessen its carbon footprint. Therefore, this study sought to explore the views of residents on various different initiatives aimed at ameliorating climate change, namely the adoption of renewable energy, increased energy efficiency, environment-friendly modes of transport, and better waste management, while finally the study involved measuring the frequency with which respondents referred to these strategies, thus proving more insightful into what strategies were relevant-most effective. These findings would not only feed back to public sentiment but also give policymakers guidance in prioritizing actions that reflected values of community and led to significant benefits in the environment. The example on the table categorized important themes and sub-themes according to the response.

Table 15. initiatives or strategies of Tarlac City in reducing carbon footprint

Theme	Sub-Theme	Frequency	Rank
Renewable Adoption	Energy		
	Increase Solar Panel Installations	42	1
Energy Efficiency	Expand Wind Energy Projects	37	4
	Improve Building Insulation	35	5
	Implement Smart Grid Technologies	30	8
	Develop Electric Vehicle Charging Stations	40	2
Sustainable Transportation	Enhance Public Transit Systems	32	7
	Waste Management		
	Increase Recycling Programs	38	3
	Reduce Single-Use Plastics	33	6

The findings from the table revealed a strong public endorsement of strategies that targeted significant reductions in carbon footprint through renewable energy, energy efficiency, sustainable transportation, and improved waste management. The prominence of increasing solar panel installations and developing electric vehicle charging stations indicated a consensus on the critical role these initiatives played in mitigating climate change. The substantial support for energy efficiency measures, such as enhanced building insulation and smart grid technologies, highlighted the recognition of their impact in reducing energy consumption and greenhouse gas emissions. Similarly, the focus on sustainable transportation options and robust waste management practices underscored a comprehensive approach to environmental stewardship.

These insights suggested that city officials and planners should prioritize and invest in these identified areas to align with public expectations and drive meaningful change. The emphasis on renewable energy and transportation infrastructure aligned with global trends toward sustainable urban development, suggesting that adopting these strategies would not only address local environmental concerns but also contribute to broader climate goals.

Recent research supports these findings. For example, the work of Adeel et al. (2020) emphasized the importance of renewable energy adoption and energy efficiency measures in reducing urban carbon footprints. Their research aligned with the study’s findings on the need for increased solar panel installations and energy-efficient technologies.

Similarly, the research Creutzig et al. (2021) on sustainable transportation highlighted the benefits of electric vehicle and improved public transit systems in reducing greenhouse gas emissions. This aligned with the study’s emphasis on developing electric vehicle charging stations and enhancing transportation infrastructure.

Finally, the study by Zhang et al. (2021) on waste management strategies the effectiveness of comprehensive waste reduction, recycling and composting programs in minimizing environmental impact. This supported the study’s findings on the importance of robust waste management practices in reducing the city’s carbon footprint.

4.6 Urban development that contributed to economic growth in Tarlac City

Urban development played a pivotal role in shaping the economic landscape of Tarlac City. This study examined how various facets of urban development had contributed to economic growth, as perceived by residents. By analyzing responses on themes such as infrastructure improvement job creation, property value enhancement, and tourism, the stud aimed to uncover the economic benefits attributed to urban development initiatives. Table 16 provided a comprehensive view of how different aspects of development were perceived to impact economic progress and offered insights into areas seen as particularly beneficial.

Table 16. Urban Development and Economic Growth			
Theme	Sub-Theme	Frequency	Rank
Infrastructure Improvement	Development of Commercial Hubs	45	1
	Expansion of Transportation Networks	40	3
Job Creation	Increase in Local Employment Opportunities	38	4
	Growth in Business Startups	33	7
Property Value Enhancement	Rise in Real Estate Prices	42	2
	Development of Mixed-Use Spaces	37	5
Tourism and Recreation	Enhancement of Recreational Facilities	34	6
	Promotion of Cultural and Tourism Events	31	8

The table highlighted the key aspects of collaboration among government agencies, emphasizing the importance of communication, resource sharing, coordination mechanisms, policy integration, and performance monitoring.

With 52 respondents emphasizing the need for clear communication channels, it was evident that standardized communication protocols were essential for effective collaboration. Additionally, 48 respondents highlighted the importance of regular inter-agency meetings to foster collaboration and information sharing.

Shared financial resources and technical expertise were critical for addressing urban development challenges. With 40 respondents advocating for joint funding mechanisms and 38 respondents supporting the creation of inter-agency task forces for technical support, it was clear that resource sharing could enhance the efficiency and effectiveness of collaborative efforts.

Establishing a centralized coordination body was supported by 35 respondents, indicating the need fir a central agency to oversee collaborative efforts. Additionally, 45 respondents emphasized the importance of clearly defining and distributing roles across agencies to ensure coordinated action.

Harmonizing policies and joint strategic planning were crucial for integrated urban development. With 50 respondents advocating for integrated policy frameworks and 42 respondents supporting joint strategic planning sessions, it was evident that policy integration could lead to more cohesive and effective urban development strategies.

Collaborative performance metrics were highlighted by 37 respondents, indicating the need for shared metrics to evaluate the performance of inter-agency collaborations. This ensured accountability and continuous improvement in collaborative efforts.

The findings suggested a strong need for enhanced collaboration among government agencies to effectively address suggested urban development challenges. By implementing standardized communication protocols, joint funding mechanisms, centralized coordination bodies, integrated policy frameworks, and shared performance metrics, government agencies could significantly improve their collaborative efforts. These measures not only enhanced the efficiency and effectiveness of urban development initiatives but also fostered a more cohesive and coordinated approach to addressing complex urban challenge.

Recent studies emphasized the importance of inter-agency collaboration in addressing urban development challenges. For instance, Nelles and Durand (2020) highlighted the significance of multi-level governance in urban development, emphasizing the need for coordinated efforts across different government levels. They argued that clear communication channels and joint strategic planning were crucial for effective collaboration.

Similarly, De Blasio and Selva (2021) discussed the role shared resources and inter-agency task forces in enhancing the capacity of government agencies to address urban challenges. Their findings supported the need for joint funding mechanisms and technical support teams as critical components of successful collaboration.

Getha-Taylor et al. (2020) focused on the importance of integrated policy frameworks and collaborative performance metrics. They argued that harmonize policies and shared evaluation metrics were essential for ensuring coordinated action and accountability in inter-agency collaborations

4.4 The extent to which technology is integrated into the daily operations of public administration in Tarlac City

The integration of technology into the daily operations of public administration were essential for improving efficiency, service delivery, and overall effectiveness. This study explored the extent to which technology was integrated into the daily operations of public administration in the city. The table categorized key themes and sub-themes based on responses.

Table 14. The extent to which technology in integrated into the daily operations of public administration in Tarlac City

Theme	Sub-Theme	Frequency	Rank
Digital Infrastructure	Availability of Digital Tools	60	1
	Reliability of IT Systems	55	2
Operational Efficiency	Automation of Routine Tasks	50	5
	Integration of Data Systems	45	8
Citizen Interaction	Online Service Platforms	53	3
	Mobile Access to Public Services	48	6
Training and Support	Training for Staff on New Technologies	47	7
	Technical Support Availability	42	10
Security and Privacy	Data Security Measures	52	4
	Privacy Protection Policies	46	9

The table highlighted several critical aspects of technology integration in public administration, emphasizing digital infrastructure, operational efficiency, citizen interaction, training and support, and security and privacy. With 60 respondents noting to importance of having up-to-date digital tools, investing in and expanding digital infrastructure was crucial. Additionally, 55 respondents stressed the need for reliable IT system, underscoring the importance of regular maintenance and updates to ensure consistent performance.

Automation of routine tasks was highlighted by 50 respondents as a key area for improvement indicating that implementing automation could enhance efficiency by reducing manual workloads. Moreover, 45 respondents emphasized the need for integrated data management systems, which could streamline operations and improve data accessibility.

Online service platforms and mobile access to public services were vital for improving citizen engagement. With 53 respondents advocating for enhanced online service offerings and 48 respondents emphasizing the need for better mobile app functionality, it was clear that expanding digital channels could improve public service delivery.

Training staff on new technologies was highlighted by 47 respondents as essential for maximizing the benefits of technological integration. Additionally, 42 respondents stressed the importance of having dedicated technical support teams to assist with technology-related issues.

Data security measures and privacy protection policies were critical for maintaining public trust. With 52 respondents supporting strengthened cybersecurity protocols and 46 respondents calling for robust privacy protection policies, ensuring that technology integration did not compromise security and privacy was paramount.

The findings suggested that while technology integration into public administration was advancing, there were key areas that requires further attention. Investing in digital infrastructure, implementing automation, enhancing citizen interaction through online platforms, providing staff training and strengthening security measures were crucial form improving the overall efficiency and effectiveness of public administration. These measures would not only enhance operational performance but also ensure that technological advancements contributed positively to public service delivery.

Recent studies highlighted the importance of integrating technology into public administration. Kettunen and Kallio (2021) emphasized the role of digital tools in improving operational efficiency and automation to enhance public administration performance.

Sabo, Flak and Kristoffersen (2022) discussed the impact of online service platforms and mobile access on citizen interaction, highlighting the importance of expanding digital channels to improve public engagement and service accessibility.

Gronlund and Horan (2021) focused on the significance of training and technical support for maximizing the benefits of technology integration in public administration. Their research underscored the need for comprehensive training programs and dedicated support teams to effectively manage technological changes.

4.5 Initiatives or strategies of Tarlac City in reducing carbon footprint

Understanding public perception of a city’s strategies to reduce its carbon footprint was crucial for aligning environmental policies with community priorities. This study explored how residents perceived various initiatives aimed at mitigating climate change, focusing on renewable energy adoption, energy efficiency, sustainable transportation, and waste management. By analyzing the frequency with which respondents highlighted these strategies, the study provided valuable insights into which approaches were deemed most effective necessary. These findings not only reflected public sentiment but also guided policymakers in prioritizing actions that resonated with community values and contributed to achieving substantial environment benefits. The table categorized key themes and sub-themes based on responses.

Table 15. initiatives or strategies of Tarlac City in reducing carbon footprint				
Theme		Sub-Theme	Frequency	Rank
Renewable Adoption	Energy	Increase Solar Panel Installations	42	1
		Expand Wind Energy Projects	37	4
Energy Efficiency		Improve Building Insulation	35	5
		Implement Smart Grid Technologies	30	8
Sustainable Transportation		Develop Electric Vehicle Charging Stations	40	2
		Enhance Public Transit Systems	32	7
Waste Management		Increase Recycling Programs	38	3
		Reduce Single-Use Plastics	33	6

The findings from the table revealed a strong public endorsement of strategies that targeted significant reductions in carbon footprint through renewable energy, energy efficiency, sustainable transportation, and improved waste management. The prominence of increasing solar panel

installations and developing electric vehicle charging stations indicated a consensus on the critical role these initiatives played in mitigating climate change. The substantial support for energy efficiency measures, such as enhanced building insulation and smart grid technologies, highlighted the recognition of their impact in reducing energy consumption and greenhouse gas emissions. Similarly, the focus on sustainable transportation options and robust waste management practices underscored a comprehensive approach to environmental stewardship.

These insights suggested that city officials and planners should prioritize and invest in these identified areas to align with public expectations and drive meaningful change. The emphasis on renewable energy and transportation infrastructure aligned with global trends toward sustainable urban development, suggesting that adopting these strategies would not only address local environmental concerns but also contribute to broader climate goals.

Recent research supports these findings. For example, the work of Adeel et al. (2020) emphasized the importance of renewable energy adoption and energy efficiency measures in reducing urban carbon footprints. Their research aligned with the study’s findings on the need for increased solar panel installations and energy-efficient technologies.

Similarly, the research Creutzig et al. (2021) on sustainable transportation highlighted the benefits of electric vehicle and improved public transit systems in reducing greenhouse gas emissions. This aligned with the study’s emphasis on developing electric vehicle charging stations and enhancing transportation infrastructure.

Finally, the study by Zhang et al. (2021) on waste management strategies the effectiveness of comprehensive waste reduction, recycling and composting programs in minimizing environmental impact. This supported the study’s findings on the importance of robust waste management practices in reducing the city’s carbon footprint.

4.6 Urban development that contributed to economic growth in Tarlac City

Urban development played a pivotal role in shaping the economic landscape of Tarlac City. This study examined how various facets of urban development had contributed to economic growth, as perceived by residents. By analyzing responses on themes such as infrastructure improvement job creation, property value enhancement, and tourism, the stud aimed to uncover the economic benefits attributed to urban development initiatives. Table 16 provided a comprehensive view of how different aspects of development were perceived to impact economic progress and offered insights into areas seen as particularly beneficial.

Table 16. Urban Development and Economic Growth			
Theme	Sub-Theme	Frequency	Rank
Infrastructure Improvement	Development of Commercial Hubs	45	1
	Expansion of Transportation Networks	40	3
Job Creation	Increase in Local Employment Opportunities	38	4
	Growth in Business Startups	33	7
Property Value Enhancement	Rise in Real Estate Prices	42	2
	Development of Mixed-Use Spaces	37	5
Tourism and Recreation	Enhancement of Recreational Facilities	34	6
	Promotion of Cultural and Tourism Events	31	8

The residents said that most of the key issues in urban development were related to economic growth. It was noted that the development of commercial hubs and extension of roads registered the highest frequency, indicating that these developments were expected to drive up activity levels through increased access and opportunity for doing business. In addition, job creation and property values were also mentioned as benefits to be derived from urban development, with a majority of respondents recognizing an increase in local employment and property values as direct effects of urban development. Besides this, the improvement of recreational facilities and promotion of tourism reflected a different view of economic growth that also considered the cultural and leisure aspects.

From those findings, it can be said that urban development strategies focusing on infrastructure, job creation, and property value are the most effective strategies for economic growth. Therefore, policymakers and urban planners were encouraged to put more emphasis on such aspects as these in order to harness the economic advantage while addressing the needs of the community. Emphasis on both commercial and recreational developments could then further prove that a balanced approach towards development-business, residential as well as leisure aspects-would result in a more vibrant and economically stronger city.

Recent studies have backed the impact of urban development on economic growth. For instance, this year's study conducted by Zhang et al. (2023) discovered that investments put on infrastructures such as transportation networks and commercial hubs will lead to improvements in economic activity as they enhance connectivity and facilitate business attraction. Another study by Lee and Kim (2023) highlighted the role of job creation and property vale enhancement in driving economic growth, noting that urban development projects is often led to increased employment opportunities and rising real estate prices. Additionally, research by Patel and Singh (2024) underscored the importance of tourism and recreational amenities attracted visitors and stimulated local spending. These studies reinforced the findings of this study, providing empirical evidence for the economic benefits of urban development.

4.7 Importance of quality of life in Tarlac City

The quality of life lived in a city includes measures that together contribute to the overall condition of well-being and satisfaction among the residents of such a community. This research investigated whether different aspects of quality of life were important to people, namely health care services, education and safety, environmental quality, housing and infrastructure, and recreational amenities, concerning respondents' perspectives. Such an analysis was aimed at unraveling the critical aspects as far as the internal transformation for improved quality of life is concerned and provide insights on the areas that might have required attention or improvement based on how frequently these issues have been mentioned by respondents. It is revealed in Table 17 that the respondents entail a consideration of both medical services, education and safety, and environmental quality when it comes to evaluation of their quality of life in the city.

Table 17. Importance of Quality of Life			
Theme	Sub-Theme	Frequency	Rank
Healthcare Services	Accessibility to Medical Facilities	50	1
	Quality of Healthcare Services	45	4
Education and Safety	Availability of Quality Education	42	6
	Safety and Security in the Community	48	2
Environmental Quality	Clean Air and Green Spaces	46	3
	Pollution Control Measures	40	8
Housing and Infrastructure	Affordable Housing	44	5
	Well-Maintained Public Infrastructure	41	7
Recreational Amenities	Access to Parks and Recreation Areas	38	9
	Availability of Cultural and Leisure Activities	36	10

Those were the highest priorities for residents in terms of accessibility to medical facilities and security within the community. The focus on clean air, green spaces, and pollution control strongly reflected a general concern about environmental factors increasingly influencing overall well-being. Moreover, they considered affordable housing and public infrastructure necessary to ensure good quality of life. There were also indications of the importance placed by residents on recreational amenities, slightly lower, but still pointing to the value they placed on leisure and cultural activities.

Implications for city planners and policy makers would include ensuring quality healthcare delivery, safety, environmental health, and housing and infrastructure development in addressing the needs and expectations of the residents. Attending to these priorities would create a more desirable and supportive living environment that may lead to an improved general quality of life.

Recent research evidence was seen to validate those issues on the quality of life. Access to quality health care services and safe living environments were tightly knit by such a study of Smith et al. (2023), which explains the importance of such continued investment in urban areas to improve the quality of life through ensuring that such facilities are available to urban dwellers.

An additional investigation by Johnson and Lee (2023) emphasized the role of environmental quality, specifically that clean air and green spaces contributed greatly to health and well-being among residents. Patel and Jones (2024) showed that affordable housing and ample infrastructure are some of the essentials that must exist in order to ensure a high quality of life given that these will have direct effects on how residents experience life and feel about it every day. These studies provided empirical proof for the findings by demonstrating that attention needs to be given to these important areas to improve the overall quality of life in urban settings.

4.8 Public administration practices that contributed to social equity in Tarlac City

Public administration practices have played a vital role in facilitating social equity within Tarlac City. The study aimed to investigate the extent to which such practices helped achieve social equity, comprising areas like access to public services, fair distribution of resources, people's participation, educational opportunities, and equal enforcement of law. In the end, it analyzed the responses under these broad social equity themes to determine how effective public administration practices were in addressing issues of social equity as well as areas for improvement. According to the responses in table 18, respondent said that public administration practices played an important role in relation to the social equity impact, particularly in terms of accessibility, resource allocation, and public engagement.

Table 18. Public Administration Practices and Social Equity			
Theme	Sub-Theme	Frequency	Rank
Accessibility and Inclusivity	Equal Access to Public Services	52	1
	Inclusive Policy Development	47	2
Resource Allocation	Fair Distribution of Resources	44	4
	Support for Underserved Communities	39	8
Public Engagement	Participation in Decision-Making	41	6
	Transparency and Accountability	38	9
Education and Opportunity	Equal Educational Opportunities	46	3
	Support for Economic Advancement	43	5
Law and Justice	Equitable Law Enforcement	40	7
	Fair Legal Processes	37	10

Equal access to public services and inclusive policy formulation received the highest frequencies indicating that residents considered this core to social equity. There were concerns for the fair distribution of resources and support to underserved communities, particularly highlighting the needs of address inequalities, ensuring that all residents benefited from such public initiatives. Moreover, such public engagement and transparency would provide the hallmarks of equity, emphasizing governance of participatory and accountable nature. Notably, education and law enforcement would further prove the case for equitable opportunities and just processes in law.

These findings indicate that public administration practices were viewed as arriving at improvements in social equity, but with room for improvement in resource allocation and public engagement. Policymakers wish to stress improvements in inclusivity, transparency, and fairness in their practices which are likely to contribute towards reducing social gaps and guaranteeing equal access for all community members to the opportunities and resources they make available.

Recent studies have empirically validated the effective role of public administration in bringing about social equity. Brown and Green (2023) argue that equal access to public services and inclusive policy development advances social equity in urban settings, with effective public administration practices as key in addressing systemic disparities. Garcia and Martinez (2023) emphasize equal distribution of resources and public involvement on social equity, noting that

transparency and participatory governance would help solve gaps and support underlined communities. Lee and Thompson (2024) researched on equal laws and education opportunities improving social equity, implying that fair and accessible services go a long way in alleviating social inequalities. These studies corroborated the findings of this study validating the importance of effective public administration practices in promoting social equity.

CONCLUSION

The findings of smart city initiatives in Tarlac City state that the people have moderately high familiarity with such technologies and have recognized the role of public administration in these projects. According to the findings of the study, although a considerable segment of the society was informed and had an active interest in the aspects of the new smart city, there was still the tremendous need for outreach and education for exhaustive public awareness participation. The general perception of public administration was that it was positive with people's perceptions of the public authority's contribution in terms of leadership, policy formulation, and collaboration. However, it was helpful to engage in practices that were intended to improve the effectiveness and inclusivity of smart city projects. The perception that some sections of the community had regarding minimal or no involvement in the initiatives was also important. The standards and conditions assigned for ISO 37122:2019 such as governance, economy, environment, living, mobility, people, and technology would also strengthen the multifaceted nature of smart city development. Public administration should have capitalized on these aspects to prioritize and balance initiatives under these pillars for holistic and thus sustainable urban growth.

It should be noted that under public administration practices, the successful implementation of sustainable smart city projects in Tarlac City was on some of the issues and gaps ranging from the securing adequate funds and resource allocation optimization, improving technical expertise and infrastructure, dealing with resistance to change, and improving bureaucratic processes. These would have made it possible for the public administrators to develop an enabling environment for the development of smart cities, where Tarlac City would be well positioned to benefit from technological innovation, citizen engagement, and sustainable urban planning. A good understanding of these challenges stands in line with strategic recommendations that served as a roadmap for Tarlac City to smarten up as they move toward becoming a city that values integrated and sustainable growth.

Conducting smart city initiatives in Tarlac City within public administration was geared toward a multifaceted approach considering the various issues of funding and resource allocation, technology limitations, resistance to change, as well as bureaucratic inefficiencies. Public administration could have opened windows of opportunity for smart city development by securing alternative funding sources, optimizing resource management, enhancing technical expertise, innovative culture of development, and streamlining bureaucratic processes. All these actions would not only ensure proper implementation of smart city projects but also foster sustainable, efficient, and inclusive urban growth. Strategic recommendations offered in this study constitute a detailed map for public administrators to navigate through the complexities surrounding smart city transformation and ensure that Tarlac City fully reaped the benefits of becoming a smart urban center.

In reality, the success of smart cities' sustainability with urbanization directly depended on the performance capacity of public administration. As cities were becoming increasingly complex and interconnected, the structures of public administration evolved to address highly diverse sustainability issues. High-functioning public administration integrated and based in advanced technologies and innovations took active roles in realizing sustainability through efficient resource utilization, open governance, and inclusive practices. This assessment highlighted the importance of data management and analytics, citizen engagement, operational efficiency, security and privacy, and interdepartmental coordination. Through the focus areas, improved public administration significantly contributed to the resilience, efficiency, and responsiveness of smart cities, ensuring their long-term sustainability and ability to meet the needs of their citizens.

RECOMMENDATIONS

The recommendations included improving communication and visibility of public administration's efforts in smart city projects to win greater trust and acceptance from the public. Increasing reach and education for specific audiences would have likely closed the gap for those less informed on such initiatives. It all bore down to strengthening the public-private partnerships and

having enough funding. Environmental sustainability, data privacy, and security could address the community issues for a better quality of life. Public administration would require capacity building programs to equip the public and organizations with skills and knowledge for effective implementation of smart cities. Such improvements would have made it possible for public administration to contribute significantly to the effective development and implementation of smart city initiatives in Tarlac City to a more efficient, sustainable, and livable urban environment.

The strategic recommendations that were necessary for successful implementation of sustainable smart city projects in Tarlac City included the need for public administrators to start identifying budget efficiency and possible diverse funding sources through public-private partnerships, grants and international aid. Second, to build the required technical competence: substantial investments were needed in technical training and infrastructure upgrades. Third, developing an organization culture that valued innovation and open to new technologies could have averted resistance to change, achieved through continuous professional development and programs of change management and stakeholder engagement initiatives. Finally, streamlining bureaucratic processes with inter-departmental coordination could have improved efficiency and thus paved way for smoother project execution. These recommendations would have also served to see Tarlac City go beyond the present challenges and transform towards a vision of a sustainable and smart urban center.

For an effective advancement of smart city initiatives, the public administration at Tarlac City should have prioritized several strategic actions. Enhance financial management and secure alternative funding sources such as public-private partnerships and grants for proper resource allocation toward smart city projects. Continuous technical training and development programs for staff in public administration and hiring qualified professionals can eventually minimize or eliminate technological limitations. It would have encouraged innovation through leadership and policy reforms to curtail resistance to change and adoption of different technologies. Upgrade and modernize technological infrastructure, smart grid, and high-speed internet would be important for supporting smart city initiatives. Streamlined approval processes and internal coordination digitally and automated would have promoted the efficiency of the bureaucracy. Such measures could have effectively established Tarlac City to support and propel its smart city initiatives as it serves the various needs of the present generation in ensuring a liveable urban environment for future generations in an enduring way.

It was advisory to further improve urban sustainability in smart cities by recommending several points. Firstly, extending and improving online services on digital platforms could enhance access and convenience for many citizens. Secondly, they were an essential entitler to equality around physical access to service increased centers and improved transport linkages. Thirdly, these could improve service reliability and delivery efficiency through time-recording systems, performance metrics, and automated systems. Fourthly, with responsive public administration through effective feedback loops and grievance-redress mechanisms, citizen satisfaction was vital. Fifthly, accountable public service delivery would be enhanced through public dashboards and routine updates-trust and accountability would further nurture it. Finally, astute resources management with data analytics and predictive modeling added cost-saving technology applications would ensure the effective and efficient use of resources. These are the valuable measures that could make smart cities much more sustainable, efficient, and citizen-centric in their urban development framework.

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Above all, we offer our profound gratitude to Almighty God. You are the eternal source of inspiration and guidance in all we do. This study is dedicated to you, and we acknowledge that all our efforts are made possible through your grace. May this research serve as a humble beginning in our quest to help others, following the example you have set for us.

We also extend our heartfelt thanks to all individuals who have shown their support, contributed their time and talents, and made this project a reality. Your assistance and encouragement have been invaluable, and we are truly grateful for your contributions.

AI DECLARATION AND TOOLS

The researcher utilized artificial intelligence (AI) tools, specifically ChatGPT and QuillBot, solely for the purpose of improving grammar, sentence structure, and the overall flow of the manuscript. These tools were not used to generate content or develop the ideas presented in the study.

All concepts, analyses, and interpretations are the original work of the researcher. The researcher has carefully reviewed and finalized all content and assumes full responsibility for the accuracy, integrity, and originality of the study.

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AUTHOR'S BIOGRAPHY

	Dr. Edwin T. Caoleng is the Dean of the College of Public Administration and Governance at Tarlac State University. He is a senior higher education leader with extensive experience in academic administration, public administration, student affairs, accreditation, and institutional development. Throughout his career, he has held key leadership roles as Dean and Program Chairperson, demonstrating expertise in governance, strategic planning, quality assurance, research, and community engagement. He has overseen academic, research, and extension functions, contributed to curriculum development aligned with outcomes-based education, and supported faculty development, research productivity, and student services. He has also been actively involved in accreditation and quality assurance processes, including serving as a national accreditor and contributing to institutional compliance, policy development, and performance management initiatives. Beyond the academe, his professional background includes public sector service as a Tourism Operations Officer, as well as experience in banking, consultancy, and academic instruction. He holds a Doctor of Public Administration and a Master of Business Administration, along with undergraduate degrees in Marketing Management and Nursing, and has completed international training in local economic development. He possesses multiple professional eligibilities and licenses, including passing Stages 1, 2, and 3 of the Career Executive Service Written Examination (CESWE), in addition to Civil Service Commission Professional and Sub-Professional Eligibilities. He is also a registered nurse and a licensed professional teacher. His work is further complemented by involvement in research, scholarly publications, conference presentations, and community extension initiatives, reflecting his commitment to knowledge development and public service.
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CONTRIBUTION OF AUTHORS

AUTHOR'S NAME	Current Affiliation (University/College)	*% Contribution	Conforme (Sign if you agree with the % distribution)
DR. EDWIN T. CAOLENG	Tarlac State University – College of Public Administration and Governance	100	

*should have a total of 100% 100%