Jurnal Teknologi Informasi dan Pendidikan
Volume 18, No. 2, September 2025
https://doi.org/10.24036/jtip.v18i2.976

P.ISSN: 2086 – 4981
E.ISSN: 2620 – 6390
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Analysis of Determinants Influencing the Adoption of 5G Technology in Bandung City

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Article Information

Article history:

No. 976
Rec. June 25, 2025
Rev. August 04, 2025
Acc. August 04, 2025
Pub. August 19, 2025
Page. 347 – 361

Keywords:

- *5G*
- *Technology Adoption*
- *Bandung*
- *Ordinal Logistic Regression*

ABSTRACT

This research aims to examine determinants influencing the adoption of 5G technology by users in Bandung City. As Indonesia begins its transition toward an advanced communication infrastructure, understanding user behavior and adoption level becomes important, especially in Bandung city. Use a quantitative approach, this research collected data from 206 respondents through a structured questionnaire designed to capture various technical and non-technical factors. Eight independent variables were analyzed: infrastructure availability, technology awareness and knowledge, network service quality, service and device cost, perception of security and privacy, potential and benefits offered by 5G, user experience, and social influence. Data analysis was performed using ordinal logistic regression to determine which factor adopted 5G technology. The results reveal that network service quality, perception of security and privacy, and social influence have a statistically significant effect on adoption levels. Meanwhile, the remaining variables showed no significant influence. Based on the research findings, the article provides recommendations such as improving network service quality, optimizing security and privacy, and increasing public awareness campaigns to address user concerns and support broader adoption of 5G technology. These efforts are expected to enhance user experience and accelerate the implementation of 5G in support of smart city development in Bandung.

How to Cite:

Alhafizh, D., et al. (2025). Analysis of Determinants Influencing the Adoption of 5G Technology in Bandung City. Jurnal Teknologi Informasi dan Pendidikan, 18(2), 347–361. https://doi.org/10.24036/jtip.v18i2.976

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1. INTRODUCTION

The development of communication technology has significantly transformed human activities. The presence of Fifth Generation Network Technology (5G) has been an important breakthrough in the telecommunications industry, promising faster, more reliable, and more responsive connectivity. This technology presents the potential to transform the way people move, work, and interact in increasingly connected urban environments. With high speed, low latency, and superior capacity, 5G enables users to access heavy content such as 4K video without buffering, instant response for real-time applications such as gaming and telemedicine, and stable connections in dense areas that support the growth of IoT and smart cities [1], [2], [3].

According to data from the Central Statistics Agency (BPS) sourced from the Indonesian Ministry of Communication and Information, the number of telephone subscribers in Indonesia in 2023 reached 361,317,486 people. The majority of this number, namely 352,157,364 subscribers, use wireless or cellular telecommunications services, while the remaining 9,160,122 subscribers are connected via wired telecommunications [4].

Bandung is home to many startups, tech companies, and higher education institutions, resulting in a thriving tech ecosystem. Bandung is also home to a vibrant creative community that can leverage 5G technology to drive innovation and creativity. With its increasingly advanced ICT infrastructure and diverse population, the city is a great example of how 5G technology is evolving. The smart city concept has begun to be implemented in several regions in Indonesia, including the city of Bandung. The implementation of the smart city concept in Bandung refers to the Bandung Mayor Regulation Number 1470 of 2018, which sets the Bandung Smart City Master Plan 2018–2023 as the basis for its development [5].

The Diffusion of Innovation Theory by Everett M. Rogers explains how and why new ideas or technologies are adopted within a social system. The adoption process is influenced by factors such as the characteristics of the innovation, communication channels, time, and social context. Rogers identifies five stages in the decision-making process: Knowledge, individuals become aware of the innovation; Persuasion, they form an attitude toward it; Decision, they choose to adopt or reject it; Implementation, they start using it, and Confirmation, they seek validation for their decision [6]. this research proposes eight variables hypothesized to influence 5G adoption.

First, infrastructure availability is considered a key enabler for adoption. Without qualified signal coverage and consistent connectivity, the usefulness of 5G decreases [7].

P.ISSN: 2086 – 4981
E.ISSN: 2620 – 6390
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Second, technology awareness and knowledge influence adoption by shaping user expectations and familiarity. A lack of understanding may result in hesitance or indifference toward newer technologies [8], [9]. Third, network service quality plays a direct role in user satisfaction. If users experience frequent disconnections or speed fluctuations, their willingness to adopt declines [10]. Fourth, the cost of services and devices remains a practical barrier. High subscription fees or device prices may discourage price sensitive users, especially in developing countries [11], [12]. Fifth, perception of privacy and security affects trust in the technology. Concerns over data leaks, surveillance, or cyberattacks can influence user willingness to switch to 5G [13]. Sixth, Potential and Benefits Offered by 5G. The applications of the 5G network involve different ways 5G technology can be used to provide new services and improve services [13]. Seventh, user experience reflects how users evaluate their actual interactions with 5G, whether it's reliable, seamless, or beneficial for daily activities [14]. Finally, social influence relates to peer, family, or community encouragement. In Bandung city, trends and social proof often play a role in adopting emerging technologies [8].

These eight factors form the basis of the research's conceptual model. While each has been examined separately in prior studies, few have integrated all eight in a model using ordinal logistic regression. This research fills that gap by examining their collective and individual effects on 5G adoption levels in Bandung City.

By utilizing a structured survey and statistical analysis, this research aims to identify which factors significantly influence user adoption of 5G and whether these factors have a statistically significant influence on user adoption.

2. RESEARCH METHOD

This research employed a quantitative approach using a structured survey to examine the determinants of 5G technology adoption by users in Bandung City. A total of 206 respondents were selected through random sampling. Random sampling was chosen for this study to ensure that the sample accurately reflects the diverse characteristics of 5G users in Bandung City. This method involves dividing the population into specific subgroups, such as by age, gender, or profession, and then randomly selecting participants from each group. The key benefit of this approach is its ability to reduce sampling bias while improving the representativeness of the sample. By giving every individual an equal chance of being included, the data collected is more likely to mirror the actual population. In the context of analyzing the determinants of 5G adoption, this sampling technique helps ensure

that insights are drawn from a well-balanced and inclusive respondent group, thereby strengthening the accuracy and credibility of the research findings. Data were collected through a self administered questionnaire using Likert-scale 1-5, from 1 = strongly disagree to 5 = strongly agree measuring one dependent variable 5G adoption level and eight independent variables: infrastructure availability, technology awareness and knowledge, network service quality, service and device cost, perception of privacy and security, potential and benefits offered by 5G, user experience, and social influence. Data were analyzed using ordinal logistic regression. Ordinal logistic regression was selected for this study because the dependent variable, the level of 5G technology adoption, is an ordinal variable, categorized into ordered levels such as low, medium, and high. Since the outcome is not continuous but follows a ranked structure, this type of regression is more suitable than linear regression.

2.1. Research Model

This research employed a quantitative approach using a structured survey to examine the determinants of 5G technology adoption by users in Bandung City. The dependent variable studied is the level of 5G adoption, categorized into three classifications: Not Adopted, Considering Adoption, and Adopted. The dependent variable is ordinal in scale.

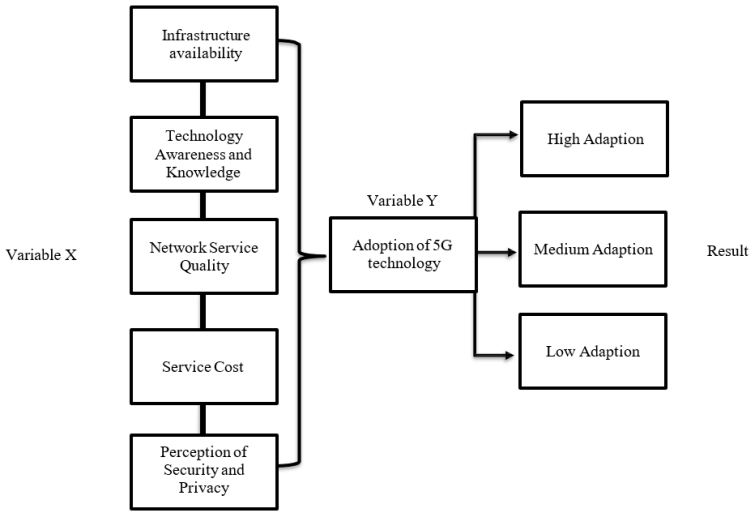


Figure 1. Research Model

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2.2. Research Hypothesis

This research proposes the following hypothesis:

1) Infrastructure availability has a significant influence on the adoption of 5G technology.
2) Technology awareness and knowledge have a significant influence on the adoption of 5G technology.
3) Network service quality has a significant influence on the adoption of 5G technology.
4) Service and device costs have a significant influence on the adoption of 5G technology.
5) Perception of Security and Privacy has a significant influence on the adoption of 5G technology.
6) Potential and benefits offered by 5G have a significant influence on the adoption of 5G technology.
7) User experience has a significant influence on the adoption of 5G technology.
8) Social influence has a significant influence on the adoption of 5G technology.

2.3. Assumption Testing

Before regression analysis, key assumptions were tested:

1) Ordinality of Dependent Variable: Ensure that the dependent variable (Y) is ordinal with three levels [15].
2) No Multicollinearity: Verify the absence of high correlation across independent variables using the Variance Inflation Factor (VIF). Values below 10 suggest no significant multicollinearity. [16], [17].
3) Proportional Odds Assumption: The proportional odds assumption was tested using the Test of Parallel Lines. A non-significant p-value ($p > 0.05$) indicates that the assumption is met [16].

3. RESULTS AND DISCUSSION

This research utilized ordinal logistic regression to examine the influence of eight independent variables on the level of 5G technology adoption by users in Bandung City. The analysis aimed to identify which factors significantly affect the adoption levels.

The model fitting information indicated a significant improvement of the final model over the null model, with a chi-square value that was statistically significant ($p < 0.05$). This suggests that the independent variables collectively contribute to explaining variations in

the dependent variable. The goodness-of-fit tests using Pearson and Deviance statistics showed non-significant p-values ($p > 0.05$), indicating that the model provided a good fit to the observed data. The test of parallel lines also delivered a significant result, confirming that the proportional odds assumption was satisfied.

3.1. Respondent Description

Based on the data collected from 207 respondents who use 5G technology, the following description of the respondents was obtained:

Table 1. Respondent Description

Participation respondent		Number	Percentage (%)
Gender	Male	117	56,8
	Female	89	43,2
Age	16–25	163	79,1
	26–35	35	17
	36–45	3	1,5
	46–55	4	1,9
	65	1	0,5
Education Level	Bachelor	112	54,4
	Senior High School	71	34,5
	Diploma	10	4,9
	Master	9	4,4
	Doctorate	3	1,5
	Not school	1	0,5
Job	Students	79	38,3
	Private Employees	65	31,6
	Self-Employed	34	16,5
	Others	19	9,2
	Civil Servants	9	4,4

Source: Compiled by the author research

Based on data collected from 207 respondents who use 5G technology, the characteristics of the respondents are summarized in Table 1. In terms of gender, the majority of respondents are male, totaling 117 individuals or 56.8%, while females account for 89 respondents or 43.2%. Regarding age distribution, the largest group falls within the 16–25 age range, comprising 163 individuals or 79.1% of the total. This is followed by respondents aged 26–35, who make up 17% (35 individuals). Smaller proportions are seen in the 36–45 age group (1.5% or 3 people), the 46–55 age group (1.9% or 4 people), and those aged 65 and above (0.5% or 1 person). In terms of education level, the majority hold a

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E.ISSN: 2620 – 6390
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Bachelor's degree (54.4% or 112 respondents). High school graduates make up 34.5% (71 people), followed by Diploma holders at 4.9% (10 people), Master's degree holders at 4.4% (9 people), and Doctorate holders at 1.5% (3 people). One respondent (0.5%) reported having no formal education. Looking at occupation, the highest proportion of respondents are students, making up 38.3% (79 people). This is followed by private sector employees at 31.6% (65 people), self-employed individuals at 16.5% (34 people), and respondents with other types of jobs at 9.2% (19 people). Civil servants account for the smallest group, with 4.4% (9 individuals). Overall, the data suggests that the majority of 5G technology users are young, well-educated individuals, predominantly students or employed in the private sector.

3.2. Ordinal Logistic Regression Assumption Test

Before ordinal logistic regression analysis, some of the assumptions need to be tested to ensure the feasibility of the model used. The assumption tests carried out are as follows.

3.2.1. Multicolinearity Test

The multicollinearity test is performed by looking at the Variance Inflation Factor (VIF) value in linear regression. Based on the output results, all independent variables have VIF values between 1.314 and 2.234, which means far below the threshold of 10, indicating that there is no multicollinearity between the predictor variables.

Table 2 presents the results of the multicollinearity test using the Variance Inflation Factor (VIF) and Tolerance values for each independent variable in a linear regression model. This test aims to detect whether there is a high linear correlation (multicollinearity) among the independent variables, which could distort the regression results. According to the table, all variables have VIF values ranging from 1.314 to 2.234. These values are well below the commonly accepted threshold of 10, indicating that multicollinearity is not a concern in this model. The lower the VIF value, the less likely it is that the variable is highly correlated with others. The variable "Infrastructure Availability" has the lowest VIF value at 1.314 and a tolerance of 0.761, suggesting it is the least affected by other variables. On the other hand, "User Experience" has the highest VIF at 2.234 and a tolerance of 0.448. Although this is the highest value in the table, it is still well below 10, which means it is still within the acceptable range. Other variables such as "Technology Awareness and Knowledge," "Network Service Quality," "Service and Device Cost," "Perception of Security and Privacy," "Potential and Benefits Offered by 5G," and "Social Influence" also have relatively low VIF

values (ranging between 1.483 and 1.600), indicating minimal correlation with one another. In conclusion, these results show that there is no multicollinearity among the independent variables in this regression model. Therefore, all the predictors can be used together in the analysis without causing bias or distortion in the estimated regression coefficients. As a result, the regression model is reliable and can be interpreted with greater confidence.

Table 2. Coefficient

Model	Colinearity Statistic	
	Tolerance	VIF
(Constant)		
Infrastructure availability	.761	1.314
Technology Awareness and Knowledge	.645	1.550
Network Service Quality	.639	1.565
Service and Device Cost	.625	1.600
Perception of Security and Privacy	.664	1.507
Potential and Benefits Offered by 5G	.652	1.534
User Experience	.448	2.234
Social Influence	.674	1.483

3.2.2. Test of Parallel Lines

The proportional odds assumption is an important requirement in ordinal logistic regression. This test is performed using the Test of Parallel Lines, which compares the cumulative logit model with the general model. The test results show a significance value of 0.060 (> 0.05).

Table 3. Test of Parallel Lines

Model	Likelihood	Chi-Square	df	Sig.
Null Hypothesis	106.631			
General	81.010	25.621	16	.060

Table 3 presents the results of the Test of Parallel Lines, which is used to evaluate the proportional odds assumption in ordinal logistic regression. This assumption is crucial

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E.ISSN: 2620 – 6390
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because it implies that the relationship between each pair of outcome categories is the same. In other words, the coefficients that describe the relationship between predictors and the outcome are assumed to be consistent across all levels of the dependent variable. The test compares the null hypothesis model, which assumes the proportional odds assumption holds true, with the general model, which does not make that assumption. The test uses the difference in likelihood values (106.631 for the null hypothesis and 81.010 for the general model) to calculate a Chi-Square value of 25.621 with 16 degrees of freedom (df). Most importantly, the significance value (Sig.) of the test is 0.060. Since the significance value is greater than 0.05, we fail to reject the null hypothesis, which means that the proportional odds assumption is met. In simpler terms, the cumulative logits are sufficiently parallel across the response categories, and it is appropriate to proceed with the ordinal logistic regression model. This result supports the reliability and validity of the regression analysis using the proportional odds model.

3.2.3. Ordinal Logistic Regression Analysis Results

Ordinal logistic regression analysis was conducted to determine the influence of eight independent variables on the level of 5G technology adoption.

The results show that three variables have a significant effect on the level of 5G adoption. (Network Quality) has a significant coefficient (p = 0.045), which means that the perceived quality, the less likely individuals are to achieve the highest level of adoption. (Perception of Security and Privacy) also has a significant coefficient (p = 0.026), indicating that the perception of Security and Privacy reduces the tendency to adopt 5G. (Social Influence): is the most significant predictor (p =0.001), with a strongly significant coefficient on adoption, which can be interpreted as low social influence reducing the tendency to adopt technology. Meanwhile, other variables such as infrastructure, technology awareness, service and device cost, potential and benefits offered by 5G, and user experience do not show a statistically significant effect at the 5% significance level [18].

Table 4. Parameter Estimates

							95% Confidence Interval	
		Estimate	Std. Error	Wald	df	Sig.	Lower Bound	Upper Bound
Threshold	[Y1_Recode=1.00]	-7.095	.843	70.800	1	.000	-8.747	-5.442
	{Y1_Recode=2.00]	-3.345	.456	53.903	1	.000	-4.238	-2.452

Location	Infrastructure Availability	.159	.577	.076	1	.783	-.971	1.289
	Technology awareness and knowledge	.507	.657	.595	1	.441	-.781	1.794
	network service quality	-1.210	.604	4.015	1	.045	-2.393	-.026
	Service and Device Cost	-.996	.548	3.304	1	.069	-2.069	.078
	Perception of Security and Privacy	-1.235	.556	4.933	1	.026	-2.324	-.145
	Potential and Benefits Offered by 5G	-.828	.607	1.858	1	.173	-2.018	.363
	User Experience	.824	.696	1.401	1	.237	-.541	2.189
	Social Influence	-1.808	.536	11.393	1	.001	-2.858	-.758

Table 4 displays the parameter estimates from an ordinal logistic regression analysis. These estimates show how each predictor variable influences the likelihood of a response falling into higher or lower categories of the dependent variable (Y1_Recode), while controlling for other variables. The threshold estimates for [Y1_Recode = 1.00] and [Y1_Recode = 2.00] are both statistically significant (p = 0.000), with estimates of -7.095 and -3.345, respectively. These values help define the cut-off points between categories in the ordinal logistic model and are not interpreted in terms of direction or strength like predictor variables. In the context of 5G adoption or usage, users expect faster, more reliable, and stable connections. If the network service quality is low, such as frequent disconnections, poor coverage, or inconsistent speed, it directly affects user satisfaction and trust, making them less likely to adopt or support the technology. With the rise of digital technologies like 5G, users are increasingly aware of risks like data breaches, surveillance, and identity theft. If they perceive 5G as insecure or a threat to privacy, they are less likely to engage with or trust the technology even if it offers performance benefits. People are often influenced by the opinions, experiences, and behaviors of those around them. If their social circles are doubtful or critical of 5G (due to myths, misinformation, or lack of awareness), individuals may mirror those views. This aligns with social psychology, where perceived norms and peer behavior heavily shape decision making.

3.2.4. Goodness of Fit Test

The Goodness of Fit test is used to determine whether the ordinal logistic regression model is appropriate for the application.

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Table 5. Goodness of Fit Test

	Chi-Square	df	Sig.
Pearson	110.703	146	.987
Deviance	87.256	146	1.000

The test results show that the significance value for Pearson is 0.987, and for Deviance is 1.000. Both of these significance values are far above the threshold of 0.05, which means that the null hypothesis is not rejected. In other words, there is no significant discrepancy comparing the values predicted by the model to the observed data [19].

3.2.5. Model Fitting Information Test

Based on the output obtained, the final model shows a -2 Log Likelihood value of 106.631, which is much lower than the model with only an intercept (197.561). This difference produces a Chi-Square value of 90.930 with 16 degrees of freedom and a significance level of $p < 0.001$.

Table 6. Model Fitting

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	197.561			
Final	106.631	90.930	16	.000

3.2.6. Model Determination Coefficient

The number of determination coefficient values in the logistic regression model is indicated by the McFadden, Cox and Snell values, and Nagelkerke R Square. The table of determination can be seen in the following table:

Table 7. Pseudo R-Square

Cox and Snell	.357
Nagelkerke	.523
McFadden	.385

Table 7 presents the pseudo R-square values used to evaluate the goodness-of-fit of a logistic regression model, specifically using three common metrics: Cox and Snell, Nagelkerke, and McFadden R^2. These measures serve as alternatives to the traditional R^2 used in linear regression, as logistic regression does not provide a direct equivalent. The

Cox and Snell R^2 value is 0.357, indicating that approximately 35.7% of the variation in the dependent variable (in this case, the degree of 5G technology adoption) can be explained by the model. However, Cox and Snell R^2 has a limitation: it cannot reach the maximum value of 1 even with a perfect model. To address this, the Nagelkerke R^2, a modified version of Cox and Snell's, adjusts the scale so that it can reach 1. In this model, the Nagelkerke R^2 is 0.523, meaning the model explains about 52.3% of the variation in 5G adoption. This is a relatively strong value in logistic regression and indicates that the model has moderate to strong explanatory power. This value is particularly important because it is the most commonly cited and interpreted pseudo R^2 in logistic regression due to its normalization. The McFadden R^2 value is 0.385, which also suggests a good model fit. In logistic regression, an McFadden R^2 between 0.2 and 0.4 is typically considered indicative of an excellent model fit, so 0.385 supports the strength of this model. In summary, the pseudo R^2 values, especially the Nagelkerke R^2 of 0.523, suggest that the logistic regression model, with its eight independent variables, can collectively explain a significant portion (more than half) of the variability in respondents' level of 5G technology adoption. This indicates that the model is effective in capturing the key factors that influence user adoption behavior [20].

3.2.7. Predicted Response Category

Table 8. Predicted Response Category

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	2	1.0	1.0	1.0
	2.00	28	13.6	13.6	14.6
	3.00	176	85.4	85.4	100.0
	Total	206	100.0	100.0	

Table 8 shows the predicted response categories for the level of 5G technology adoption for 206 respondents, based on the ordinal logistic regression model. The data is categorized into three levels: low adoption (coded as 1.00), medium adoption (2.00), and high adoption (3.00). From the results, it can be seen that the majority of respondents, 176 individuals, or 85.4% fall into the high adoption category. This suggests that a large portion of the population in the study area (Bandung City) is highly engaged with or receptive to 5G technology. This strong tendency toward high adoption reflects a positive perception

P.ISSN: 2086 – 4981
E.ISSN: 2620 – 6390
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and readiness among users to embrace this advanced communication technology. In contrast, 28 respondents (13.6%) fall into the medium adoption category, indicating a smaller group that is somewhat engaged with 5G but may have reservations or lower levels of access, awareness, or satisfaction. Finally, only 2 respondents (1%) are classified under low adoption, which implies that very few individuals remain unengaged or resistant to the adoption of 5G technology. The cumulative percentages also help illustrate how adoption increases across categories. For example, 14.6% of users fall into the low to medium adoption range cumulatively, while the remaining 85.4% represent the highest tier. In summary, this table demonstrates that the logistic regression model predicts a strong inclination toward high 5G technology adoption, with more than four-fifths of the population studied showing a high level of acceptance. This finding reflects the general trend in Bandung City, where 5G infrastructure, awareness, and perceived benefits may already be well established, leading to widespread user uptake.

4. CONCLUSION

This research aims to analyze the determinants of 5G technology adoption by users in Bandung City, focusing on identifying the factors that influence the adoption rate. Based on the ordinal logistic regression analysis conducted on 207 respondents in Bandung City, several main conclusions:

The analysis shows that perceived network quality significant coefficient 5G adoption ($\beta = -1.210$, $p < 0.05$). This suggests that users with a moderate perception of network quality are less likely to adopt 5G. Therefore, service providers such as Telkomsel are advised to improve network consistency and reliability, especially in areas with lower coverage or performance.

Perception of Security and Privacy affordability also has a significant coefficient on adoption ($\beta = -1.235$, $p < 0.05$). It is recommended that the government and service providers strengthen personal data protection and educate the public about 5G network security standards to reduce concerns that could worry the adoption of 5G technology."

Social influence has the strongest significant effect on adoption ($\beta = -4.095$ for low social support). Public awareness campaigns should leverage community leaders, influencers, and digital literacy ambassadors to promote positive narratives and success stories around 5G usage.

Adoption Rate in Bandung: The majority of respondents in Bandung City indicated a high level of 5G adoption, with 85.4% of users falling into the high adoption category. A

total of 13.6% were in the medium adoption category, and only 1% were in the low adoption category.

Future monitoring and follow up surveys are recommended to evaluate the effectiveness of adoption strategies and detect changing public perception in the future.

Overall, these conclusions highlight that aspects of service quality, perception of security and privacy, and social influence are the main factors influencing 5G adoption, while other factors may require further exploration or different contexts to show significance.

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