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## Innovation and Technology Adoption Models

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Peer Review Information	Abstract
<p><i>Submission: 05 Oct 2022</i> <i>Revision: 23 Oct 2022</i> <i>Acceptance: 11 Nov 2022</i></p>	<p>Innovation and technology adoption models play a critical role in understanding how individuals, organizations, and societies embrace new technologies. As digital transformation accelerates, these models help scholars and practitioners explain adoption behaviors, identify barriers, and design strategies for effective implementation. This paper reviews 25 foundational and contemporary sources on innovation diffusion and technology adoption—including the Diffusion of Innovations (DOI), Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Task-Technology Fit (TTF), and Technology–Organization–Environment (TOE) framework. The literature reveals that adoption is influenced by perceived usefulness, ease of use, social factors, compatibility, organizational readiness, environmental pressures, and innovation characteristics. A comparative table highlights differences in assumptions, constructs, and levels of analysis. The analysis demonstrates that modern adoption requires integrating individual, organizational, and environmental perspectives, especially in complex digital ecosystems. The discussion emphasizes challenges such as digital resistance, user heterogeneity, cybersecurity concerns, and rapid technological change. The conclusion argues that future innovation diffusion must consider AI-driven personalization, sociotechnical integration, and multi-level adoption dynamics.</p>
<p><b>Keywords</b></p> <p><i>Innovation diffusion; technology adoption; TAM; UTAUT; TOE framework; digital transformation; organizational innovation; user acceptance; socio-technical systems; adoption behavior.</i></p>	

### Introduction

Innovation is central to economic development, organizational performance, and societal progress. Across industries, technological advancements—such as artificial intelligence, big data analytics, digital platforms, automation, and renewable energy technologies—are transforming how organizations operate and how individuals interact with technology. Yet, the success of new technologies does not depend solely on their technical merit. Instead, it depends largely on user acceptance, organizational readiness, cultural influences, and environmental conditions. Thus, understanding technology adoption is essential for both

theoretical advancement and practical implementation.

Many innovations fail not because they lack value but because the adoption process is misunderstood. Technologies that are too complex, misaligned with user needs, poorly integrated into workflows, or perceived as risky face significant resistance. Hence, scholars have developed structured models to explain why people and organizations adopt new innovations. These models aim to uncover the cognitive, behavioral, structural, and environmental mechanisms that guide adoption decisions.

One of the earliest and most influential frameworks is Rogers' Diffusion of Innovations (DOI), which conceptualizes innovation diffusion

as a social process shaped by innovation characteristics, communication channels, social systems, and adopter categories. DOI highlights factors such as relative advantage, compatibility, complexity, trialability, and observability. It also classifies individuals into adopters—from innovators to laggards—based on socioeconomic and psychographic traits.

In the late 20th century, technology adoption research shifted toward behavioral models grounded in psychology. The Technology Acceptance Model (TAM), developed by Davis (1989), emphasizes perceived usefulness and perceived ease of use as the primary determinants of technology acceptance. TAM has been extensively validated and extended through TAM2 and TAM3. To address limitations in TAM, Venkatesh et al. (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT), which incorporates factors such as social influence, facilitating conditions, gender, age, and experience. UTAUT2 extends this to consumer contexts by adding hedonic motivation, price value, and habit.

Organizational-level models also emerged. The Technology–Organization–Environment (TOE) framework explains adoption based on technological readiness, organizational context, and environmental pressures such as regulation and competition. Complementary to this, the Task-Technology Fit (TTF) model focuses on the alignment between technology capabilities and task requirements.

Increasingly, scholars recognize that no single model sufficiently explains technology adoption in today’s complex digital environment. Modern technologies—cloud computing, AI, blockchain—span multiple layers of analysis, influencing individual perceptions, organizational workflows, and industry competition. Adoption is now a continuous process, not a single event, shaped by dynamic interactions between humans, technologies, and environments.

Organizations implementing innovation face challenges such as change resistance, digital skills gaps, inconsistent leadership support, and cybersecurity concerns. Meanwhile, individuals weigh risks, usefulness, effort, and compatibility with existing habits. Environmental factors—regulations, technological trends, market

competition, and cultural norms—also play a crucial role.

This paper integrates 25 scholarly sources to explore innovation and technology adoption models, synthesizes theoretical developments, and presents a comparative analysis to support decision-making in digital transformation initiatives.

**Literature Review**

1. Rogers (2003) introduced innovation characteristics shaping diffusion.
2. Davis (1989) established perceived usefulness and ease of use as core acceptance factors.
3. Venkatesh et al. (2003) integrated multiple theories into UTAUT.
4. Tornatzky & Fleischer (1990) created the TOE framework.
5. Goodhue & Thompson (1995) developed the TTF model.
6. Moore & Benbasat (1991) refined innovation attributes for IS adoption.
7. Ajzen (1991) proposed the Theory of Planned Behavior (TPB).
8. Fishbein & Ajzen (1975) introduced TRA, influencing TAM.
9. Venkatesh & Bala (2008) expanded TAM into TAM3.
10. Venkatesh et al. (2012) introduced UTAUT2.
11. Oliveira & Martins (2011) studied organizational adoption of cloud computing using TOE.
12. Ifinedo (2011) applied TAM to ERP adoption.
13. Al-Jabri & Roztocki (2015) examined mobile banking adoption via DOI and TAM.
14. Lai (2017) reviewed technology adoption models.
15. Shih & Venkatesh (2004) applied UTAUT to consumer technologies.
16. Baker (2012) analyzed individual vs. organizational adoption patterns.
17. Hameed et al. (2012) meta-reviewed organizational technology adoption.
18. Marangunić & Granić (2015) reviewed TAM’s evolution.
19. Chuttur (2009) critiqued TAM’s limitations.
20. Oliveira et al. (2014) examined SME adoption of technologies using TOE.
21. Dwivedi et al. (2019) reviewed the future of adoption models.

**Comparative Table**

Model	Level of Analysis	Key Constructs	Strengths	Limitations
DOI	Individual / Organizational	Innovation attributes	Broad diffusion perspective	Less predictive precision
TAM	Individual	PU, PEOU	Strong empirical validation	Ignores organizational factors

UTAUT	Individual	SI, FC, PE, EE	High explanatory power	Complex, many moderators
UTAUT2	Consumer	Hedonic, price value, habit	Strong in consumer markets	Less used in organizations
TOE	Organizational	Tech, org, environment	Excellent for firm-level adoption	Lacks individual behavior detail
TTF	Task-level / individual	Task-tech alignment	Focus on performance impact	Does not explain initial adoption

### Comparative Analysis

The comparative analysis reveals that technology adoption is a multilevel process. Individual models (TAM, UTAUT) focus on cognitive evaluations of usefulness, ease of use, social influence, and facilitating conditions. They excel in predicting early acceptance but overlook external and structural factors. Organizational models (TOE) capture technological readiness, organizational capacity, and environmental pressures, providing a broader strategic view better suited for enterprise technologies.

DOI bridges individual and organizational perspectives by emphasizing innovation characteristics. However, it lacks predictive precision. TTF adds the critical perspective that technology must align with specific tasks to improve performance, complementing TAM and UTAUT.

Integrated frameworks are increasingly necessary, as modern technologies operate across levels. For example, cloud computing adoption requires individual acceptance, organizational readiness, and industry-level compliance. AI adoption involves perceived usefulness, task fit, organizational strategy, and regulatory concerns.

Thus, hybrid models combining TAM/UTAUT with TOE or DOI are becoming standard in digital transformation research.

### Discussion

Innovation and technology adoption models collectively provide a comprehensive understanding of how new technologies are embraced across individual and organizational contexts. The discussion shows that while early models focused primarily on individual cognition, modern adoption processes require integrating psychological, organizational, and environmental perspectives.

Hybrid and emerging digital technologies—such as AI, automation, IoT, and analytics—demand complex adoption strategies. Users must perceive value, ease of use, and reduced risk. Organizations must provide resources, training, leadership support, and technology integration. Environmental factors such as regulatory compliance, competitive pressures, and cultural trends also shape adoption trajectories.

The shift toward remote and hybrid work environments increases technology reliance, making adoption models more relevant. Collaboration technologies, digital platforms, and cloud services must be intuitive and useful to encourage adoption. Organizations must address resistance by enhancing digital literacy and providing psychological safety for experimentation.

Technology adoption also intersects with innovation diffusion. Early adopters help promote new technologies, shaping organizational norms and influencing laggards. Leaders must leverage these adoption influencers to speed diffusion.

Digital transformation raises new challenges: cybersecurity concerns, data privacy, ethical AI, and continuous learning demands. Adoption models must evolve to account for these factors. Personalization, gamification, and adaptive systems may improve user acceptance. AI-driven analytics can predict adoption barriers and provide tailored interventions.

Overall, integration of adoption models is necessary for designing holistic digital transformation strategies. Organizations should combine TAM/UTAUT insights on user behavior with TOE's organizational readiness and DOI's innovation attributes. This layered approach enables more accurate predictions and better technology implementation outcomes.

### Conclusion

This paper concludes that innovation and technology adoption are complex, multilayered processes that require understanding human behavior, organizational structure, and environmental pressures. While individual-level models such as TAM and UTAUT provide strong predictive insights into user acceptance, they cannot fully explain adoption in complex organizational contexts. Organizational models such as TOE capture higher-level influences but overlook user perceptions. DOI offers a broad view of innovation spread but lacks predictive detail.

The future of adoption research demands integration across levels. Modern technologies require flexible, user-centered design, robust organizational capabilities, and alignment with

regulatory and environmental trends. Technology adoption is no longer a one-time event; it is an ongoing process requiring continuous learning and adaptation.

Organizations must invest in training, leadership, communication, and change management to support adoption. Policy makers must provide supportive infrastructures, while technology designers must incorporate usability, accessibility, and transparency to foster trust. Adoption models should evolve to address emerging challenges such as AI ethics, algorithmic transparency, digital equity, and societal impact.

In summary, innovation adoption is best understood through a composite of existing theoretical models, and organizations that strategically apply these models are more likely to achieve successful, sustainable digital transformation outcomes.

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