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Functional Barriers and Innovation Resistance Following the Discontinuation of Conventional Services: The Mediating Role of User Characteristics Among Pln Mobile Users

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ABSTRACT

This study examines the effects of usage, value, and risk barriers on innovation resistance among PLN Mobile users and tests the mediating role of user characteristics. A cross-sectional survey of 200 Indonesian users selected through purposive sampling was analysed using PLS-SEM. Usage barrier (β=.315), value barrier (β=.285), risk barrier (β=.286), and user characteristics (β=.462) positively affected innovation resistance. User characteristics mediated the effect of usage barrier (β=.164), but not the effects of value barrier (β=.022) or risk barrier (β=.039). The model explained 74.2% of innovation resistance and demonstrated predictive relevance. Reducing resistance therefore requires a simpler interface, stronger perceived value and security, and targeted digital-literacy support during the transition from conventional services.

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INTRODUCTION

Digital transformation has reshaped the delivery of public services by transferring interactions that were previously conducted through offices, counters, and face-to-face channels to integrated digital platforms. For public utilities, this transition promises faster transactions, wider access, operational efficiency, and more transparent service processes. Yet digital availability does not automatically produce sustained use. The discontinuation or reduction of conventional channels can expose a gap between organisational transformation targets and users' ability or willingness to adopt the replacement technology (Vial, 2019; Dener et al., 2021).

PT PLN (Persero) has accelerated its service transformation through PLN Mobile, an application that consolidates electricity-bill payment, prepaid-token purchases, service requests, disruption reports, and customer information. The expansion of the user base indicates substantial diffusion, but the shift towards an application-centred service model also changes established routines. Customers who previously relied on service counters, agents, or direct assistance must learn new procedures, depend on devices and connectivity, and assume greater responsibility for completing digital transactions.

Innovation Resistance Theory (IRT) explains why individuals may postpone, reject, or oppose an innovation even when it offers functional improvements. Ram and Sheth (1989) distinguish functional barriers from psychological barriers. Functional barriers arise when an innovation conflicts with usage patterns, provides insufficient value, or creates perceived risk. These barriers are particularly relevant when adoption is not entirely voluntary because a conventional alternative is being reduced or discontinued.

Usage barrier refers to perceived complexity, disruption of routines, learning effort, and the technical skills required to operate an innovation. Value barrier emerges when users judge that the benefits of a new service do not compensate for its financial, temporal, cognitive, or behavioural costs. Risk barrier reflects uncertainty concerning privacy, security, financial loss, transaction errors, system performance, or other adverse consequences (Laukkanen, 2016; Mani & Chouk, 2018). Each barrier can motivate customers to preserve familiar service practices.

The response to these barriers may vary across users. Personal innovativeness, service motivation, digital competence, and access to adequate devices and connectivity shape an individual's capacity to manage digital change. In the present study, user characteristics are positioned as a mediator: functional barriers may influence users' readiness and behavioural orientation, which in turn affect innovation resistance. This mechanism is theoretically important because earlier research has more often tested direct barrier–resistance relationships or treated user characteristics as independent or moderating factors.

Accordingly, this study examines the direct effects of usage, value, and risk barriers on innovation resistance among PLN Mobile users and evaluates whether user characteristics mediate those relationships. It contributes to IRT by testing a mediation mechanism in a public-utility context characterised by the withdrawal of conventional services, and it offers evidence for designing an inclusive transition to digital service delivery.

LITERATURE REVIEW

Innovation Resistance Theory

Innovation resistance is not simply the opposite of adoption. It may occur before adoption, during trial, or after initial use, and can be passive or active. Passive resistance reflects reluctance caused by established habits or status-quo preference, whereas active resistance follows a conscious evaluation of perceived disadvantages (Ram, 1987; Heidenreich & Spieth, 2013). IRT therefore complements acceptance-oriented theories by explaining the frictions that impede change.

Ram and Sheth's (1989) model groups resistance drivers into functional and psychological barriers. Functional barriers relate to usage, value, and risk, while psychological barriers concern tradition and image. This study focuses on functional barriers because the transition to PLN Mobile directly changes service procedures, the cost–benefit assessment of obtaining electricity services, and users' exposure to perceived digital risk.

Usage Barrier and Innovation Resistance

A usage barrier occurs when an innovation is inconsistent with established routines or requires substantial effort, learning, or technical skill. Application complexity, unfamiliar navigation, registration and verification procedures, and difficulty locating features can increase cognitive burden. Evidence from mobile banking, mobile payment, e-health, and other digital services consistently links usage complexity with resistance and discontinuance (Kaur et al., 2020; Chen et al., 2022; Iyanna et al., 2022). Thus, H1 proposes that usage barrier positively affects innovation resistance.

Value Barrier and Innovation Resistance

Users evaluate whether an innovation delivers a meaningful advantage relative to the sacrifices required to use it. A value barrier arises when service speed, convenience, feature relevance, or added benefits are perceived as inadequate compared with conventional methods. When users believe that an application demands additional data costs, time, effort, or behavioural change without a commensurate benefit, rejection becomes a rational response (Laukkanen, 2016; Santos & Ponchio, 2021). H2 therefore proposes that value barrier positively affects innovation resistance.

Risk Barrier and Innovation Resistance

A risk barrier represents uncertainty about possible negative consequences. Digital public services may generate concerns about misuse of personal data, transaction errors, financial loss, system instability, and service failure. Such perceptions encourage customers to retain channels that appear more controllable or trustworthy. Prior evidence identifies risk as a central determinant of resistance to digital payment, banking, and platform services (Kaur et al., 2020; Chen & Yuan, 2023). H3 proposes that risk barrier positively affects innovation resistance.

The Mediating Role of User Characteristics

User characteristics reflect personal innovativeness, service motivation, digital competence, and the availability of supporting infrastructure. Users with greater technological experience and stronger digital skills are generally better able to learn

unfamiliar procedures and recover from operational difficulties (Carretero et al., 2017; van Laar et al., 2020). User characteristics are also expected to affect innovation resistance directly because readiness and resources shape the perceived manageability of digital services.

The study proposes three mediation hypotheses. H4 predicts that user characteristics mediate the usage barrier–resistance relationship because individual capability can amplify or reduce the consequences of complexity and learning effort. H5 predicts mediation for value barrier, as user motivation and innovativeness may influence benefit evaluation. H6 predicts mediation for risk barrier, because digital competence and self-efficacy may shape how security and uncertainty are interpreted.

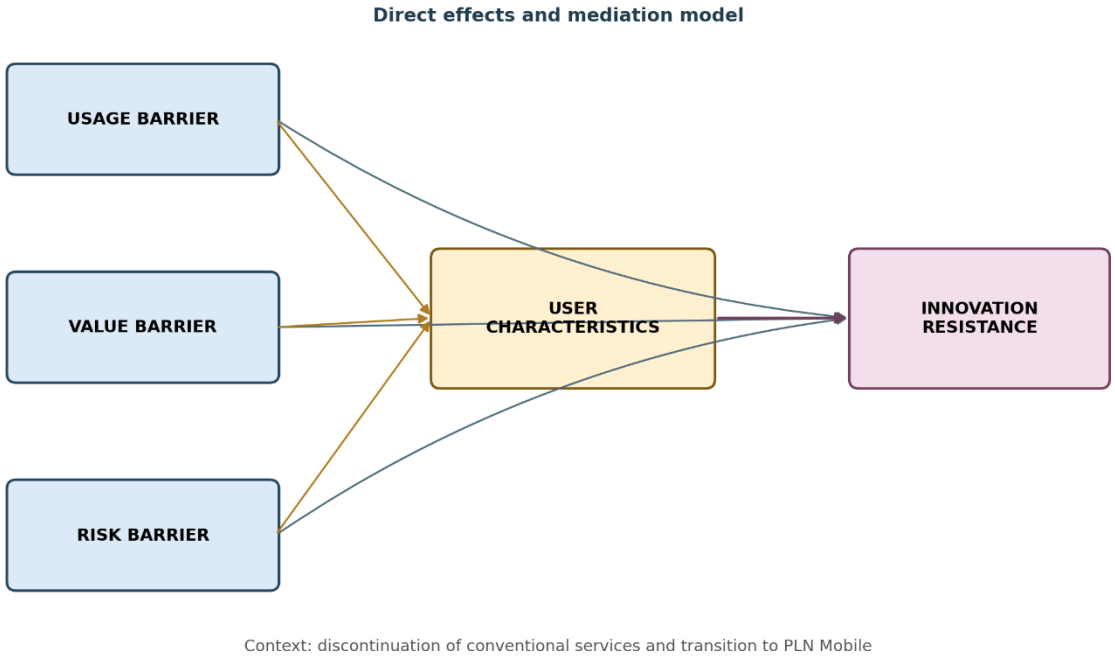


Figure 1. Conceptual Framework

METHODOLOGY

This explanatory study used a quantitative, cross-sectional survey design. The target population comprised PLN Mobile users in Indonesia who had experience with both conventional and digital PLN services. Data were collected online through a structured questionnaire distributed using Google Forms, social media, and online communication platforms. A five-point Likert scale measured respondents' agreement with statements representing usage barrier, value barrier, risk barrier, user characteristics, and innovation resistance.

Non-probability purposive sampling was applied. Eligible respondents were at least 17 years old, used PLN Mobile, had previously used both conventional and digital PLN channels, and had conducted a transaction or used a service feature within the application. A total of 200 valid responses met the criteria. This sample size satisfied the PLS-SEM guideline of five to ten observations per indicator and provided sufficient cases for estimating the proposed latent-variable model.

The measurement instrument comprised reflective indicators derived from IRT and prior digital-service studies. Usage barrier captured routine incompatibility, complexity, learning effort, and technical-skill requirements. Value barrier measured relative advantage, performance–cost comparison, solution adequacy, and incentives. Risk barrier represented security, financial, performance, and uncertainty concerns. User characteristics covered personal innovativeness, service motivation, and personal infrastructure. Innovation resistance measured postponement, rejection, preference for existing channels, and reluctance to rely on the application.

Data were analysed with SmartPLS 4. The measurement model was evaluated using indicator loadings, average variance extracted (AVE), the Fornell–Larcker criterion, the heterotrait–monotrait ratio, Cronbach's alpha, rho_A, and composite reliability. The structural model was assessed using R^2, effect size (f^2), blindfolding-based predictive relevance (Q^2), and goodness of fit (GoF). Direct and indirect effects were tested through bootstrapping; relationships were regarded as significant when $t > 1.96$ and $p < .05$.

RESEARCH RESULTS

Measurement Model

All retained indicator loadings exceeded .60, ranging from .627 to .863. Although several loadings fell between .60 and .70, they were retained because the study was model-development oriented and all corresponding constructs satisfied AVE and composite-reliability requirements. The AVE values ranged from .532 to .676, exceeding the .50 threshold. The square root of each construct's AVE was greater than its correlations with other constructs, and all HTMT ratios were below .90; thus, convergent and discriminant validity were established.

Table 1. Measurement Model Quality

Construct	AVE	Cronbach's α	rho_A	Composite Reliability
User Characteristics	.641	.949	.951	.955
Innovation Resistance	.580	.895	.900	.917
Risk Barrier	.532	.875	.891	.900
Usage Barrier	.676	.940	.943	.949
Value Barrier	.658	.926	.928	.939

Internal consistency was strong. Cronbach's alpha ranged from .875 to .949, rho_A from .891 to .951, and composite reliability from .900 to .955. These values exceeded the recommended .70 threshold and confirmed that the indicators consistently represented their respective constructs.

Structural Model and Predictive Performance

Table 2. Structural-Model Evaluation

Criterion	User Characteristics	Innovation Resistance	Interpretation
R^2	.321	.742	Weak–moderate / substantial
Q^2	.197	.420	Predictive relevance established
Average AVE	—	.618	Model-wide component
Average R^2	—	.532	Model-wide component
GoF	—	.573	Large overall fit

Usage, value, and risk barriers explained 32.1% of the variance in user characteristics. Together with user characteristics, the three barriers explained 74.2% of innovation resistance, indicating substantial explanatory power. Q^2 values were positive for both endogenous constructs, with innovation resistance reaching .420. The GoF value of .573 exceeded the .36 benchmark for a large fit. User characteristics also produced the largest effect on innovation resistance (f^2=.392), followed by usage barrier (f^2=.187), value barrier (f^2=.143), and risk barrier (f^2=.131).

Direct Effects

Table 3. Bootstrapping Results for Direct Effects

Relationship	β	t	p	Decision
Usage Barrier → Innovation Resistance	.315	7.227	<.001	Supported
Value Barrier → Innovation Resistance	.285	6.544	<.001	Supported
Risk Barrier → Innovation Resistance	.286	5.767	<.001	Supported
User Characteristics → Innovation Resistance	.462	7.890	<.001	Significant

Usage barrier had a positive and significant effect on innovation resistance (β=.315, t=7.227, p<.001), supporting H1. Users who experienced greater difficulty, routine disruption, and learning requirements displayed stronger reluctance to use PLN Mobile. Value barrier also positively affected resistance (β=.285, t=6.544, p<.001), supporting H2; perceived benefits that failed to compensate for effort or sacrifice increased rejection.

Risk barrier exerted a positive effect (β=.286, t=5.767, p<.001), supporting H3. Concerns about personal data, transaction accuracy, and system reliability therefore remained salient. User characteristics had the strongest direct coefficient in the model (β=.462, t=7.890, p<.001), confirming their central contribution to the explanation of innovation resistance.

Mediation Effects

Table 4. Bootstrapping Results for Indirect Effects

Indirect Relationship	β	t	p	Decision
Usage Barrier → User Characteristics → Innovation Resistance	.164	4.605	<.001	Supported
Value Barrier → User Characteristics → Innovation Resistance	.022	.576	.565	Not supported
Risk Barrier → User Characteristics → Innovation Resistance	.039	.965	.335	Not supported

User characteristics significantly mediated the relationship between usage barrier and innovation resistance (β=.164, t=4.605, p<.001), supporting H4. However, the indirect effects of value barrier (β=.022, t=.576, p=.565) and risk barrier (β=.039, t=.965, p=.335) were not significant; H5 and H6 were therefore not supported.

DISCUSSION

Functional Barriers as Direct Drivers of Resistance

The significant effect of usage barrier confirms that a mandatory or strongly encouraged digital transition can become difficult when it disrupts established service routines. Respondents still encountered difficulties locating features, understanding instructions, adapting to new procedures, and completing registration or verification. The finding supports IRT and prior evidence that complexity and learning effort encourage users to retain familiar channels (Laukkanen, 2016; Chen et al., 2022). The practical issue is not merely whether the application functions, but whether diverse customers can complete essential tasks independently and confidently.

Value barrier was also a significant source of resistance. Some users perceived that PLN Mobile did not provide an advantage sufficiently greater than conventional services to justify the required time, data, effort, or behavioural adjustment. This result reinforces the utilitarian logic of IRT: adoption is unlikely when the new service cannot demonstrate clear relative advantage. Feature proliferation alone will not eliminate resistance if speed, convenience, problem resolution, and service reliability are not visibly improved (Santos & Ponchio, 2021).

Risk barrier remained significant and was the most highly perceived barrier descriptively. Users were concerned about personal-data security, transaction errors, financial loss, and system disruption. In a public-utility context, these risks may be especially consequential because electricity services are essential and failed transactions can directly affect households. The result aligns with studies of digital payment and mobile services showing that uncertainty and security concerns encourage customers to prefer channels perceived as more controllable (Kaur et al., 2020; Waliullah et al., 2025).

Why User Characteristics Mediate Only the Usage Barrier

The significant mediation of usage barrier indicates that complexity does not produce the same degree of resistance for every user. Individuals with higher personal innovativeness, stronger service motivation, better digital capability, and adequate devices or connectivity can more readily learn procedures and overcome operational problems. Conversely, users with limited readiness translate the same usage difficulty into stronger resistance. This mechanism clarifies why digital education, tutorials, and assisted transition programmes can reduce the effect of usage-related obstacles.

User characteristics did not mediate value barrier. Users with high or low digital readiness can both reject an application when its perceived benefits fail to exceed the sacrifices required. Value assessment is therefore primarily determined by the service proposition itself rather than by individual readiness. PLN must improve transaction speed, feature relevance, service personalisation, responsiveness, and tangible incentives rather than relying only on digital-literacy interventions.

Similarly, user characteristics did not mediate risk barrier. Even technologically capable users may resist when they question security, privacy, transaction integrity, or system reliability. Risk is therefore evaluated as a direct service-level concern. Reducing it requires robust technical safeguards, transparent privacy and security communication, transaction confirmation, rapid error resolution, and visible accountability. User education can help, but cannot substitute for trustworthy system design.

Theoretical and Managerial Implications

Theoretically, the findings extend IRT in two ways. First, they confirm the relevance of usage, value, and risk barriers within a digital public-utility service rather than a purely commercial, discretionary innovation. Second, they demonstrate that mediation is barrier-specific. User characteristics transmit the effect of operational difficulty, but not the effects of inadequate value or perceived risk. This distinction prevents user readiness from being treated as a universal explanation for resistance.

Managerially, PT PLN should pursue a segmented transition strategy. Application navigation, registration, verification, and core transactions should be simplified and subjected to usability testing across age and capability groups. Short tutorials, assisted onboarding, community demonstrations, accessible help channels, and targeted support for users with lower digital capability can address usage-related resistance.

At the same time, PLN must strengthen the service proposition and trust architecture. Customers require faster and more dependable transactions, features that solve priority problems, clear advantages over conventional channels, and rapid complaint resolution. Security controls, privacy protection, system stability, transparent risk communication, and recovery procedures must be visible to users. Maintaining limited assisted channels during the transition may also prevent exclusion while capability and trust are being developed.

CONCLUSIONS AND RECOMMENDATIONS

Usage, value, and risk barriers positively and significantly increase innovation resistance among PLN Mobile users. User characteristics also have a strong direct

relationship with resistance and significantly mediate the effect of usage barrier. They do not, however, mediate the effects of value or risk barriers. The model explains 74.2% of innovation resistance and has adequate predictive relevance and large overall fit. These results show that resistance during the discontinuation of conventional services is simultaneously an operational, value, security, and user-readiness problem.

PT PLN should simplify the interface and service flows, provide inclusive onboarding and digital assistance, improve feature relevance and transaction efficiency, and strengthen security, privacy protection, system stability, and transparent communication. User segmentation should guide education and support, while service-level improvements should address value and risk concerns directly. A gradual and assisted channel transition is advisable for customers who remain digitally vulnerable.

FURTHER RESEARCH

The study used purposive sampling and a cross-sectional design, limiting statistical generalisation and causal interpretation. Future research should use probability or multi-region samples, longitudinal designs, and objective usage data. Additional constructs such as trust, perceived usefulness, technology readiness, digital literacy, service quality, customer experience, forced-adoption perception, and status-quo bias could be incorporated. Multi-group analysis across age, education, location, and usage intensity would clarify whether resistance mechanisms differ among customer segments.

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