

Digital Literacy, Local Tax Service Digitalization, and Tax Compliance: Evidence from Malang, Indonesia

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Abstract

Digital tax services are often treated as an uncomplicated route to compliance, although their effects depend on users' capabilities. This study examines whether digital literacy changes the relationship between perceived local tax service digitalization and taxpayer compliance in Malang, Indonesia. A cross-sectional questionnaire survey yielded 201 usable responses from individual and business taxpayers who used electronic local tax administration. Ten items measured each construct, and moderated regression analysis tested the proposed relationships. Digitalization ($B=1.226$, $p<0.001$) and digital literacy ($B=1.650$, $p<0.001$) were positively associated with compliance. Contrary to the hypothesized strengthening effect, their interaction was negative ($B=-0.030$, $p<0.001$). The model explained 73.0% of the variance in compliance. This pattern suggests diminishing dependence, digitally capable taxpayers may comply more independently, whereas less-capable users rely more heavily on service simplicity, stability, security, and support. This result does not make literacy undesirable. It shows that uniformly improving digital interfaces may produce unequal marginal gains. Local tax authorities should combine accessible system design with targeted assistance and capability building. Because measures were self-reported and recruitment was not documented as a verifiable probability draw, the findings are associational and locally bounded.

Keywords: Digital Government, Digital Literacy, Local Taxation, Moderated Regression, Taxpayer Compliance

1. INTRODUCTION

Digital tax administration promises faster transactions, more traceable records, and lower compliance costs; however, technology does not produce compliance by itself. Evidence from Peru, Ethiopia, and other settings connects electronic invoicing and information systems with stronger reporting or payment behavior, while also showing that institutional design and taxpayer response determine the magnitude of the effect ([Bellon, Dabla-Norris, Khalid, & Lima, 2022](#); [Kotsogiannis, Salvadori, Karangwa, & Murasi, 2025](#); [Mascagni, Mengistu, & Woldeyes, 2021](#); [Shah, 2026](#)). Cross-national evidence similarly links tax-collection efficiency to digitalization, simplification, decentralization, and education, rather than digital infrastructure alone ([Martínez, Arzoz, & Arregui, 2022](#)). This distinction is important for local governments, where taxpayers encounter a concrete interface, unstable connectivity, security concerns, and uneven access to assistance.

Research on digital tax administration has primarily emphasized system deployment, enforcement capacity, or aggregate revenue effects ([Bassey, Mulligan, & Ojo, 2022](#); [Closs-Davies, Bartels, & Merkl-Davies, 2024](#); [Zhao, & Wang, 2025](#)). These outcomes are important, yet they can conceal a behavioral problem, two taxpayers may face the same platform but differ sharply in their capacity to find information, evaluate instructions, recover from errors, and complete a transaction ([Haliza, Purwoto, & Lestari, 2025](#); [Oleiji, 2026](#)). Studies of e-government and digital financial services show that performance expectancy, effort expectancy, and facilitating conditions shape adoption, while digital competence can alter how users evaluate service effectiveness ([Asmah, Ampong, Bibi, & Ofori, 2025](#); [Lee-Geiller, 2024](#); [Mphahlele, Kekwaletswe, & Seaba, 2025](#)). A platform can therefore raise average compliance while leaving some taxpayers dependent on unusually clear interfaces or human help.

Underlying this behavioral gap is a more general pattern documented in the digital divide literature. Early digital divide research concentrated on physical access to devices and connectivity, but subsequent scholarship distinguished a second-level divide in digital skills and use from a third-level divide in the tangible outcomes that access and skills eventually produce ([Scheerder, van](#)

[Deursen, & van Dijk, 2017](#)). Applied to public administration, this distinction implies that equal availability of a digital tax portal does not guarantee equal ability to benefit from it, taxpayers with weaker operational and strategic skills may still complete a transaction, but only with greater effort, more errors, or reliance on someone else's help ([Shavqiyev, & Davirova, 2025](#); [Tarigan, & Yuliansyah, 2025](#)). Fieldwork on United Kingdom local council services illustrates this mechanism directly, documenting how less digitally literate residents routinely depend on family members, friends, or front-line staff described in that literature as digital carers to complete online government transactions that more literate users complete unassisted ([Harvey, Hastings, & Chowdhury, 2023](#)). If a comparable pattern holds in local tax administration, then the quality of a digital service should matter most for taxpayers who lack an equivalent support network or personal capability, which is precisely the substitution logic this study tests.

The Unified Theory of Acceptance and Use of Technology (UTAUT) explains technology use through performance expectancy, effort expectancy, social influence, and facilitating conditions ([Venkatesh, Morris, Davis, & Davis, 2003](#)). The Theory of Planned Behavior (TPB) explains behavior through attitudes, subjective norms, and perceived behavioral control ([Ajzen, 1991](#)). Read together, the frameworks suggest a pathway from usable digital services to perceived control and compliant behavior. However, the direction of digital literacy's moderating role is not self-evident. A complementarity argument predicts that skills allow taxpayers to extract more value from better systems. A substitution argument predicts that skilled taxpayers depend less on marginal improvements in system quality because they can navigate imperfect systems independently. A recent synthesis of UTAUT applications finds that most empirical studies test only the theory's main effects and rarely examine the moderating relationships it implies, leaving the direction of ability-based moderation in technology-mediated public services comparatively untested by [Dwivedi, Rana, Tamilmani, and Raman \(2020\)](#), a gap this study directly addresses in the tax administration context.

This unresolved direction constitutes the central gap. Prior work has linked digital capability to e-government effectiveness and tax compliance intentions ([Garg, Narwal, & Kumar, 2024](#); [Lee-Geiller, 2024](#); [Mulatsih, Saepuloh, Putri, & Alicia, 2024](#)). But evidence that directly tests digital literacy as a moderator of local digital tax services remains limited. This issue is particularly relevant in Malang, where local tax administration has expanded electronically across restaurant, hotel, entertainment, parking, and other tax categories. Revenue growth alone cannot establish whether digital services improve compliance equitably or merely work best for people already able to navigate them.

This study tests two propositions among users of electronic local tax administration in Malang. First, perceived service digitalization is positively related to taxpayer compliance. Second, digital literacy changes this relationship. The original directional hypothesis expected reinforcement, but the analysis also permits a weakening effect. This study contributes by distinguishing the direct benefit of literacy from its conditional role: literacy may raise compliance overall while reducing taxpayers' dependence on perceived service quality. By situating the interaction within both the digital divide literature and the slippery slope framework of tax compliance, the study also offers a plausible behavioral account for why the interaction runs in the opposite direction of the originally hypothesized direction, rather than treating the reversal as a purely statistical curiosity.

2. LITERATURE REVIEW

2.1 Digital Tax Services and Compliance

In UTAUT, users adopt a system when they expect useful performance, perceive manageable effort, experience supportive social conditions, and possess enabling resources ([Venkatesh et al., 2003](#)). Applied to taxation, a digital service can reduce the time and ambiguity involved in filing and payment, improve access, and create a reliable record of transactions ([Ogli, 2026](#)). Contemporary studies find that technology-enabled tax administration can strengthen domestic revenue mobilization and compliance, although the effect varies with implementation quality and taxpayer circumstances ([Asmah et al., 2025](#); [Bassey et al., 2022](#); [Duve & Schutte, 2025](#)). The TPB clarifies why a usable platform can translate into compliance. Convenience and reliability can improve attitudes toward

digital filing, social normalization can strengthen perceived expectations, and accessible support can raise perceived behavioral control ([Ajzen, 1991](#); [Garg et al., 2024](#)). These mechanisms lower the practical and psychological costs of acting compliantly. Evidence from e-invoicing and digital enforcement supports a positive connection between well-functioning digital administration and compliant responses ([Bellon et al., 2022](#); [Kotsogiannis et al., 2025](#); [Shah, 2025](#)).

Evidence from Indonesian local governments reinforces this expectation. Cross-regional evidence indicates that digital platforms for tax administration are associated with higher subnational tax revenue, largely because they lower transaction costs and improve the monitoring capacity of local revenue offices ([Mujiyati et al., 2024](#)). Complementary work on Indonesia's national core tax administration system frames digitalization as an instrument that can strengthen either the power dimension of tax administration through more comprehensive third-party data matching and automated enforcement or the trust dimension, through greater transparency and service consistency, depending on how the system is implemented and communicated to taxpayers ([Darmayasa & Hardika, 2024](#)). A broader review of digital tax administration frames current developments as a transition toward Tax Administration 3.0, in which artificial intelligence and integrated digital infrastructure are expected to shift compliance behavior beyond what earlier e-filing systems achieved, provided taxpayers can actually interact with these more sophisticated interfaces ([Belahouaoui & Attak, 2024](#)). Together, these strands support H_1 while also foreshadowing why the benefits of digitalization might not be uniform across taxpayers with different capabilities. Accordingly, H_1 states that perceived digitalization of local tax services is positively associated with taxpayer compliance in Malang.

2.2 Digital Literacy as a Moderator

Digital literacy includes the capacity to access a system, understand procedures, use features independently, and solve basic technical problems. It should have a positive direct relationship with compliance because capable taxpayers face fewer procedural barriers. Its interaction with service digitalization is more complicated. Under complementarity, literacy amplifies system benefits. Under substitution, high-literacy taxpayers can compensate for defects, making their compliance less responsive to incremental gains in ease, stability, and support. Low-literacy taxpayers, by contrast, may depend heavily on those service characteristics ([Lee-Geiller, 2024](#); [Lutfi, Alshirah, Al-Ababneh, Alrawad, Almaiah, & Alardi, 2023](#)). The source study proposed the complementarity account. H_2 therefore states, digital literacy strengthens the positive association between the perceived digitalization of local tax services and taxpayer compliance. A significant interaction in the opposite direction would reject this directional hypothesis while still demonstrating moderation.

The competing predictions embedded in H_2 map onto a longstanding debate in digital divide research about whether skill gaps widen or narrow the practical consequences of a given technology. The first-level divide concerns access, the second-level divide concerns skill and effective use, and the third-level divide concerns the outcomes that access and use eventually produce, critically, the size of an outcome gap at the third level is not fixed by the technology itself but depends on how much a user's skill is required to convert access into benefit ([Scheerder, van Deursen, & van Dijk, 2017](#)). A well-designed service that requires little skill to operate correctly should compress this outcome gap, because low-literacy and high-literacy users can both complete the task with similar ease. A poorly designed or unstable service should widen it, because only skilled users can work around friction points, ambiguous instructions, or intermittent errors. Under this reasoning, service digitalization and digital literacy could behave as substitutes rather than complements: literacy compensates for weak system design, and a well-functioning system compensates for weak literacy, so that the two inputs matter less in combination than either does alone.

Qualitative evidence from e-government support services is broadly consistent with this account. Front-line staff report that digitally capable users self-serve regardless of platform quality, while less capable users depend heavily on people who can operate the system on their behalf whenever the platform is anything less than fully intuitive ([Harvey, Hastings, & Chowdhury, 2023](#)). Reviews of technology acceptance research raise a related caution, most empirical applications of UTAUT-family models estimate main effects only and rarely test the moderating relationships the

theory implies; therefore, direct evidence on whether ability variables strengthen or substitute for system-quality effects remains comparatively thin ([Dwivedi, Rana, Tamilmani, & Raman, 2020](#)). The present study's negative interaction term is therefore not an anomaly to be explained away; it is one of the few direct empirical tests of a substitution mechanism that the broader digital divide and technology-acceptance literatures had largely implied but seldom measured in a local tax administration setting.

A complementary explanation for why digital literacy might reduce dependence on service quality comes from the slippery slope framework of tax compliance, which separates voluntary compliance grounded in trust in the tax authority from enforced compliance grounded in the perceived power of the authority to detect and sanction noncompliance. Cross-cultural tests of the framework confirm that trust and power operate through distinct psychological pathways and that their relative weight varies with context and taxpayers' own capacity to evaluate the administration's conduct ([Kogler, Olsen, Bogaers, Böhm, Chow, Gangl, Kasper, Kirchler, Möllerström, Petrovic, Roland-Levy, Sardzoska, Shabbir, & Torgler, 2022](#)). Digitally literate taxpayers are, in principle, better positioned to inspect a digital tax system directly: they can verify a payment history, cross-check a calculated liability, or independently confirm that a transaction was correctly recorded, which allows trust to be grounded in personal verification rather than in the system's surface-level usability. Less literate taxpayers cannot perform this verification as easily and may instead infer trustworthiness from how smooth, stable, and well-supported the interface feels exactly the set of qualities the digitalization construct captures in this study.

Indonesian evidence of the slippery slope framework supports the plausibility of this channel. Studies of the national core tax administration system link perceived system quality to both the power and trust dimensions of compliance by [Darmayasa and Hardika \(2024\)](#), microenterprise-focused work finds that trust in tax authorities predicts voluntary compliance even when the perceived power of enforcement does not by [Tahar and Bandi \(2024\)](#), and earlier evidence shows that basic tax knowledge and awareness independently raise compliance, net of other administrative factors ([Setiyowati, Winarno, & Kusumawati, 2021](#)). Read together, this literature suggests that the interaction tested here may partly reflect a shift in how taxpayers come to trust the tax administration: through the system's design for those with limited capability and through direct, literacy-enabled scrutiny for those with greater capability.

3. RESEARCH METHODOLOGY

3.1 Design, Participants, and Procedure

This study used a cross-sectional explanatory survey. The target population comprised 42,147 taxpayers who reported using electronic local tax administration in Malang in 2025. The final dataset contained 201 respondents, exceeding the conventional minimum for a regression with the focal predictors ([Green, 1991](#)). Respondents were approached through activities around the local revenue agency, household visits, and WhatsApp distribution. Eligibility required residence or business activity in Malang and use of an electronic tax administration service. Because the source documentation did not identify a sampling frame, randomization mechanism, invitation count, or response rate, the recruitment should not be represented as verified simple random sampling. It is more accurately treated as eligibility-based field recruitment. This limits population-level generalization but does not prevent the analysis of associations within the observed sample.

This limitation is not unique to our study. Non-probability field recruitment is common in survey-based tax compliance research because verified sampling frames of active taxpayers are rarely available to outside researchers, and studies using convenience or purposive recruitment routinely report the same caveat about restricted generalizability ([Garg et al., 2024](#); [Mulatsih et al., 2024](#)). What distinguishes a defensible use of such data from an overstated one is whether the researchers openly flag the recruitment method's limits rather than describing the sample as representative; the present reanalysis follows the more conservative course and treats the 201 respondents as a bounded field sample rather than as a probability draw from the 42,147 registered electronic users.

Of the 201 participants, 115 (57.21%) were women and 86 (42.79%) were men. The sample included 112 individual taxpayers (55.72%) and 89 business taxpayers (44.28%). All reported residence or business activity in Malang. Data were collected using a structured online questionnaire distributed through Google Forms. The source manuscript does not state the collection dates, incentive arrangement, ethics approval identifier, or exact consent procedure. These details must be confirmed before journal submission rather than reconstructed after the fact.

3.2 Measures

All constructs were measured with ten self-report items on a five-point agreement scale. Perceived tax-service digitalization captured ease of use, administrative simplicity, system stability, accessibility, security, and efficiency. The construct was informed by UTAUT's performance expectancy, effort expectancy, and facilitating conditions ([Airawaty et al., 2025](#); [Venkatesh et al., 2003](#)). Digital literacy measured access and login ability, procedural understanding, independent feature use, confidence, and basic problem solving, consistent with capability-oriented work on e-government use ([Lee-Geiller, 2024](#)). Taxpayer compliance measured timeliness, completeness, and accuracy, consistency, and voluntary fulfillment of tax obligations, drawing on TPB-informed compliance research ([Garg et al., 2024](#); [Mulatsih et al., 2024](#)). Item-total Pearson correlations exceeded the reported critical value of 0.138 and were significant at $p < 0.001$. Internal consistency was acceptable for digitalization (Cronbach's $\alpha = 0.872$), digital literacy ($\alpha = 0.881$), and compliance ($\alpha = 0.886$). Alpha values should be interpreted as evidence of score consistency, not as proof that each scale is unidimensional or valid in every population ([Taber, 2018](#)).

The three constructs also map onto complementary but distinct strands of the wider literature, which helps clarify what the instrument does and does not measure. The digitalization items are closest in spirit to system- and service-quality measures used in e-government satisfaction research, which typically combine ease of use, reliability, and support into a single perceived-quality construct rather than separating them into independent factors ([Harvey et al., 2023](#); [Lee-Geiller, 2024](#)). The literacy items resemble operational and procedural skill measures from the digital divide literature more than they resemble the broader strategic skills associated with the third level of the divide, such as the ability to convert online access into new information or income opportunities ([Scheerder et al., 2017](#)). This distinction matters for interpretation: the moderator captures whether a taxpayer can operate the tax system competently, not whether the taxpayer possesses the fuller repertoire of digital skills that third-level divide research associates with converting technology access into broader life outcomes. A literacy measure confined to operational use would, if anything, make the observed negative interaction a conservative estimate of the substitution effect, since a richer strategic-skill measure might capture an even larger capacity for independent workaround behavior among highly literate taxpayers.

Further interpretive caution concerns construct overlap. Because digitalization, literacy, and compliance were all rated by the same respondent using similarly worded five-point items, part of the strong zero-order association among the three constructs may reflect a general tendency to rate one's own tax-related experience favorably rather than three fully independent evaluations. The high internal consistency reported for each scale (α above 0.87 in all three cases) supports reliability but does not by itself rule out this kind of halo effect, since acquiescent or socially desirable responding tends to raise, not lower, internal consistency estimates. A future instrument that separates the measurement occasion for the moderator from that of the outcome, or that supplements self-reported compliance with administrative filing records, would allow this possibility to be assessed rather than merely acknowledged.

3.3 Analysis

Moderated regression estimated compliance from digitalization, digital literacy, and their product term. The Formula 1 was :

$$Y = a + b1X + b2M + b3(XxM) + e \quad (1)$$

Where Y represents the dependent variable, X represents the independent variable, M represents the moderating variable, a represents the constant, $b1$ and $b2$ represent the direct effects of X and M , $b3$ represents the interaction effect between X and M , and e represents the error term. The significance of $b3$ indicates whether M moderates the relationship between X and Y . A significant $b3$ indicates moderation, and its sign identifies whether literacy strengthens or weakens the digitalization slope (Baron & Kenny, 1986). The reported diagnostics indicated tolerance of 0.201 and variance inflation factors of 4.972 for the focal predictors. Park-test significance values were 0.552 for digitalization and 0.071 for literacy, offering no evidence of heteroscedasticity at the .05 threshold (Park, 1966). Because the source output does not report centering, robust standard errors, residual normality, influential cases, confidence intervals, or a simple-slopes analysis, coefficient interpretation remains conditional and should not be inflated into causal evidence.

Because compliance, digitalization, and literacy were measured concurrently through a single self-report instrument, the design is also exposed to common method bias, a threat that recent methodological work reframes as a set of related sociopsychological and statistical mechanisms rather than a single artifact correctable by one post-hoc test (Podsakoff et al., 2024). Contemporary guidance on moderated regression similarly recommends that mean-centered predictors, robust or bootstrapped standard errors, and an explicit simple-slopes analysis accompany any interaction term before its substantive magnitude is discussed in-depth (Hayes, 2018). The source output examined here does not report these procedures, which is why the interpretation offered in the Discussion is confined to the direction and statistical significance of the interaction rather than to its precise magnitude, and why a full reanalysis following current best-practice guidance is recommended before the coefficients are used for policy costing.

4. RESULTS AND DISCUSSION

4.1 Descriptive Results

Table 1. Descriptive statistics

Construct	N	Minimum total	Maximum total	Mean per item
Digital tax services	201	15	50	4.34
Digital literacy	201	16	50	4.32
Taxpayer compliance	201	14	50	4.37

Table 1 shows respondents reported high average ratings for all three constructs. Perceived digitalization averaged 4.34, digital literacy averaged 4.32, and compliance averaged 4.37 on the item-level five-point metric. The source table lists standard deviations of 4.642, 4.701, and 4.770, respectively. These values appear to describe the ten-item total scores rather than item-level means; labeling them as item-level standard deviations would be mathematically inconsistent with a five-point scale. Therefore, the standard deviation values should be interpreted based on the aggregated construct scores rather than individual item responses to ensure accurate statistical interpretation.

Ceiling-leaning means of this kind are a recurring pattern in self-report tax compliance surveys distributed by researchers affiliated with the tax administration itself, and prior studies using similar recruitment channels report comparably high average agreement scores by Mulatsih, Saepuloh, Putri, and Alicia (2024), which is consistent with, though not conclusive proof of, some degree of socially desirable responding in this sample. The practical reading of these descriptives is nonetheless informative. Average item ratings above 4.3 on a five-point scale indicate that most respondents

already regard both the digital tax service and their own digital skills favorably, which narrows the observed range of both predictors. A moderated regression estimated on a narrower-than-ideal range of the moderator tends, if anything, to understate rather than overstate the true size of an interaction because there are comparatively few very-low-literacy respondents in the sample against whom the dependence pattern could be most clearly observed. This makes the negative and highly significant interaction reported below a conservative signal of the substitution pattern rather than an inflated one, although it also means that the results speak most directly to taxpayers within the moderate-to-high literacy range that dominates this sample and less directly to the small minority of taxpayers with very limited digital skills who may not have been reachable through the Google Forms and WhatsApp recruitment channels in the first place.

4.2 Moderated Regression

Table 2. Moderated regression predicting taxpayer compliance (N=201)

Predictor	B	SE	beta	t	p
Constant	-23.509	4.194		-5.605	<0.001
Digital tax services	1.226	0.149	1.193	8.236	<0.001
Digital literacy	1.650	0.153	1.626	10.757	<0.001
Digitalization x literacy	-0.030	0.004	-1.972	-8.152	<0.001

Table 2 shows the regression model was statistically significant ($F(3, 197) = 177.427$, $p < 0.001$). R was 0.854, R^2 was 0.730, and adjusted R^2 was 0.726, the standard error of estimate was 2.498. Perceived digitalization had a positive coefficient ($B=1.226$, $SE=0.149$, $\beta=1.193$, $t=8.236$, $p < 0.001$), supporting H_1 . Digital literacy also had a positive coefficient ($B=1.650$, $SE=0.153$, $\beta=1.626$, $t=10.757$, $p < 0.001$). The interaction was negative ($B=-0.030$, $SE=0.004$, $\beta=-1.972$, $t=-8.152$, $p < 0.001$). Thus, literacy significantly moderated the association in the direction opposite to H_2 . The fitted equation was:

$$\begin{aligned} \text{Compliance} = & -23.509 + 1.226(\text{digitalization}) \\ & + 1.650(\text{literacy}) - 0.030(\text{digitalization} \times \text{literacy}) \end{aligned} \quad (2)$$

Formula 2 indicates that taxpayer compliance is influenced by digitalization, digital literacy, and their interaction effect. The positive coefficients of digitalization (1.226) and digital literacy (1.650) show that higher levels of perceived digital service quality and digital literacy are associated with increased taxpayer compliance. Meanwhile, the negative interaction coefficient (-0.030) indicates that digital literacy weakens the relationship between digitalization and compliance, suggesting that digitally capable taxpayers may rely less on improvements in digital tax service quality.

4.3 Discussion

These findings separate two effects that are easily confused. Digital literacy was positively associated with compliance, however, it weakened the slope linking perceived service digitalization to compliance. In other words, digitally capable taxpayers reported higher compliance overall, but their compliance varied less with perceived platform quality. Less capable users appeared to be more dependent on whether the service was easy, stable, secure, and well supported. Calling this result evidence that literacy is harmful is nonsensical. This interaction indicates a diminishing dependence on the service environment.

The positive digitalization coefficient aligns with UTAUT and evidence that electronic systems reduce friction, improve traceability, and enable enforcement or service access ([Bassey, Mulligan, & Ojo, 2022](#); [Bellon, Dabla-Norris, Khalid, & Lima, 2022](#); [Mascagni, Mengistu, & Woldeyes, 2021](#); [Venkatesh, Morris, Davis, & Davis, 2003](#)). It also fits the TPB when the administrative act feels feasible, perceived control increases, and compliance becomes easier to enact ([Ajzen, 1991](#); [Garg, Narwal, & Kumar, 2024](#)). Therefore, the result is not merely a technology adoption story. It reflects how interface quality and enabling conditions can shape the practical possibility of compliance.

Negative interaction favors the substitution account. High-literacy taxpayers may navigate menus, interpret instructions, recover from errors, and seek alternative information without relying on every element of service quality. For low-literacy taxpayers, the same design features are not cosmetic. They determine whether a task can be completed. Related e-government research shows that digital literacy changes how citizens convert service effectiveness into institutional outcomes by [Lee-Geiller \(2024\)](#), while tax studies demonstrate that knowledge and capability can alter the behavioral impact of administrative conditions ([Lutfi, Alshirah, Al-Ababneh, Alrawad, Almaiah, & Alardi, 2023](#); [Mulatsih, Saepuloh, Putri, & Alicia, 2024](#)). The Malang result extends this logic to local tax compliance.

This pattern also fits the third-level digital divide argument that skill differences matter most when a system is imperfect ([Scheerder, van Deursen, & van Dijk, 2017](#)). If Malang's digital tax platform still contains points of friction and an ambiguous field, an unstable connection, and an unfamiliar security prompt literate taxpayers can route around them using transferable digital problem-solving skills, whereas less literate taxpayers experience the same friction as a barrier to completing the transaction at all. Consistent with the digital carer pattern documented in e-government support settings, some of Malang's less literate taxpayers may be completing their obligations with informal help from family members, tax officers, or community assistants rather than independently, which would make their reported compliance more sensitive to how easy the official channel and its surrounding support are to use ([Harvey, Hastings, & Chowdhury, 2023](#)). The interaction can therefore be read as indirect evidence of an assisted-compliance channel operating alongside the self-service channel that the survey items describe, even though the source instrument did not ask respondents to report whether they completed their filings unaided.

The trust dimension of the slippery slope framework offers a related reading ([Kogler, Olsen, Bogaers, Böhm, Chow, Gangl, Kasper, Kirchner, Möllerström, Petrovic, Roland-Levy, Sardzoska, Shabbir, & Torgler, 2022](#)). If less literate taxpayers infer the tax administration's trustworthiness largely from how the interface behaves, whether it is stable, secure-looking, and responsive, then a poorly performing platform doubles as a signal of an untrustworthy administration, depressing voluntary compliance through the trust channel as well as through the practical channel of task completion. More literate taxpayers, able to verify transactions and outcomes directly, have less need for the interface itself to carry that signal. Indonesian evidence on the national core tax administration system by [Darmayasa and Hardika \(2024\)](#) and on trust-driven compliance among microenterprises by [Tahar and Bandi \(2024\)](#) is consistent with this reading, although the present dataset cannot separate a practical-usability channel from a trust-signaling channel because it did not measure trust or perceived administrative power directly.

A further question is whether the substitution pattern applies equally to individual and business taxpayers, who made up 55.72% and 44.28% of the sample, respectively. Business taxpayers more often deal with recurring, higher-stakes obligations across categories such as hotel, restaurant, and entertainment tax, which may give them more frequent opportunities to build platform-specific familiarity regardless of their general digital literacy, whereas individual taxpayers may interact with the system only sporadically. Evidence from small-firm tax digitalization research suggests that repeated exposure to a digital administrative channel can itself function as a form of situational literacy that supplements general digital skills ([Duve & Schutte, 2025](#)). If business and individual taxpayers differ in this way, the pooled interaction reported here may average across two somewhat different substitution dynamics: a skill-driven pattern among individual taxpayers and a familiarity-driven pattern among business taxpayers. The source analysis did not report the interaction separately by taxpayer type, therefore, this remains a plausible boundary condition rather than a demonstrated one.

There is also a statistical caution. Main effects in an interaction model are conditional on the zero point of the other predictor. If raw summed Likert scores were multiplied without mean centering, zero falls outside the observed scale and the large standardized coefficients become difficult to interpret. The negative product coefficient is still evidence of a changing slope, but claims about

substantive magnitude require centered predictors, confidence intervals, and simple-slopes estimates at meaningful literacy levels. The source analysis did not provide these outputs. Future reanalyses should report them, following established guidance for probing interactions in ordinary least squares regression by [Hayes \(2018\)](#), and visualize predicted compliance across low, mean, and high literacy levels.

4.4 Practical Implications

Malang's tax authority should avoid a one-size-fits-all digital strategy. Platform improvement remains useful, but its marginal compliance benefit may be the largest among users with weaker digital skills. Priority features include plain language instructions, error recovery, stable mobile access, clear security cues, assisted channels, and human escalation. Capability building should run alongside interface improvement through short demonstrations, community-based assistance, and task-specific guidance. This dual strategy avoids treating taxpayers as deficient users or passive recipients of technology.

Investment in platform quality is not wasted, since cross-regional evidence links digital tax administration to measurable local revenue gains ([Mujiyati, Zulfikar, Witono, & Cahyo, 2024](#)), but the present findings imply that Malang should budget explicitly for the assisted-service side of that investment rather than treating it as a temporary transition cost. Emerging discussions of Tax Administration 3.0 suggest that artificial-intelligence-supported chat assistance and guided workflows could shift part of this support burden from human staff to automated channels without removing the option of human escalation by [Belahouaoui and Attak \(2024\)](#), while findings from local-government e-service research caution that any such automation should be evaluated for whether it actually reduces informal reliance on digital carers family members, colleagues, or front-line staff who complete transactions on behalf of less literate taxpayers rather than simply relocating that burden onto unpaid intermediaries ([Harvey, Hastings, & Chowdhury, 2023](#)). A practical first step would be to log which transactions are completed through assisted or walk-in channels versus fully self-service channels, since this indicator would let the tax office track whether capability-building programs are actually reducing assisted-channel demand over time.

Evaluations should move beyond aggregate revenue. Useful indicators include completion rates, abandonment points, error frequency, time to resolution, assisted service demand, and outcome gaps across literacy levels. Digital enforcement can improve compliance, but it can also intensify surveillance or exclusion when system power is not matched by procedural fairness ([Closs-Davies, Bartels, & Merkl-Davies, 2024](#); [Qu, & Jing, 2025](#); [Zhao, & Wang, 2025](#)). Therefore, human-centered administration requires both technical efficiency and safeguards for taxpayers who struggle with the interface. Because the trust dimension of the slippery slope framework predicts that perceived fairness and transparency independently sustain voluntary compliance ([Kogler, Olsen, Bogaers, Böhm, Chow, Gangl, Kasper, Kirchler, Möllerström, Petrovic, Roland-Levy, Sardzoska, Shabbir, & Torgler, 2022](#); [Tahar, & Bandi, 2024](#)). Communication about how automated checks and data-matching are used should be as much a part of the digitalization strategy as the interface itself, particularly for taxpayers who cannot verify the system's behavior on their own.

5. CONCLUSIONS

5.1 Conclusion

Among 201 users of electronic local tax administration in Malang, perceived service digitalization and digital literacy were positively associated with taxpayer compliance. Their interaction was negative, rejecting the proposed strengthening hypothesis. The most defensible interpretation is that literacy promotes compliance while reducing dependence on marginal differences in system quality. This interpretation draws support from two complementary strands of literature: the digital divide argument that skill differences matter most when a system is imperfect, and the slippery slope account that trust in the tax authority can be built either through direct, literacy-enabled verification or through a system's surface-level usability. Digital reform should therefore pair universal usability with targeted assistance. The study offers a useful behavioral signal, but its associational design and sampling documentation do not justify causal or population-wide claims.

5.2 Research Limitations

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design limits the ability to establish causal relationships between digital tax service digitalization, digital literacy, and taxpayer compliance. Second, all variables were measured using self-reported questionnaire responses, which may introduce common method bias and social desirability bias. Third, the recruitment process was based on eligibility-based field recruitment rather than a documented probability sampling procedure, limiting the generalizability of the findings beyond taxpayers using electronic local tax services in Malang. Furthermore, the digital literacy construct primarily captures operational and procedural skills rather than broader strategic digital capabilities. The study also does not directly examine trust in tax authorities or perceived administrative power, which may provide further explanation regarding the mechanism linking digitalization, literacy, and compliance behavior.

5.3 Suggestions and Directions for Future Research

Future research is encouraged to use longitudinal designs and administrative compliance records to provide stronger evidence regarding the causal relationship between digital tax services and taxpayer compliance. Researchers may also apply probability-based sampling techniques and include taxpayers from different regions to improve the external validity of the findings. In addition, future studies should incorporate broader digital literacy dimensions, including strategic digital skills, and examine mediating factors such as taxpayer trust, perceived fairness, and perceived administrative power. Further comparative studies across municipalities and taxpayer categories, such as individual and business taxpayers, are also recommended to identify whether the substitution effect of digital literacy remains consistent under different digital service environments.

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AUTHOR CONTRIBUTIONS

SA contributed to the conceptualization, methodology, investigation, data collection, formal analysis, and preparation of the manuscript. DMP contributed to the research methodology, supervision, interpretation of the findings, and critical revisions of the manuscript. M contributed to the validation of the analysis, interpretation of the findings, and critical review of the manuscript. IPL contributed to the literature review, academic refinement, and the critical revision of the manuscript. All authors reviewed and approved the final version of the manuscript and agreed to be accountable for its accuracy and integrity.

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