Determinants of E-SIM Adoption Among Telkomsel Consumers in Indonesia

Bambang Mulyadi*

Hasanuddin University, Makassar, Indonesia
*mulyadib25a@student.unhas.ac.id

Abstract. Indonesia's emerging e-SIM user base faces behavioral transition challenges from physical SIM cards. Identifying adoption intention drivers is vital for business continuity. This research analyzes how Perceived Ease of Use, Perceived Usefulness, Perceived Security, and Social Influence impact Adoption Intention for Telkomsel's e-SIM service, using descriptive research with structural equation modeling (SEM). Questionnaire data were obtained from Telkomsel customers using purpose sampling to determine the sample, then analyzed using PLS-SEM on five variables. Findings indicate Perceived Ease of Use, Perceived Usefulness, Perceived Security, and Social Influence significantly and positively influence Adoption Intention. Results recommend Telkomsel's e-SIM service focus on enhancing perceived usefulness to boost customer Adoption Intention, thereby increasing service uptake and driving growth. These insights hold implications for service industries, emphasizing functional value and tangible benefits importance in building customer adoption. This study delivers valuable perspectives on Adoption Intention factors in e-SIM contexts, providing actionable guidance for strategic planning and customer satisfaction enhancement.

Keywords: Technology Acceptance Model (TAM), Perceived Usefulness, Adoption Intention, e-SIM

1 Introduction

The massive adoption of smartphone technology by Indonesians has fundamentally changed the national telecommunications landscape. The number of smartphone users in Indonesia is projected to reach 194.26 million in 2024, an increase of 2.23% from 190.03 million in 2023, this shows a consistent growth trend in smart device penetration [1]. Furthermore, Indonesia's population growth from around 250 million to 275.5 million in 2025 shows a slower rate than the growth of smartphone users. In 2025, it is estimated that there will be around 68.65 percent of Indonesia's population owned a mobile phone, an increase from 67.29 percent in the previous year [2]..

Responding to market dynamics and increasingly complex consumer needs, and referring to smartphone users and telecommunications customers who exceed population growth, innovative telecommunications are absolutely necessary. To support the penetration of digital telecommunications users, advanced and affordable

M. Nohong et al. (eds.), *Proceedings of the 10th International Conference on Accounting, Management, and Economics (10th ICAME 2025)*, Advances in Economics, Business and Management Research 388,
https://doi.org/10.2991/978-94-6239-709-5_55

smartphones are required. Telecommunications users require a SIM card to use telecommunications services. With the number of telecommunications subscribers exceeding the population, where customers can use more than two SIM cards in one smartphone, a more compact digital smartphone device in the form of an e-SIM (Embedded Subscriber Identity Module) is needed [3]. Telkomsel, as the largest mobile operator in Indonesia serving 159.4 million customers by the end of December 2024 [4], has provided e-SIM services in Indonesia since around 2024. This marks a new chapter in mobile service innovation in the country [5]. e-SIM technology allows consumers to activate and manage operator profiles digitally without the need for a physical card, providing ease in switching operators, managing multiple numbers, and a more seamless user experience [5]. Therefore, the study titled "Determinants of e-SIM Adoption Among Telkomsel Consumers in Indonesia" aims to identify and analyze the determining factors that influence Telkomsel consumers' decisions to adopt e-SIM technology. By understanding these adoption factors, it is hoped that strategic insights can be provided to mobile operators in designing appropriate policies and marketing strategies to accelerate the technological transition.

2 Literature Review

2.1 Technology Acceptence Model (TAM)

The Technology Acceptance Model (TAM), originally proposed by Davis in 1989, remains a foundational framework for understanding how individuals come to embrace new technological systems. According to this model, the decision to adopt a particular technology is shaped predominantly by two key perceptions: its perceived usefulness (PU) and its perceived ease of use (PEOU). These perceptions influence the user's behavioral intention (BI) to engage with the technology, which in turn serves as a predictor of actual usage behavior [6]. The Technology Acceptance Model (TAM) supports modifications by adding context-specific external factors, as noted by Venkatesh and Davis [7]. This study builds on TAM's foundation, maintaining its core components of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) while adding Perceived Security and Social Influence. These additional factors provide deeper insights into how Telkomsel consumers adopt e-SIM technology.

2.2 Perceived Ease of Use (PEOU)

Perceived Ease of Use measures how much effort an individual expects to expend when using a specific technology [6]. Systems that appear straightforward and simple to navigate tend to gain higher user acceptance. For e-SIM technology specifically, factors such as straightforward activation processes, seamless digital configuration, and intuitive management platforms can substantially boost adoption rates [3]. Minimizing complexity and enhancing simplicity foster favorable perceptions and confidence in emerging digital solutions [8]. In addition, previous studies have consistently shown a significant relationship between Perceived Ease of Use and Adoption Intent. Based on research confirm it was found that ease of use positively influences consumers'

willingness to adopt mobile payment systems [9]. Therefore, in this study, Perceived Ease of Use (X_1) is expected to have a positive influence on consumers' intention to adopt e-SIM.

2.3 Perceived Usefulness (PU)

Perceived Usefulness as the extent to which individuals believe a system improves their performance or productivity. In telecommunications, this translates to user beliefs that e-SIM surpasses physical SIM cards through benefits like flexibility, ease of use, and managing multiple accounts without tangible cards [6]. Perceived usefulness directly influences adoption decisions, as users favor technologies offering real advantages [7]. Corroborating research includes studies identified usefulness as the most influential factor affecting consumers' willingness to transition to digital shopping [10]. Similarly, study demonstrated that perceived usefulness plays a significant role in driving wearable technology adoption intentions [8]. Therefore, in this study, Perceived Usefulness (X2) is expected to have a positive influence on consumers' intention to adopt e-SIM.

2.4 Perceived Security

Perceived Security measures users' confidence that a system protects their information from misuse [11]. In digital telecommunications, trust in data protection and privacy critically shapes adoption decisions. Featherman and Pavlou highlight perceived security as essential for online service adoption, especially when personal or financial data is involved. Regarding e-SIM, consumers' confidence in Telkomsel's encryption standards and network security directly affects their adoption readiness [12]. Based on research, the study confirmed that perceived security emerges as a critical determinant of technology acceptance in both mobile services and e-payment environments, directly influencing how consumers engage in purchasing activities through these platforms [13]. Similary, research perceived security has an effect positive of adoption of FintTech service [14]. Therefore, in this study. Perceived Security (X3) is expected to have a positive influence on consumers' intention to adopt e-SIM.

2.5 Social Influence (SI)

Social Influence measures the degree to which people believe that important others expect them to adopt new technology [15]. In e-SIM contexts, adoption decisions are shaped by peer recommendations, social media visibility, and the social status linked to owning cutting-edge devices [13]. Based on research, social influence has a strong effect of behavioral intention for adopter mobile payment service [16]. Likewise, research confirm media influence has positive effect of behavior intention [17]. Therefore, in this study, Social Influence (X4) is expected to have a positive influence on consumers' intention to adopt e-SIM.

2.6 Adoption Intention (AI)

Adoption Intention, or Behavioral Intention to Use, represents how strongly an individual plans to adopt and use a particular technology moving forward [6]. Evaluating technology adoption demands a context-specific, subjective approach [18]. E-SIM technology has not achieved consistent maturity levels in developing countries, with Indonesian consumers representing a market still in early adoption phases.

3 Research Method

This research adopted a descriptive approach using structural equation modeling (SEM) to analyze complex variable relationships. Purposive sampling determined participant selection, with minimum sample size based on research who suggest five observations per indicator or construct in SEM studies [19]. With 20 indicators across five latent variables, the study required at least 100 respondents. Primary data came from structured questionnaires distributed to Telkomsel Indonesia customers who had prior experience using Telkomsel SIM cards. Partial Least Squares Structural Equation Modeling (PLS-SEM) analyzed five constructs: Perceived Ease of Use, Perceived Usefulness, Perceived Security, Social Influence, and Adoption Intention. This methodology aimed to deliver comprehensive understanding of customer behavior patterns and interconnected factors affecting Telkomsel e-SIM adoption.

4 Result And Discussion

4.1 Measurement Model Evaluation (Outer Model)

As the outer model involves verifying that each indicator effectively represents its corresponding construct. This verification process tests both validity and reliability dimensions. The critical evaluation criteria as convergent validity, discriminant validity, composite reliability, average variance extracted (AVE), and Cronbach's Alpha [19].

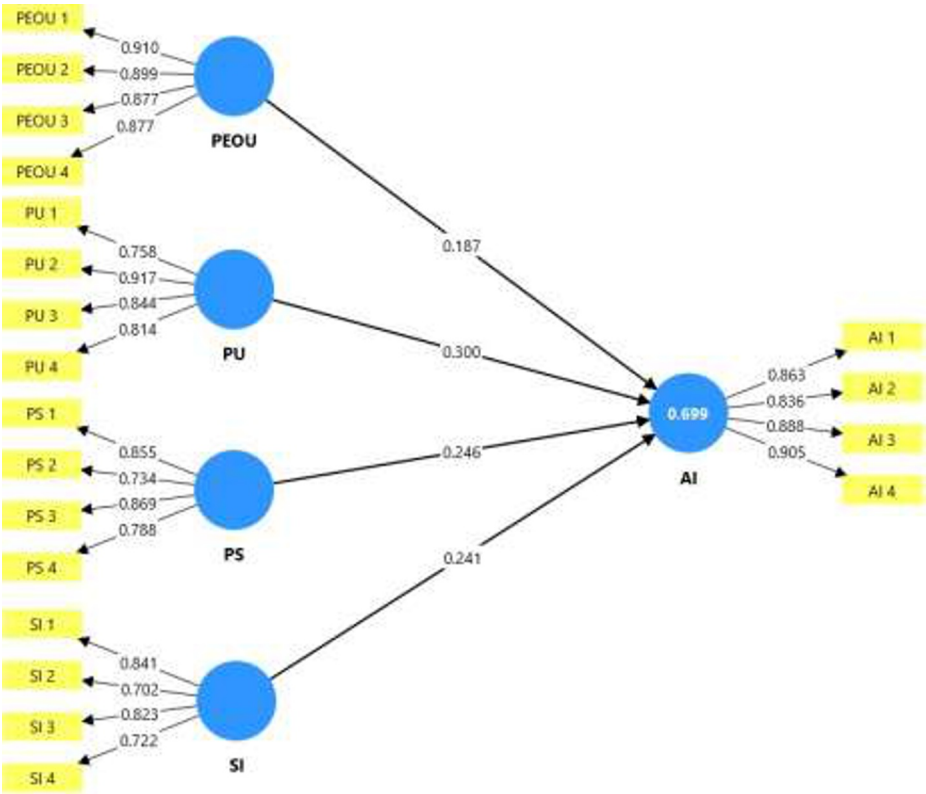

Fig. 1. Measurement & Structural Model Graphical

Convergent validity assessment begins with examining loading factors, which should surpass 0.708 or 0.7 for latent variable indicators. Average Variance Extracted (AVE) provides additional validation, with acceptable values exceeding 0.50 [19]. The analysis examined 20 indicators distributed across five variables. Results demonstrated that each indicator produced an outer loading value greater than 0.7, with these findings presented in Fig. 1

Discriminant validity assessment examines how reflective indicators load across different constructs through cross loading analysis. An indicator qualifies as valid when its loading factor reaches its maximum value on its target construct while showing lower values on competing constructs. This pattern demonstrates that the latent construct predicts its associated indicators more accurately than it predicts indicators from other constructs [19].

Table 1. Output Outer Loading

Construct	Indicator	Outer Loading
Adoption Intention (AI)	AI1	0.863
	AI2	0.836
	AI3	0.838
	AI4	0.905
Perceived Ease of Use (PEOU)	PEOU1	0.910
	PEOU2	0.899
	PEOU3	0.877
	PEOU4	0.877
Perceived Usefulness (PU)	PU1	0.855
	PU2	0.734
	PU3	0.758
	PU4	0.788
Perceived Security (PS)	PS1	0.758
	PS2	0.917
	PS3	0.844
	PS4	0.814
Social Influence (SI)	SI1	0.841
	SI2	0.823
	SI3	0.702
	SI4	0.722

The discriminant validity assessment demonstrates adequate construct distinction, with cross loading values in each variable column surpassing corresponding values in other columns. This indicates that all items appropriately fulfill discriminant validity standards.

Composite reliability determines whether research instruments are consistent and reliable. Hair (2022), specify that constructs meet reliability standards when composite reliability and Cronbach's alpha exceed 0.7 across all variables. This confirms the questionnaire's suitability as a research instrument. The construct reliability results for this study's variables are presented below [20].

Table 2. Output Composite Reliability

Variables	Composite Reliability	Critical Value	Average Variance Extract	Evaluate Model
PEOU	0.939	0.7	0.794	Reliable
PU	0.886		0.662	Reliable
PS	0.902	0.7	0.697	Reliable
SI	0.856		0.600	Reliable
AI	0.928		0.763	Reliable

Analysis of reliability metrics reveals that composite reliability and AVE measurements meet the minimum requirements of 0.7 and 0.5 across all constructs. These results establish that Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Perceived Security (PS), Social Influence (SI), and Adoption Intention all satisfy construct reliability standards.

4.2 Structural Model Evaluation (Inner Model)

The evaluation process advances from outer model analysis to structural model (inner model) examination, which investigates the impact of exogenous latent variables on their endogenous counterparts. Conducting this inner model evaluation establishes the precision of the constructed structural model. Assessment relies on multiple indicators: the coefficient of determination (R^2) measuring endogenous variable variance, predictive relevance (Q^2) obtained through blindfolding techniques, and the goodness of fit index.

Table 3. Output Inner Model

Variables	R-Square	Q-Square	GoF
Adoption Intention	0.699	0.654	0.587

Coefficient of Determination (R-square) values into three categories, there are values of 0.70 indicate strong explanatory power, 0.50 represents moderate strength, and 0.25 signifies weak predictive capability. Table 3 presents the coefficient of determination results for the endogenous constructs examined in this research [21]. Analysis of the measurement model shows Adoption Intention has an R-Square of 0.699, indicating that approximately 70% of its variance can be attributed to the combined influence of PEOU, PU, PS, and SI. Unexplored variables contribute the remaining 30.1% of explanatory power.

Predictive Relevance (Q-Square) Structural model predictive relevance gauges how well the model produces values and estimates. The specify that Q^2 must exceed 0 for adequate predictive relevance; values of 0 or less signal inadequate predictive power [19]. Q^2 values for Adoption Intention (AI) stand at 0.654 respectively, surpassing 0. This demonstrates robust predictive relevance, validating the model's ability to capture true variable relationships and its appropriateness for PLS-SEM analysis. (see Table 3).

Goodness of Fit is model fitness is evaluated through GoF analysis. Thre are categorize model fit as small (0.1), moderate (0.25), or large (0.36). The formula for calculating overall model adequacy appears below:

$$\text{GoF} = \sqrt{\overline{AVE} \times \overline{R^2}} \quad (1)$$

Analytical findings reveal a GoF of 0.587, well above the 0.36 standard for proper model fit, confirming excellent correspondence between empirical data and the research framework. The combined evaluation of R^2,Q^2,and GoF metrics establishes sufficient model capability,warranting advancement to hypothesis examination.

4.3 Hypothesis Testing Model

Hypotheses are tested using t-statistics and p-values derived from SmartPLS bootstrapping with 5000 replications. Acceptance requires p-values below 0.05 and t-statistics above 1.96; otherwise, hypotheses are rejected. PLS iterations additionally yield original sample values (unstandardized beta coefficients showing predictive relationships), sample means (iteration averages), and standard deviations (standard errors) [21]

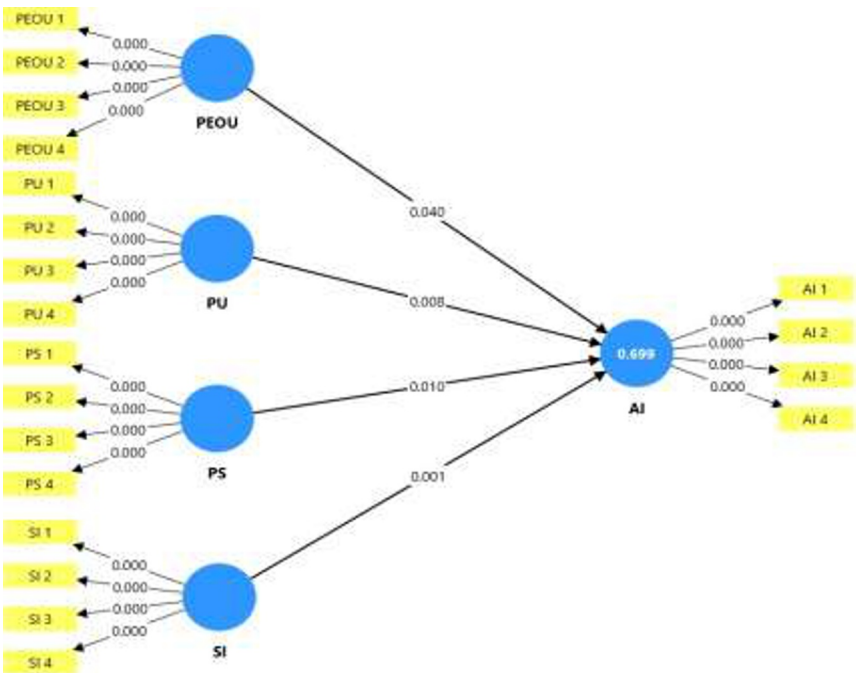

Fig. 2. Output Bootstrapping Graphical

Table 4. Output Total Effect

Hypothesis	Relationship	Original Sample	T-Statistic	P Value	Decision
H1	PEOU > AI	0.187	2.057	0.040	Accepted
H2	PU > AI	0.300	2.642	0.008	Accepted
H3	PS > AI	0.246	2.586	0.010	Accepted
H4	SI > AI	0.241	3.192	0.001	Accepted

According to the table, Adoption Intention is influenced by Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Perceived Security (PS), and Social Influence (SI) with effect sizes of 0.187, 0.300, 0.246 and 0.241 respectively. Collectively, these

predictors exhibit positive influences on Adoption Intention. Total effects examination demonstrated positive relationships throughout all variables. Each of the four exogenous variables fulfilled the standard requirements, exhibiting T-statistic values greater than 1.96 and p-values lower than 0.05. Consequently, Perceived Ease of Use, Perceived Usefulness, Perceived Security, and Social Influence were confirmed to exert significant influence on Adoption Intention.

Hypothesis Analysis result a lot of hypothesis are accepted it mean a lot of variables have a positive and significant effect on adoption intention consumers.

5 Discussion

This research reveals Perceived Usefulness as the most influential factor ($\beta = 0.300$, $p = 0.008$) driving e-SIM adoption intention, validating the core principles of TAM within Indonesia's digital telecommunications transformation. This finding carries particular weight given the market dynamics where smartphone penetration 194.26 million users in 2024 outpaces population growth, and telecommunications subscriptions exceed the total population due to widespread multi-SIM usage, creating genuine demand for more efficient and compact connectivity solutions. The demographic composition of respondents primarily aged 35-49 years, employed in private sector positions, and earning monthly incomes above 10 million rupiah reinforces the conclusion that this professional segment places high value on e-SIM's functional capabilities. These include managing multiple phone numbers without physical cards, flexible operator switching, and seamless user experiences that directly enhance communication productivity and operational efficiency. Within today's fast-paced business environment, high-income professionals require telecommunications solutions that accommodate work-life boundaries, international mobility requirements, and multi-device connectivity needs, establishing e-SIM as a necessity-driven innovation rather than a technological curiosity. Perceived Security emerges as the second most significant factor ($\beta = 0.246$, $p = 0.010$), reflecting heightened awareness among affluent segments regarding data protection and digital identity safeguards, particularly because e-SIM involves complete digitalization of the subscriber identity module with inherent vulnerability to cyber threats. For professionals managing confidential business communications and personal information, security guarantees through strong encryption, protection from SIM swap attacks, and adherence to regulatory standards become essential prerequisites before committing to technological migration. Social Influence ($\beta = 0.241$, $p = 0.001$) and Perceived Ease of Use ($\beta = 0.187$, $p = 0.040$) also demonstrate statistical significance, indicating that while utility serves as the primary motivator, peer validation among professional colleagues and straightforward activation processes remain important considerations in the decision-making journey, especially for technology recently introduced especially e-SIM by Telkomsel in 2024.

The notable aspect of these findings lies in their alignment with TAM predictions where perceived usefulness functions as the strongest predictor, contrasting with numerous technology adoption studies in emerging markets that typically identify

social influence or ease of use as dominant factors. This outcome suggests that the target audience for e-SIM mature professionals with substantial incomes exhibits stronger rational decision-making tendencies compared to emotional or socially-driven adoption patterns. These individuals embrace new technology based on transparent value propositions and concrete benefits experienced in everyday activities, rather than responding primarily to social expectations or technology trends. Given the widespread availability of dual-SIM smartphones and the commoditized nature of telecommunications services, e-SIM must demonstrate clear utility advantages to trigger switching behaviors. Specific benefits such as immediate digital provisioning that removes the need for physical store visits, capability to manage multiple operator profiles for optimized network coverage and pricing, improved security through elimination of physical SIM card vulnerabilities, and simplified international roaming management address genuine pain points experienced by mobile professionals. The significance of perceived security as the second strongest influence also reveals the sophisticated understanding this target segment possesses regarding digital security complexities and their unwillingness to sacrifice data protection for mere convenience. The combination of these four factors explaining 69.9% of adoption intention variance ($R^2 = 0.699$), alongside robust predictive relevance ($Q^2 = 0.654$) and excellent model fit (GoF = 0.587), confirms that e-SIM adoption represents a multi-dimensional phenomenon where functional utility, security confidence, social validation, and transition ease interact in complex ways to shape behavioral intentions.

6 Conclusion

This research successfully identifies the critical factors influencing e-SIM adoption among Telkomsel consumers in Indonesia, revealing that Perceived Usefulness serves as the primary driver, followed by Perceived Security, Social Influence, and Perceived Ease of Use all demonstrating statistically significant positive effects on adoption intention. The dominance of perceived usefulness confirms that Indonesian consumers, particularly professionals aged 35-49 years with high incomes, adopt e-SIM based on rational evaluation of functional benefits rather than merely following social trends or technological novelty. This finding is particularly relevant given Indonesia's unique telecommunications landscape where smartphone users and telecom subscribers exceed the population due to multi-SIM ownership patterns, creating genuine demand for more efficient digital solutions. The significance of perceived security as the second strongest factor underscores the importance of trust and data protection in driving technological migration, while social influence and ease of use continue to play supporting roles in reducing adoption barriers. These findings provide valuable insights for understanding technology acceptance behavior in emerging markets, demonstrating that when clear functional value is articulated, rational considerations can override social pressures even in collectivist societies.

For Telkomsel, strategic recommendations focus on strengthening the value proposition communication and building comprehensive adoption support systems. First, marketing efforts should emphasize concrete benefits that resonate with daily

consumer needs such as simplified number management for work-life separation, cost savings through flexible operator switching, and convenience of instant activation without visiting physical stores. Second, security messaging must be reinforced through transparent communication about encryption standards, SIM swap fraud protection mechanisms, and partnership with reputable cybersecurity institutions to build consumer confidence. Third, leveraging social influence can be achieved through targeted referral programs and community-based adoption initiatives, particularly within corporate environments where professionals can share experiences and validate the technology's benefits among peers. Fourth, continuous improvement of the user experience remains essential, ensuring that the activation process stays simple, intuitive, and well-supported through multiple customer service channels. Additionally, Telkomsel should develop segment-specific packages that demonstrate clear advantages over traditional SIM cards, such as premium international roaming solutions for business travelers and integrated IoT services for tech-savvy consumers. By addressing these four dimensions simultaneously functional value, security assurance, social validation, and user convenience Telkomsel can accelerate e-SIM adoption and successfully navigate Indonesia's digital telecommunications transformation while meeting the evolving needs of its diverse consumer base.

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