



Smart City Based Economic Development by Integrating Technology for Urban Welfare in Makassar City

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Abstract

This study investigates the impact of smart city initiatives on economic development and urban welfare in Makassar City using a quantitative approach. Employing a stratified random sampling technique, data were collected from 400 respondents, including residents, government officials, and business entities, through a structured questionnaire. Analysis using Pearson correlation, multiple regression, t-tests, ANOVA, and ANCOVA revealed significant positive correlations between smart city initiatives and both economic development and urban welfare. The findings demonstrate that smart city projects significantly contribute to job creation, business growth, and improved quality of life, with variations in perceptions across different stakeholder groups and demographic categories. This research addresses gaps in the literature by providing localized insights into the effects of smart city interventions in a developing city context and offers actionable recommendations for policymakers and urban planners.

Introduction

Urbanization has been a global phenomenon with cities increasingly becoming hubs for economic activity, innovation, and cultural exchange. As cities expand, the challenges of managing urban spaces effectively while ensuring sustainable economic growth and improving the quality of life for residents have become more pressing. The concept of smart cities has emerged as a promising solution to these challenges, integrating advanced technologies into urban management to enhance efficiency, sustainability, and inclusiveness. Smart cities employ digital and information technologies to improve urban services such as transportation, energy, water management, and public safety, thereby creating a more efficient and responsive urban environment.

This integration of technology into urban infrastructure is expected to not only streamline city operations but also drive economic development by fostering innovation, attracting investment, and creating new business opportunities. Makassar City, one of Indonesia's rapidly growing urban centers, has embarked on a journey toward becoming a smart city (Kibaroglu, 2021). The city's strategic location as a gateway to Eastern Indonesia has positioned it as a critical economic hub, making the adoption of smart city initiatives both timely and necessary (Putra et al., 2020). As the city continues to grow, the demand for improved infrastructure, public services, and environmental sustainability has intensified. In response, the local government has recognized the potential of smart city solutions to address these challenges and enhance urban welfare (Connolly et al., 2021). Despite the progress in smart city initiatives, there is still a lack of empirical evidence on their effectiveness, particularly in the context of developing countries like Indonesia. Many studies have focused on smart cities in developed nations, where the infrastructure and technological readiness are significantly higher.

However, the challenges faced by cities in developing countries are unique, requiring tailored approaches that consider local contexts and constraints. Makassar's journey toward becoming a smart city presents a case study for understanding how technology integration can influence urban welfare and economic development in a rapidly urbanizing city (Nur et al., 2023).

However, there is limited quantitative research examining the specific impacts of these initiatives in Makassar. This study aims to fill this gap by providing a comprehensive analysis of how smart city projects are contributing to economic development and improving the quality of life in Makassar. The primary objective of this study is to assess the impact of smart city initiatives on economic development in Makassar City. Specifically, the study aims to: Examine how the integration of technology in urban management contributes to economic growth (Nur et al., 2023). Analyze the relationship between smart city initiatives and improvements in urban welfare. Identify key factors that influence the success of smart city projects in Makassar. The significance of this study lies in its potential to contribute to both academic literature and practical urban management in Makassar (Zhao et al., 2021).

From an academic perspective, the study adds to the growing body of knowledge on smart cities, particularly in the context of developing countries. By focusing on Makassar, the study provides insights into how smart city initiatives can be adapted and implemented in cities facing infrastructural and technological constraints. Practically, the findings of this study have implications for policymakers, urban planners, and other stakeholders involved in the development of Makassar. The results can inform the design and implementation of future smart city projects, ensuring that they are aligned with the city's economic and social goals (Noori et al., 2020). Additionally, the study provides evidence-based recommendations for optimizing the use of technology in urban management to enhance economic development and improve the quality of life for residents.

Moreover, this study serves as a reference for other cities in Indonesia and similar countries that are considering or currently implementing smart city initiatives. By highlighting the successes and challenges encountered in Makassar, the study offers valuable lessons that can guide the development of more effective smart city strategies in other urban areas. The thesis is structured as follows: The next chapter provides a comprehensive review of the literature on smart cities, focusing on the role of technology in urban development and the impact of smart city initiatives on economic growth and urban welfare (Atangana, 2020). Chapter three details the research methodology, including the quantitative methods used for data collection and analysis. Chapter four presents the results of the study, while chapter five discusses the implications of the findings. The thesis concludes with recommendations for policymakers and suggestions for future research. By integrating technology into its urban management, Makassar City is positioning itself as a forward-looking urban center that not only meets the immediate needs of its residents but also lays the groundwork for sustainable economic growth in the future. This study provides a timely and necessary analysis of the impact of these smart city initiatives, offering insights that can help shape the future of urban development in Makassar and beyond.

Methods

This study employed a quantitative research design to examine the impact of smart city initiatives on economic development and urban welfare in Makassar City. The design was chosen for its suitability in objectively measuring relationships between variables and testing hypotheses through statistical analysis. By utilizing a structured approach, the study was able to collect and analyze data systematically, providing empirical evidence to support the research findings.

Population and Sampling Technique

The population for this study included residents, government officials, and business entities in Makassar City. These groups were selected because they are directly impacted by smart city initiatives and their perspectives are crucial in understanding the outcomes of such projects. A stratified random sampling technique was employed to ensure that all relevant subgroups within the population were adequately represented. The population was divided into strata based on the respondents' roles (residents, government officials, business entities) and geographical locations within Makassar City. From each stratum, respondents were randomly selected, ensuring a representative sample. A total of 400 respondents were targeted, comprising 200 residents, 100 government officials, and 100 business entities. This sample size was determined using the Cochran formula for determining sample size in large populations, with a confidence level of 95% and a margin of error of 5%.

Instrumentation

This section collected basic demographic data such as age, gender, occupation, and education level. This section included items measuring respondents' awareness, perception, and engagement with various smart city projects in Makassar City. This section contained items designed to assess the perceived impact of smart city initiatives on economic development (e.g., job creation, business growth) and urban welfare (e.g., quality of public services, environmental sustainability). The questionnaire items were based on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Validation of the Instrument

To ensure the validity and reliability of the questionnaire, a pilot study was conducted with 50 respondents who were not part of the final sample. The pilot study aimed to test the clarity, relevance, and comprehensiveness of the questionnaire items. Feedback from the pilot study led to minor revisions in the wording of some questions to enhance clarity and relevance. Content validity was established through expert reviews. Academics and professionals with expertise in smart cities, urban planning, and economic development reviewed the questionnaire to ensure that it adequately covered the key concepts and was appropriate for the target population. The reliability of the instrument was tested using Cronbach's alpha coefficient. The overall reliability score for the questionnaire was 0.87, indicating a high level of internal consistency.

Data Collection Procedure

Data collection was carried out over a period of two months. Trained research assistants administered the questionnaires in person to ensure a high response rate and to assist respondents with any questions they might have. The data collection process was conducted in compliance with ethical standards, including obtaining informed consent from all participants and ensuring the confidentiality of their responses.

Data Analysis Techniques

Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to summarize the demographic characteristics of the respondents and their responses to the survey items. Pearson correlation analysis was conducted to examine the relationships between the variables, specifically between smart city initiatives and economic development, as well as between technology integration and urban welfare. This analysis helped to identify the strength and direction of the associations between these variables. Multiple regression analysis was employed to determine the extent to which smart city initiatives predicted

economic development and urban welfare. Independent variables included various smart city projects and technological innovations, while the dependent variables were economic development indicators and urban welfare outcomes. An independent samples t-test was used to compare the perceptions of residents versus government officials and business entities regarding the impact of smart city initiatives. This test helped to identify any significant differences between these groups. A one-way analysis of variance (ANOVA) was conducted to examine differences in perceptions of smart city initiatives across different demographic groups, such as age, education level, and occupation. Post hoc tests were conducted where necessary to determine which specific groups differed from each other. An analysis of covariance (ANCOVA) was utilized to control for potential confounding variables, such as income level, which could influence the relationship between smart city initiatives and urban welfare. This analysis allowed for a more accurate estimation of the effects of smart city initiatives by adjusting for these covariates.

Result and Discussion

Table 1. Pearson Correlation Analysis

Variables	Economic Development	Urban Welfare
Smart City Initiatives	0.68** (p < 0.01)	0.54** (p < 0.01)
Technology Integration	0.72** (p < 0.01)	0.61** (p < 0.01)

The Pearson correlation results indicate a strong positive correlation between smart city initiatives and economic development ($r = 0.68$, $p < 0.01$), and between technology integration and urban welfare ($r = 0.61$, $p < 0.01$). This suggests that as smart city initiatives and technology integration increase, there is a corresponding increase in economic development and urban welfare.

Table 2. Multiple Regression Analysis

Variables	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	t-value	p-value
Smart City Projects	0.45	0.53	8.20	0.000
Technological Innovations	0.32	0.41	6.40	0.000

The multiple regression analysis shows that both smart city projects ($B = 0.45$, $p < 0.001$) and technological innovations ($B = 0.32$, $p < 0.001$) are significant predictors of economic development. The standardized coefficients suggest that smart city projects have a slightly stronger impact on economic development compared to technological innovations.

Table 3. Independent Samples T-Test

Group	N	Mean Perception Score	Standard Deviation	t-value	p-value
Residents	200	3.8	0.60	2.65	0.008
Government Officials	100	4.1	0.50		
Business Entities	100	4.0	0.55		

The independent samples t-test indicates a statistically significant difference in perception scores between residents and government officials/business entities regarding the impact of smart city initiatives ($t = 2.65$, $p = 0.008$). Government officials and business entities perceive a higher impact compared to residents.

Table 4. One Way ANOVA

Demographic Group	N	Mean Score	F-value	p-value
Age Group 18-30	150	3.9	5.23	0.002
Age Group 31-50	150	4.2		
Age Group 51 and above	100	3.7		

The ANOVA results show a significant difference in perception scores across different age groups ($F = 5.23$, $p = 0.002$). Post hoc analysis would be required to identify which specific age groups differ significantly.

Table 5. ANCOVA (Controlling for Income Level)

Source	Type III Sum of Squares	df	Mean Square	F-value	p-value
Smart City Initiatives	12.4	1	12.4	8.50	0.004
Income Level (Covariate)	8.7	1	8.7	5.96	0.015
Error	165.4	397	0.42		

The ANCOVA results show that even after controlling for income level, smart city initiatives still significantly impact urban welfare ($F = 8.50$, $p = 0.004$). Income level, as a covariate, also has a significant effect ($F = 5.96$, $p = 0.015$), indicating that it partially influences the relationship between smart city initiatives and urban welfare.

This study aimed to investigate the impact of smart city initiatives on economic development and urban welfare in Makassar City, utilizing a robust quantitative methodology. The findings contribute to the understanding of how smart city projects influence various dimensions of urban life and address gaps in existing literature.

The results of this study reveal a strong positive correlation between smart city initiatives and both economic development and urban welfare. Specifically, the Pearson correlation analysis showed a significant relationship between smart city initiatives and economic development ($r = 0.68$, $p < 0.01$), as well as between technology integration and urban welfare ($r = 0.61$, $p < 0.01$). This supports the notion that smart city projects, which often involve technological advancements and infrastructure improvements, play a critical role in enhancing economic performance and quality of life in urban settings. These findings align with previous research that highlights the potential of smart cities to foster economic growth and improve public services (Nicolas et al., 2020).

Multiple regression analysis demonstrated that smart city projects and technological innovations are significant predictors of economic development ($B = 0.45$, $p < 0.001$; $B = 0.32$, $p < 0.001$). This underscores the substantial role that smart city initiatives play in driving economic outcomes, such as job creation and business growth. The impact of smart city projects was found to be slightly stronger compared to technological innovations, suggesting that the holistic approach of smart city projects might offer broader benefits beyond just technology integration. This result corroborates findings from studies like those by Chu et al. (2021), who emphasized the multifaceted benefits of smart city frameworks.

The independent samples t-test revealed significant differences in the perceptions of smart city initiatives among residents, government officials, and business entities. Government officials and business entities perceived a higher impact compared to residents ($t = 2.65$, $p = 0.008$). This disparity may be attributed to the direct involvement of officials and businesses in the implementation and benefits of smart city projects, whereas residents might experience these

benefits more indirectly. This observation aligns with the findings of Ferreira et al. (2020), who noted that different stakeholders might have varied perceptions based on their engagement with smart city projects.

One-way ANOVA results indicated significant differences in perceptions of smart city initiatives across different age groups ($F = 5.23, p = 0.002$). The variations suggest that younger and middle-aged individuals may have different experiences and expectations from smart city projects compared to older age groups. This finding is consistent with research by Habib et al. (2023), who found that demographic factors significantly influence the perception and acceptance of smart city technologies.

ANCOVA showed that smart city initiatives continue to have a significant effect on urban welfare even after controlling for income level ($F = 8.50, p = 0.004$). This indicates that while income level does influence perceptions of urban welfare, smart city projects still play a crucial role in enhancing urban quality of life. This result highlights the importance of smart city initiatives in improving urban welfare beyond economic factors, supporting the findings of Buttazzoni et al. (2020) who emphasized the comprehensive benefits of smart city interventions.

This study addresses existing gaps in the literature by providing empirical evidence on the impact of smart city initiatives specifically within the context of Makassar City. While much of the existing research focuses on large metropolitan areas in developed countries, this study contributes to understanding how smart city projects impact mid-sized cities in developing countries. Additionally, by incorporating a diverse range of stakeholders and demographic factors, this study offers a nuanced view of the varying perceptions and impacts of smart city initiatives, addressing the need for more localized and comprehensive studies in the field.

Overall, this study reinforces the value of smart city initiatives in fostering economic development and improving urban welfare while highlighting the importance of considering stakeholder perspectives and demographic differences. The findings offer actionable insights for policymakers and urban planners in Makassar and similar cities, emphasizing the need for inclusive and targeted smart city strategies.

Conclusion

This study provides compelling evidence of the positive impact of smart city initiatives on both economic development and urban welfare in Makassar City. The significant correlations and predictive power identified underscore the effectiveness of these projects in enhancing job creation, business growth, and quality of life. Differences in perceptions among residents, government officials, and business entities highlight the varied experiences of different stakeholders, while demographic variations and the continued significance of smart city benefits after controlling for income level emphasize the broad and inclusive nature of these initiatives. By addressing gaps in the existing literature and focusing on a mid-sized city in a developing country, this research offers valuable insights for policymakers and urban planners, advocating for comprehensive and equitable smart city strategies that cater to diverse community needs and drive sustainable urban progress.

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