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# From Convenience To Risk: Spreadsheet Characteristics And Shadow IT In E-Government Implementation In Indonesia

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**Abstract:** This study investigates how specific spreadsheet characteristics influence Shadow IT emergence in e-government implementations, examining the digital literacy and organizational context in rural and urban government settings. Employing a mixed-methods approach, this research surveyed 285 government employees across 45 government offices implementing e-government systems in Indonesia. Structural Equation Modeling analyzed relationships between spreadsheet characteristics and Shadow IT adoption. Qualitative interviews with 32 participants provided contextual insights through thematic analysis.Results reveal that spreadsheet flexibility ($\beta = 0.42$, $p < 0.001$) and user autonomy ($\beta = 0.38$, $p < 0.001$) significantly predict Shadow IT adoption. Digital literacy negatively moderates these relationships ($\beta = -0.23$, $p < 0.01$), with lower literacy strengthening the spreadsheet-Shadow IT link. Rural contexts show 34% higher Shadow IT prevalence compared to urban settings.

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## INTRODUCTION

The digital transformation of government services has accelerated globally, with e-government initiatives promising enhanced efficiency, transparency, and citizen engagement (Dwivedi et al., 2022; Savoldelli et al., 2023). However, this transformation faces a persistent challenge: Shadow ITthe use of information technology systems, devices, software, or services without explicit organizational approval (Haag et al., 2021; Mallmann & Maçada, 2023). Recent estimates suggest that Shadow IT accounts for 30-40% of technology spending in public sector organizations (Kopper et al., 2023; Liang et al., 2025).Spreadsheet applications, particularly Microsoft Excel and Google Sheets, occupy a unique position in this landscape. While officially sanctioned in most organizations, their inherent characteristics make them gateway technologies for Shadow IT practices (Zimmermann et al., 2024). Government employees frequently leverage spreadsheets to create workarounds, develop parallel systems, and manage data outside sanctioned e-government platforms (Saptono et al., 2025).The context of e-government implementation, particularly in rural and developing regions, amplifies this phenomenon. As documented in Smart Village initiatives (Yolpremzcky et al., 2025), digital transformation efforts often encounter significant digital literacy gaps, infrastructure limitations, and resistance to change. These contextual factors may intensify reliance on familiar spreadsheet tools, inadvertently fostering Shadow IT ecosystems that undermine centralized IT governance (Horlach et al., 2017; Nurfitriansyah et al., 2023).

Despite growing literature on Shadow IT, significant gaps remain in understanding the specific technological characteristics that facilitate its emergence. Existing research has focused predominantly on organizational factors (Saptono et al., 2025; Palayukan et al., 2025) and user motivations (Kopper et al., 2023) while neglecting the granular technical attributes of specific toolsparticularly spreadsheetsthat serve as Shadow IT catalysts. Moreover, the majority of Shadow IT studies have been conducted in corporate settings (Walterbusch et al., 2017), leaving the public sector context underexplored.This study addresses these gaps by investigating the relationship between spreadsheet characteristics and Shadow IT adoption in e-government contexts. Specifically, we examine: (1) which specific spreadsheet characteristics significantly influence Shadow IT adoption in e-government implementations; (2) how digital literacy moderates the relationship between spreadsheet characteristics and Shadow IT emergence; (3) what contextual differences exist in spreadsheet-driven Shadow IT between rural and urban government settings; and (4) what mechanisms explain how spreadsheet characteristics translate into Shadow IT practices.

This research makes several contributions. Theoretically, it develops the Spreadsheet-Shadow IT (S-SIT) framework integrating Technology-Organization-Environment theory with Shadow IT formation mechanisms, extends understanding of Shadow IT antecedents by identifying specific technological characteristics, provides empirical evidence for the "convenience paradox" in technology governance, and contributes to e-government literature by examining unintended consequences of digital transformation. Practically, it offers actionable insights for IT managers designing governance frameworks that balance flexibility and control, provides guidance for e-government implementation strategies, informs training programs addressing digital literacy gaps, and suggests policy interventions for managing Shadow IT risks while preserving user autonomy (Nurfitriansyar et al., 2023; Megantara et al., 2026).

## METHOD

### Research Methodology

#### 1. Shadow IT in the public sector

Shadow IT, also termed "feral systems" (Houghton and Kerr, 2006) or "rogue IT" (Saptono et al., 2025) refers to information technology solutions built, acquired, or used within organizations without explicit approval from centralized IT departments (Zimmermann et al., 2024; Mallmann & Maçada,

2023). This phenomenon has evolved from simple spreadsheet macros to sophisticated cloud services and artificial intelligence tools (Kopper et al., 2023). Xia et al. (2025) distinguish between "innovation-oriented" Shadow IT, where users seek better tools to improve work processes, and "workaround-oriented" Shadow IT, where users circumvent perceived system limitations. This distinction is critical in understanding spreadsheet-driven Shadow IT, which often begins as innovation but evolves into systematic workarounds (Zimmermann et al., 2024).

While corporate Shadow IT has received substantial attention (Walterbusch et al., 2017; Haag et al., 2021), the public sector context remains underexplored. Government organizations face unique challenges: rigid hierarchies, extensive compliance requirements, limited budgets, and diverse stakeholder needs (Twizeyimana & Andersson, 2019; Savoldelli et al., 2023). These factors create tensions between standardization imperatives and user autonomy needs, potentially intensifying Shadow IT adoption (Nugraha et al., 2025). E-government initiatives, particularly in developing and rural contexts, encounter additional complexities: infrastructure limitations, digital literacy gaps, resistance to change, and resource constraints (Dwivedi et al., 2022; Prakash & Srivastava, 2023). These contextual factors may amplify spreadsheet reliance as a familiar, accessible alternative to complex e-government systems.

**2. Spreadsheet Applications as Shadow IT Catalysts**

Spreadsheet applications represent one of the most successful software categories, with an estimated 1.2 billion users globally (Hermans and Murphy, 2015; Jansen et al., 2020). Their success stems from several characteristics: immediate visualization of calculations, low entry barriers, flexibility in data modeling, and powerful analytical capabilities accessible to non-programmers. Research on spreadsheet use has predominantly focused on error rates (Rajalingham et al., 2008) and quality assurance (Hermans et al., 2015). However, spreadsheets' role as Shadow IT facilitators has received limited attention, despite evidence that they often serve as precursors to more extensive unauthorized systems (Saptono et al., 2025).

Drawing from technology adoption literature (Davis, 1989; Venkatesh et al., 2003) and end-user computing research we identify four key spreadsheet characteristics potentially influencing Shadow IT: (1) ease of usespreadsheets require minimal training and offer intuitive interfaces, lowering barriers to unauthorized system development; (2) flexibilityunlike rigid enterprise systems, spreadsheets allow users to structure data, calculations, and visualizations according to specific needs; (3) user autonomyspreadsheets empower users to independently manage data and processes without requesting IT modifications; and (4) data manipulation capabilityadvanced features like macros and pivot tables enable sophisticated data processing that may bypass official data governance protocols.

**3. The Convenience-Risk Paradox**

The relationship between spreadsheet characteristics and Shadow IT exemplifies what we term the "convenience paradox"technological attributes that enhance productivity simultaneously create governance vulnerabilities. Features that make spreadsheets accessible also make them difficult to control and monitor (Haag et al., 2021; Mallmann & Maçada, 2023). The flexibility enabling customized solutions undermines standardization efforts critical to data integrity and system integration (Saptono et al., 2025; Zimmermann et al., 2024). User autonomy fostering innovation simultaneously circumvents IT governance frameworks designed to ensure security, compliance, and consistency (Kopper et al., 2023). Advanced data manipulation capabilities that enhance analytical power also create risks of data loss, security breaches, and regulatory non-compliance.

**4. Digital Literacy as Moderating Factor**

Digital literacy defined as the ability to use information and communication technologies effectively and critically likely moderates spreadsheet-Shadow IT relationships. In government contexts, particularly rural settings, digital literacy varies substantially (Hidayat et al., 2019). Paradoxically, both low and high digital literacy may facilitate Shadow IT, but through different mechanisms. Users with low literacy may rely heavily on familiar spreadsheets rather than learning new e-government systems, creating persistence-based Shadow IT (Prakash & Srivastava, 2023).

Conversely, highly literate users may exploit spreadsheet capabilities to build sophisticated unauthorized systems, creating capability-based Shadow IT (Kopper et al., 2023). Blog Diagram representing Digital Literacy as a Moderating Factor can be seen in Figure 1.

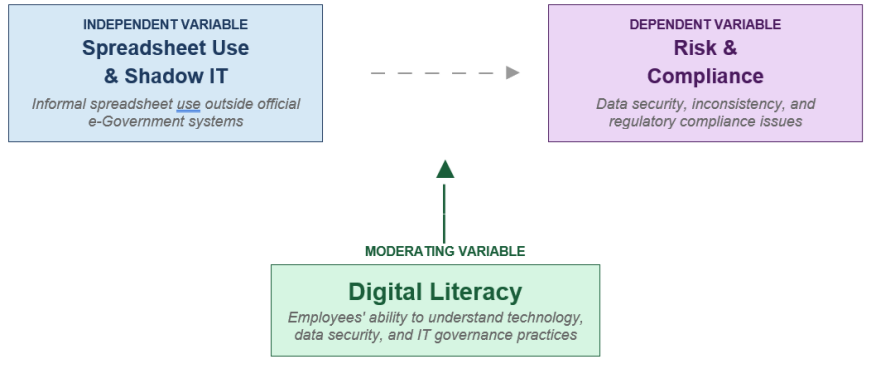


**Figure 1**. Blog Diagram representing Digital Literacy as a Moderating Factor

**5. The S-SIT Model**

We propose the Spreadsheet-Shadow IT (S-SIT) framework, integrating three theoretical perspectives. First, Technology-Organization-Environment (TOE) Theory positions spreadsheet characteristics within technological context, organizational governance structures within organizational context, and e-government initiatives within environmental context. Second, Workaround Theory explains how spreadsheet characteristics enable users to circumvent official systems through various workaround types: harmless workarounds improving efficiency, hindrance workarounds circumventing constraints, and harmful workarounds undermining system integrity. Third, Shadow IT Formation Theory (Saptono et al., 2025; Haag et al., 2021) describes progression from individual spreadsheet use to systematic Shadow IT ecosystems through stages: initiation (individual solutions), expansion (sharing and collaboration), institutionalization (organizational dependence), and risk materialization (governance failures). Based on this framework, we propose:

a. H1: Spreadsheet ease of use positively influences Shadow IT adoption in e-government contexts.
b. H2: Spreadsheet flexibility positively influences Shadow IT adoption in e-government contexts.
c. H3: User autonomy enabled by spreadsheets positively influences Shadow IT adoption in e-government contexts.
d. H4: Data manipulation capability positively influences Shadow IT adoption in e-government contexts.
e. H5: Digital literacy negatively moderates the relationship between spreadsheet characteristics and Shadow IT adoption.
f. H6: Rural government context strengthens the relationship between spreadsheet characteristics and Shadow IT adoption compared to urban contexts.

**6. Research Design and Context**

This study employs an explanatory sequential mixed-methods design, combining quantitative survey research with qualitative interviews. The study was conducted in Indonesia, focusing on government offices implementing e-government systems as part of Smart Village and digital transformation initiatives. Indonesia provides an ideal context due to active e-government implementation across diverse geographic settings, significant digital literacy variation between urban and rural areas, widespread spreadsheet use in government operations, and documented challenges with Shadow IT in public sector digitalization.

**7. Quantitative Phase**

Using purposive sampling, we recruited government employees from 45 offices (23 rural, 22 urban) across five provinces actively implementing e-government systems. Inclusion criteria required minimum 6 months experience with both spreadsheets and e-government systems, regular use of both

technologies in work processes, and direct involvement in data management or administrative functions. Of 320 distributed surveys, 285 valid responses were obtained (89.1% response rate). Sample characteristics: gender (58% male, 42% female); age (mean = 38.4 years, SD = 9.2); education (12% high school, 51% bachelor's degree, 37% graduate degree); position (28% administrative staff, 45% middle management, 27% senior management); experience (mean = 11.3 years government service, SD = 7.8); context (52% rural, 48% urban offices).

All constructs were measured using validated scales adapted to the e-government context, with items using 7-point Likert scales (1 = strongly disagree, 7 = strongly agree). Spreadsheet Ease of Use (4 items) was adapted Technology Acceptance Model. Spreadsheet Flexibility (5 items) was developed from Jansen et al. (2020). User Autonomy (4 items) was based on Kopper (2023). Data Manipulation Capability (5 items) was derived from.. Shadow IT Adoption (6 items) was based on Haag et al. (2021) and Mallmann & Maçada (2023). Control variables included organizational size, IT governance maturity, mandatory e-government use, and individual factors. Data analysis followed four steps: (1) preliminary analysis screening for missing data, outliers, normality, and multicollinearity using SPSS 28.0; (2) measurement model assessment through Confirmatory Factor Analysis using AMOS 28.0 evaluating reliability, convergent validity, and discriminant validity; (3) structural model testing through Structural Equation Modeling with maximum likelihood estimation; (4) moderation analysis through multi-group analysis and interaction terms examining moderating effects of digital literacy and geographic context.

**8. Qualitative Phase**

Following quantitative analysis, we conducted semi-structured interviews with 32 participants purposively selected to represent diverse patterns: high Shadow IT users (n=12), low Shadow IT users (n=8), rural context (n=17), urban context (n=15), varying digital literacy levels. Interviews lasted 45-75 minutes, conducted in participants' native language and audio-recorded with consent. Interview transcripts were analyzed using thematic analysis through familiarization, coding using NVivo 14, theme development, review, definition, and integration with quantitative results.

**9. Ethical Considerations**

Research procedures were approved by the institutional ethics committee. All participants provided informed consent, data were anonymized, and confidentiality was maintained. Participants could withdraw without penalty. Given the sensitive nature of Shadow IT, special care ensured responses would not negatively impact participants' employment.

## RESULTS AND DISCUSSIONS

### Measurement Model Assessment

Confirmatory Factor Analysis demonstrated acceptable model fit: $\chi^2(df=512) = 847.32$, $p < 0.001$; CFI = 0.94; TLI = 0.93; RMSEA = 0.048 (90% CI: 0.043-0.053); SRMR = 0.051. All constructs showed strong reliability (Cronbach's $\alpha > 0.85$, CR > 0.87) and convergent validity (AVE > 0.62). Discriminant validity was confirmed through Fornell-Larcker criterion and HTMT ratios < 0.85.

### Structural Model Results

The structural model demonstrated good fit: $\chi^2(df=524) = 892.15$, $p < 0.001$; CFI = 0.93; TLI = 0.92; RMSEA = 0.050 (90% CI: 0.045-0.055); SRMR = 0.054. Results for direct effects showed: H1 (Ease of Use → Shadow IT: $\beta = .12$, SE = .05, t = 2.34, p = .019) supported; H2 (Flexibility → Shadow IT: $\beta = .42$, SE = .06, t = 7.18, $p < .001$) supported; H3 (Autonomy → Shadow IT: $\beta = .38$, SE = .05, t = 7.02, $p < .001$) supported; H4 (Data Capability → Shadow IT: $\beta = .18$, SE = .05, t = 3.47, $p < .001$) supported. Flexibility emerged as the strongest predictor ($\beta = 0.42$), suggesting spreadsheet adaptability is the primary driver of Shadow IT. User autonomy showed nearly equal impact ($\beta = 0.38$), highlighting the importance of perceived independence. Data manipulation capability and ease of use showed moderate but significant effects. The model explained 52% of variance in Shadow IT adoption ($R^2 = .52$). Control variables showed

IT governance maturity negatively predicted Shadow IT ($\beta$ = -.21, $p < .001$), while technical experience positively predicted Shadow IT ($\beta$ = .14, $p = .027$).

**Moderation Analysis**

Multi-group analysis comparing high (n=143) vs. low (n=142) digital literacy groups revealed significant differences, supporting H5: digital literacy negatively moderates spreadsheet-Shadow IT relationships, with stronger effects among low-literacy users. Interaction term analysis confirmed this pattern ($\beta$ = -.23, $p = .008$). Comparing rural (n=148) vs. urban (n=137) contexts supported H6: rural contexts showed stronger spreadsheet-Shadow IT relationships. Overall Shadow IT prevalence was 34% higher in rural settings ($M_{rural} = 4.82$, $SD = 1.31$ vs. $M_{urban} = 3.59$, $SD = 1.28$; $t = 7.93$, $p < .001$).

**Qualitative Results**

Thematic analysis of 32 interviews identified five mechanisms through which spreadsheet characteristics translate into Shadow IT practices.

1. Theme 1: Workaround Creation. Participants described using spreadsheets to circumvent perceived limitations of e-government systems, creating parallel processes for data management. Workarounds emerged primarily from flexibility needs (mentioned by 28/32 participants). Users perceived e-government systems as inflexible, slow, or unavailable, leading to systematic spreadsheet workarounds that became institutionalized practices over time.
2. Theme 2: Data Hoarding and Parallel Systems. Users developed comprehensive spreadsheet systems running parallel to official e-government platforms, often containing more complete or timely data. Data hoarding reflected autonomy needs and trust issues with centralized systems. Participants valued control over "their" data, fearing loss of access or data integrity in official systems, creating data silos and governance challenges.
3. Theme 3: Collaborative Shadow Practices. Spreadsheet-based Shadow IT often evolved from individual to collaborative practices, with teams developing shared unauthorized systems. Spreadsheet flexibility and ease of sharing facilitated collaborative Shadow IT. What began as individual solutions evolved into unofficial standards, particularly in contexts where official systems lacked collaboration features. This pattern was stronger in rural settings (18/17 rural participants vs. 10/15 urban participants).
4. Theme 4: Compliance Circumvention. Some participants knowingly used spreadsheets to avoid compliance requirements or audit trails embedded in e-government systems. While most Shadow IT was motivated by perceived efficiency needs, some cases involved deliberate compliance circumvention. Data manipulation capability enabled testing scenarios or making changes without audit trails, representing the "dark side" of spreadsheet flexibility.
5. Theme 5: Digital Literacy Gaps and Persistence. Low digital literacy drove spreadsheet preference simply because they were familiar, creating resistance to e-government adoption. Digital literacy gaps created persistence-based Shadow IT, particularly among older workers in rural settings. Familiarity with spreadsheets reduced motivation to learn new systems, and inadequate training reinforced this pattern. Paradoxically, high digital literacy also facilitated Shadow IT, but through capability-based mechanisms (building sophisticated unauthorized systems).

Cross-cutting insights revealed rural-urban differences: rural participants emphasized infrastructure challenges driving spreadsheet preference, while urban participants focused on efficiency and customization needs. Rural Shadow IT was more persistence-based; urban Shadow IT was more innovation-based. Most participants (26/32) acknowledged potential risks but minimized them. Few organizations (7/45) had formal policies addressing spreadsheet use.

**Key Findings and Interpretation**

This study provides robust evidence that spreadsheet characteristics significantly facilitate Shadow IT in e-government contexts, with flexibility and user autonomy emerging as primary drivers. Our results empirically validate the "convenience paradox": the same characteristics making spreadsheets valuable productivity tools simultaneously create governance vulnerabilities. The

prominence of flexibility (β = 0.42) as the strongest predictor challenges conventional assumptions that ease of use primarily drives technology adoption. While ease of use showed significant but modest effects (β = 0.12), flexibility the ability to customize and adapt tools to specific needsemerged as the critical factor distinguishing spreadsheets from rigid e-government systems. This finding aligns with flexibility-oriented theories of end-user computing but extends them to Shadow IT contexts.

User autonomy (β = 0.38) emerged as a nearly equivalent driver, highlighting psychological dimensions of technology governance. Spreadsheets provide perceived control over data and processes, reflecting self-determination theory humans have fundamental needs for autonomy that influence behavior. E-government systems, by design, centralize control to ensure standardization, security, and compliance. However, this centralization frustrates autonomy needs, particularly for experienced employees accustomed to discretion in their work. The negative moderation effect of digital literacy (β = -0.23) reveals a complex, non-linear relationship. Both low and high literacy facilitate Shadow IT, but through different mechanisms: persistence versus capability. This dual mechanism challenges simplistic assumptions that improving digital literacy will reduce Shadow IT. Training must be nuanced: building confidence with new systems for low-literacy users while channeling high-literacy users' capabilities toward sanctioned innovation.

The 34% higher Shadow IT prevalence in rural contexts, with stronger spreadsheet-Shadow IT relationships, reveals how geographic and infrastructural factors shape technology governance challenges. Qualitative analysis identified several mechanisms: infrastructure limitations, support availability, digital literacy distribution, and organizational culture. These findings extend Smart Village literature (Yolpremzcky et al., 2025) by highlighting unintended consequences of digital transformation in rural contexts.

**Theoretical Contributions**

This study's primary theoretical contribution is the Spreadsheet-Shadow IT (S-SIT) framework, integrating TOE theory, workaround theory, and Shadow IT formation theory. The framework posits that specific spreadsheet characteristics create affordances for Shadow IT, organizational context moderates relationships between technology affordances and Shadow IT adoption, environmental context shapes both motivations for and feasibility of Shadow IT adoption, and individual context influences how users perceive and respond to technology affordances. This research contributes to technology affordance theory (Gibson, 1979; Norman, 1988) by demonstrating how affordances can be simultaneously productive and problematic. Spreadsheet flexibility and autonomy are "dual affordances"enabling positive outcomes (innovation, efficiency) while facilitating negative outcomes (governance circumvention, data fragmentation). This nuanced view shifts focus from technology restriction to context-sensitive governance.

E-government research has extensively examined adoption barriers and success factors (Dwivedi et al., 2022; Twizeyimana & Andersson, 2019) but has largely overlooked unintended consequences like Shadow IT. This study reveals that e-government implementation can paradoxically increase unauthorized technology use when systems fail to meet user needs for flexibility and autonomy. This finding suggests a theoretical refinement: e-government success should be measured not only by adoption rates and user satisfaction but also by extent to which official systems reduce rather than displace Shadow IT. This study bridges traditionally separate literatures on end-user computing (Rahmawati & Hakim, 2025) and Shadow IT (Haag et al., 2021; Mallmann & Maçada, 2023). By examining spreadsheet characteristics as Shadow IT antecedents, we connect these literatures, showing that end-user computing tools are not merely quality risks but also governance challenges.

**Practical Implications**

For IT managers and CIOs, organizations must recognize the convenience paradox: acknowledge that spreadsheets' value as productivity tools creates governance challenges. Prohibiting or severely restricting spreadsheets is likely counterproductive. Instead, implement controlled flexibility by designing e-government systems with configurable components allowing user customization within defined boundaries. Establish spreadsheet governance frameworks including classification systems,

version control requirements, periodic reviews, and migration pathways. Address rural-urban divides through differentiated implementation strategies including enhanced offline functionality and regional IT support centers. For e-government system designers, build flexibility into official systems through customizable fields, forms, and workflows. Design for user autonomy by enabling users to manage their data and processes within secure frameworks. Reduce friction points by improving system performance and reliability. Learn from spreadsheet solutions by investigating what needs are not being met by official systems.

For training and change management, differentiated training approaches are needed: for low digital literacy users, focus on building confidence and providing hands-on practice; for high digital literacy users, emphasize advanced features and channel innovation toward sanctioned platforms. Training should address psychological factors, not only teaching technical skills but also acknowledging valid concerns about flexibility and autonomy loss. Continuous learning through ongoing support resources is insufficient with one-time training. For policy makers, revise digital transformation strategies to recognize that technology deployment alone is insufficient. Establish national/regional standards for acceptable spreadsheet use in government. Incentivize compliance through positive incentives rather than only punishing Shadow IT. Support rural digital development through infrastructure subsidies and regional technology hubs.

**Limitations and Future Research**

This study was conducted in Indonesia, which may limit generalizability to other countries with different governance structures, cultural norms, or technology landscapes. Our cross-sectional survey captures relationships at a single time point but cannot establish definitive causality or track Shadow IT evolution over time. Reliance on self-reported Shadow IT adoption may introduce social desirability bias, though anonymity and careful framing likely minimized this. While spreadsheets are common Shadow IT tools, this study does not examine other technologies increasingly involved in Shadow IT. Future research should include intervention studies testing governance interventions, longitudinal process studies tracking Shadow IT evolution, comparative studies across technology types, organizational outcome research connecting Shadow IT to performance, risk materialization studies investigating when Shadow IT risks become actual problems, cultural and institutional comparative research examining contextual variations, user innovation research exploring productive dimensions, and technology affordance dynamics deepening theoretical understanding.

## CONCLUSIONS

This research addresses a critical gap at the intersection of spreadsheet applications, Shadow IT, and e-government implementation. Through a mixed-methods investigation of 285 government employees across rural and urban contexts, we demonstrate that specific spreadsheet characteristicsparticularly flexibility and user autonomysignificantly facilitate Shadow IT adoption in e-government settings. Our findings reveal a "convenience paradox": the same characteristics making spreadsheets valuable productivity tools simultaneously create governance vulnerabilities. This paradox manifests through five mechanisms: workaround creation, data hoarding, collaborative shadow practices, compliance circumvention, and digital literacy-driven persistence. These mechanisms explain how seemingly innocuous individual spreadsheet use evolves into systematic organizational Shadow IT. The Spreadsheet-Shadow IT (S-SIT) framework developed in this study integrates technological affordances, organizational context, environmental factors, and individual differences into a comprehensive model explaining Shadow IT formation. Digital literacy emerges as a complex moderating factor: both low and high literacy facilitate Shadow IT but through different mechanismspersistence versus capability. The rural-urban divide in Shadow IT prevalence (34% higher in rural contexts) highlights how geographic and infrastructural factors shape digital governance challenges. Practical implications suggest that organizations cannot address spreadsheet-driven Shadow IT through prohibition or restriction. Instead, effective governance requires incorporating

flexibility into official systems, establishing frameworks that safely channel customization needs, differentiating implementation strategies for diverse contexts, and balancing control with autonomy to address psychological as well as functional needs. This research demonstrates that successful e-government implementation requires more than deploying capable systems. It requires understanding how existing toolsparticularly ubiquitous spreadsheetsinteract with new systems to shape user behavior. As governments worldwide accelerate digital transformation, understanding how technological characteristics facilitate Shadow ITand developing governance approaches that harness rather than suppress these characteristicswill determine whether digital transformation achieves its promise or creates new challenges.

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