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Antecedents of Test Automation Adoption in DevOps Continuous Testing: A Systematic Literature Review Through the TOE Framework

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Abstract

Background: The rapid evolution of software engineering has positioned DevOps practices and Continuous Testing (CT) as critical approaches for achieving speed, quality, and reliability in software delivery. Test automation is central to CT, yet its adoption remains inconsistent due to a complex interplay of technological, organizational, and environmental conditions.

Objective: This study employs a systematic literature review guided by the Technology–Organization–Environment (TOE) framework to identify, categorize, and synthesize the antecedents that influence the test automation adoption in DevOps continuous testing.

Methods: Using the PRISMA protocol, 49 peer-reviewed studies published between 2015 and 2025 were systematically analyzed, yielding 61 distinct factors comprising 29 technological, 19 organizational, and 13 environmental antecedents. These factors were further consolidated into thematic clusters to enhance analytical clarity and reduce fragmentation.

Results: The findings demonstrate that technological and organizational drivers, including relative advantage, compatibility, top management support, and employee competence, dominate the literature, while environmental influences such as competitive pressure, regulatory requirements, and vendor ecosystems are comparatively underexplored. This imbalance indicates that although the TOE framework is widely applied in technology adoption studies, empirical research has given greater attention to internal adoption enablers than to external pressures. By simplifying and synthesizing the factors into coherent sub-themes, this study contributes to both theory and practice by offering a structured lens through which test automation adoption can be examined in the DevOps CT context. Theoretically, it validates the relevance of TOE for analysing multidimensional adoption dynamics, while practically, it provides managers with evidence-based insights to prioritize critical factors when planning automation initiatives. Methodologically, it demonstrates the importance of transparent and replicable review processes for advancing cumulative knowledge.

Conclusion: Overall, the study bridges fragmented findings into a coherent framework and strengthens understanding of adoption strategies in continuous testing environments.

Index Terms

Test Automation; DevOps; Continuous Testing; Technology organization environment; TOE Framework; Technology Adoption.

1 INTRODUCTION

The software development industry has undergone a fundamental transformation over the past two decades, driven by increasing demands for speed, scalability, and quality in delivering digital solutions.

Agile and DevOps practices have emerged as dominant methodologies for managing this transformation, enabling organizations to move away from sequential, waterfall models of development toward continuous delivery of value through automation, collaboration, and integration (Wang et al., 2020). Within this paradigm, Continuous Integration (CI) and Continuous Delivery (CD) pipelines have become essential mechanisms for managing frequent code changes and enabling rapid deployment cycles (Gota et al., 2020). A core enabler of these pipelines is Continuous Testing (CT), which provides real-time feedback on software quality by embedding automated testing throughout the lifecycle (Jain, 2023).

Regardless of its critical importance, the adoption of automated testing within CT remains inconsistent across organizations. Although a variety of tools and frameworks, such as Selenium, JUnit, Jenkins, and AI-driven platforms, are available, many organizations still rely heavily on manual or partially automated testing practices (Islam et al., 2023; Lahtinen, 2020). These limitations create bottlenecks that undermine the speed and reliability promised by DevOps practices (Zaib & Lakshmisetty, 2021). Several studies have shown that challenges in automation adoption extend beyond technical concerns, encompassing organizational culture, leadership support, skills availability, and external pressures such as compliance and market competition (Enemosah, 2025; Yarram & Rao Bittla, 2023). This suggests that the adoption of test automation for CT is not a purely technological decision but rather a multidimensional organizational process.

To capture this complexity, this review is guided by the Technology–Organization–Environment (TOE) framework (Dwivedi et al., 2012). The TOE framework has been widely applied in technology adoption research, particularly in understanding how internal and external contexts jointly shape organizational decision-making (Awa et al., 2017). The framework posits that technology adoption is influenced by three broad dimensions: technological factors (e.g., tool compatibility, relative advantage, complexity), organizational factors (e.g., leadership support, competence, cultural readiness), and environmental factors (e.g., competitive pressure, regulatory compliance, stakeholder expectations). Its organizational-level perspective makes TOE especially suitable for analyzing test automation adoption in DevOps, as decisions are often collective and strategic rather than individual.

The current state of research shows that while there is an increasing number of studies on DevOps practices, test automation adoption in the context of CT remains underexplored from a multidimensional theoretical lens. Many existing studies focus narrowly on technological enablers, such as tool performance, reliability, or integration with CI/CD pipelines (Bhanushali, 2023; Madeyski & Kawalerowicz, 2019). Others examine isolated organizational issues such as training gaps or leadership support without systematically linking them to adoption outcomes (Najihi et al., 2022). Environmental influences, such as regulatory compliance or competitive market forces, are often mentioned but rarely analyzed in depth (Jia et al., 2024; Yarram & Rao Bittla, 2023). The result is a fragmented body of evidence where antecedents of adoption are discussed in silos rather than integrated into a holistic framework.

This gap underscores the need for a systematic literature review (SLR). Unlike narrative reviews, which may selectively interpret literature, an SLR employs a transparent, replicable process to identify, evaluate, and synthesize existing studies (Okoli & Schabram, 2012). By applying systematic review protocols such as PRISMA, this study aims to consolidate scattered findings across multiple studies into a structured categorization of antecedents under the TOE framework. The use of an SLR is particularly important because the literature on DevOps and test automation is diverse, spanning technical, managerial, and contextual perspectives. A systematic approach ensures that relevant studies are comprehensively captured and assessed, reducing the risk of bias and enabling the identification of dominant themes and gaps (Kitchenham & Charters, 2007).

The domains where prior research has been concentrated also highlight the rationale for this study. Technological dimensions such as tool reliability, test coverage, and automation performance have been well studied (Mascheroni & Irrazábal, 2018; Ramu, 2023). Organizational dimensions such as skills, training, and leadership support are also recognized, though often addressed through case studies with limited generalizability (Enemosah, 2025; Sai & Poola, 2024). Environmental drivers, however, remain underrepresented in empirical work, despite evidence that competitive dynamics, customer expectations, and compliance standards strongly influence adoption decisions in practice (Alshahrani et al., 2023; Gangwar et al., 2015). The uneven attention across these domains has prevented the development of a comprehensive theoretical understanding of test automation adoption in DevOps CT.

To address these gaps, this study is guided by the following research questions:

1. To identify the factors addressed in existing theoretical and empirical studies within the software industry that explicitly apply the TOE framework, categorize these factors under the three TOE dimensions, and consolidate them into simplified sub-themes for further analysis.
2. How do the identified factors influence the adoption of test automation practices in DevOps continuous testing environments?

These questions serve two purposes: first, to evaluate and consolidate the fragmented body of literature into a coherent framework of antecedents, and second, to critically analyze how these antecedents affect organizational adoption outcomes. By answering these questions, the study contributes to both academic theory and industry practice. Academically, it advances the use of TOE in a DevOps-specific context, offering a structured categorization of factors that can inform future hypothesis-driven research. Practically, it provides evidence-based insights for practitioners and decision-makers, helping them recognize which factors most strongly shape automation adoption and where to direct investments in tools, training, or organizational change.

In summary, the introduction of DevOps and CI/CD pipelines has made CT and test automation indispensable for achieving speed and quality in modern software delivery. However, adoption remains inconsistent due to a complex interplay of technological, organizational, and environmental factors. The TOE framework provides an appropriate theoretical lens for analyzing these factors, while a systematic literature review offers the methodological rigor needed to synthesize and evaluate the existing body of work. This study, therefore, seeks to fill a critical gap by systematically identifying, categorizing, and analyzing the antecedents of test automation adoption in DevOps CT, thereby bridging theory and practice in this rapidly evolving domain.

2 METHODOLOGY

2.1 Research Design

This study employs a SLR to identify and categorize the antecedents influencing the adoption of test automation for CT in DevOps environments. A systematic approach was chosen over a narrative review to ensure rigor, replicability, and transparency in synthesizing evidence across multiple studies (Okoli & Schabram, 2012), following the PRISMA protocol for structured inclusion and exclusion (Moher et al., 2009). The review is guided by the TOE framework (Dwivedi et al., 2012), which provides a holistic view of adoption drivers across technological, organizational, and environmental dimensions (Awa et al., 2017). A multi-stage process was applied, comprising identification, screening, eligibility, inclusion, data extraction, and synthesis. Thematic coding was then used to categorize extracted antecedents and identify recurring patterns. This approach enabled the transformation of fragmented findings into a coherent evidence base, highlighting key determinants and underexplored areas shaping test automation adoption in DevOps CT.

2.2 Search Strategy

The selection process followed PRISMA guidelines, as illustrated in Figure 1 (Page et al., 2021). A systematic search was conducted in Scopus, chosen for its comprehensive coverage of peer-reviewed literature in computer science and software engineering (Mongeon & Paul-Hus, 2016). The query combined keywords for the TOE framework and the software industry:

(TITLE-ABS-KEY (toe OR technology-organization-environment))

AND (software AND industry)

AND (LIMIT-TO (DOCTYPE, "ar"))

AND (LIMIT-TO (EXACTKEYWORD, "TOE"))

The initial search retrieved 65,345 records. Filtering to journal articles reduced this to 51,190, and applying the “TOE” keyword narrowed it further to 9,743. Restricting to “software” and “industry” brought results to 98. A publication date filter (2015–2025) refined this to 85 studies, and final relevance screening (abstract and full-text review) produced 49 studies directly aligned with the review objectives. This staged process ensured comprehensive yet focused coverage of literature at the intersection of TOE, software adoption, and test automation in DevOps contexts.

Test automation has increasingly evolved within DevOps ecosystems, where continuous integration and continuous delivery (CI/CD) pipelines require rapid and reliable testing feedback. Several studies highlight that effective automation adoption depends on how well testing frameworks integrate with DevOps toolchains, deployment processes, and cultural principles of collaboration and continuous improvement (Lwakatare, Kuvaja, & Oivo, 2019). Therefore, this review emphasizes the role of test automation as a critical enabler of continuous testing in DevOps-driven software engineering.

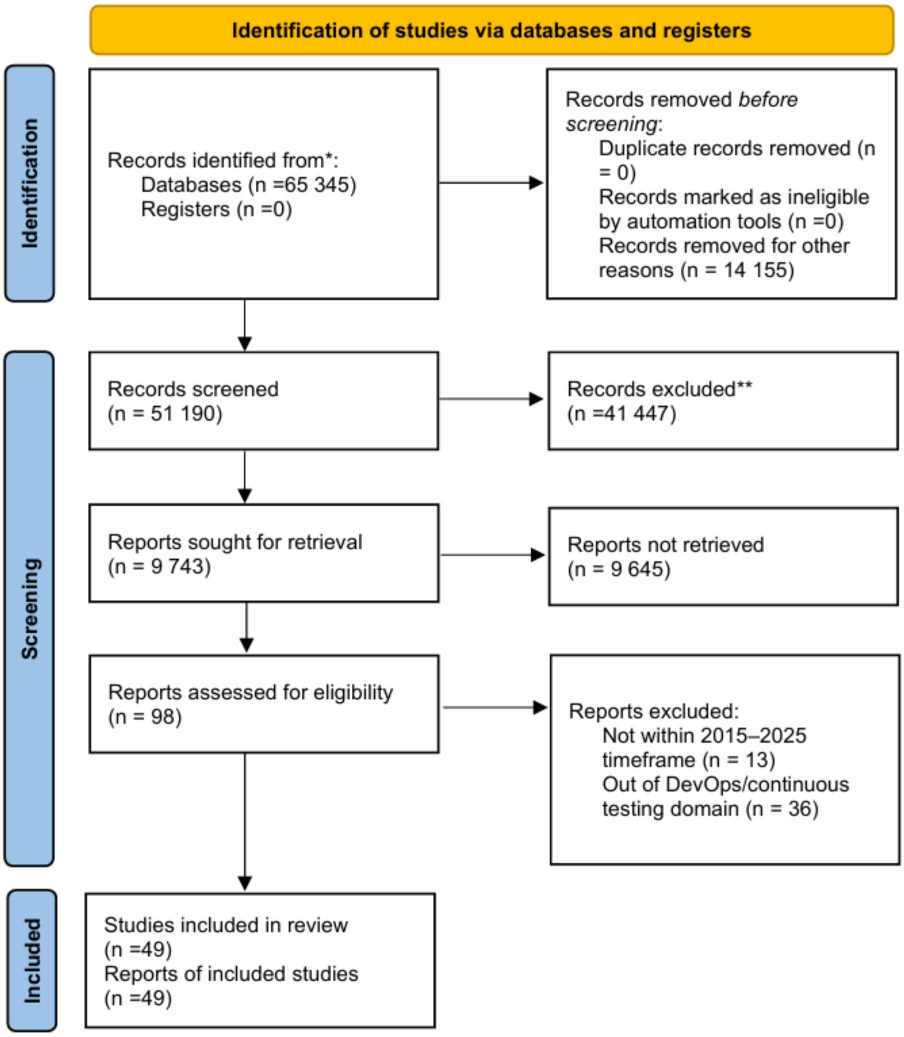

Figure 1. *PRISMA 2020 flow diagram.*

2.3 Study Selection

The literature search was conducted exclusively in the Scopus database, which offers extensive coverage of peer-reviewed journals and conference proceedings across software engineering, information systems, and DevOps research domains. Scopus was chosen because it comprehensively indexes most IEEE Xplore and ACM Digital Library publications, thereby minimizing duplication while ensuring wide disciplinary coverage. Its advanced filtering and citation-tracking capabilities also support transparent and replicable systematic review procedures.

The study selection process was conducted in two phases:

- **Phase 1** – Title and Abstract Screening: Each study's title and abstract were examined for explicit reference to TOE framework constructs in the context of technology adoption in software development or DevOps-related settings. Studies lacking theoretical grounding in TOE or disconnected from the software industry were excluded at this stage.

- **Phase 2** – Full-Text Review: Articles that passed Phase 1 underwent a full-text review to confirm substantial engagement with TOE constructs. Only studies that discussed technological, organizational, or environmental factors influencing adoption decisions in software-related contexts were retained.

Through this process, 49 high-quality, TOE-grounded studies were included for final analysis. This dual-phase selection minimized inclusion of tangential or superficial references, focusing instead on literature offering meaningful theoretical and empirical insights. To ensure relevance to continuous testing practices, studies focusing on test automation within DevOps or CI/CD contexts were prioritized. Papers explicitly addressing DevOps adoption, continuous integration, or continuous delivery in relation to automation were included where available.

2.4 Inclusion and Exclusion Criteria

To ensure methodological rigor, inclusion and exclusion criteria were systematically applied to guide the selection of studies, as summarized in Table 1.

***Table 1**. Article Inclusion and Exclusion Criteria.*

Characteristic	Inclusion Criteria	Exclusion Criteria
Type of Publication	Peer-reviewed journal articles indexed in Scopus	Conference papers, book chapters, or non-peer-reviewed sources
Time period	Published between 2015–2025	Publications before 2015, unless directly cited in retained studies as seminal
Language	English	Non-English publications
Research Focus	Explicit engagement with the TOE framework as a theoretical basis; focus on the software industry or directly relevant organizational technology adoption settings	Studies mentioning TOE only superficially, without using it as a core framework; articles outside the software/IT domain (e.g., agriculture, education)
Content Type	Empirical, conceptual, or theoretical papers that identify adoption factors	Duplicate or overlapping studies already represented in the dataset

2.5 Data Extraction

Following the application of inclusion criteria, data were systematically extracted from the 49 selected studies using a standardized template to ensure consistency. For each study, details such as the title, authorship, year of publication, country or region, research design, methodology, and context related to the software industry or DevOps were recorded. Information on how the TOE framework was applied was also captured to maintain a clear link to the theoretical basis of the review. All the factors discussed under each technological, environmental and organizational factors of each paper were extracted. This structured approach ensured that all relevant information was collected in a uniform manner across the dataset. This study extends the traditional TOE framework by applying it to continuous test automation in DevOps environments, linking each TOE dimension to specific enablers and constraints of automation adoption.

2.6 Data Analysis

The analysis process followed a structured sequence beginning with the systematically extracted dataset of 49 studies. Each study was reviewed to identify adoption antecedents, which were then consolidated into a frequency table to determine the extent to which each factor was addressed across the body of literature. This quantitative step provided an overview of the relative prominence of factors within the research field. Following this, the identified antecedents were separated into the three dimensions of the TOE framework, ensuring clear alignment between the extracted data and the theoretical lens guiding the review.

Given the large number of individual antecedents, 29 technological, 19 organizational, and 13 environmental factors further synthesis was undertaken to enhance analytical clarity. Related factors were logically grouped and summarized into four to five broader categories within each TOE dimension, allowing for comprehensive coverage while avoiding fragmentation. This framework restructuring enabled the representation of the full range of factors in a coherent and manageable form.

Finally, the synthesized categories were analyzed to assess their potential influence on the adoption of test automation in DevOps continuous testing environments. This interpretive stage emphasized the interplay of technological, organizational, and environmental determinants, highlighting how these collective factors shape adoption outcomes.

3 RESULTS

This section presents the findings of the systematic literature review, which included 49 studies selected through the PRISMA screening process. The review focused on identifying antecedents of technology adoption as conceptualized within the TOE framework. From these studies, a total of 61 unique factors were extracted: 29 technological, 19 organizational, and 13 environmental. Figure 2 visually summarizes the factors identified within the TOE dimensions. To provide clarity and synthesis, these antecedents were consolidated into thematic categories under each TOE dimension. The frequency of occurrence across the 49 studies was analyzed, highlighting the relative emphasis of different factors in the existing literature.

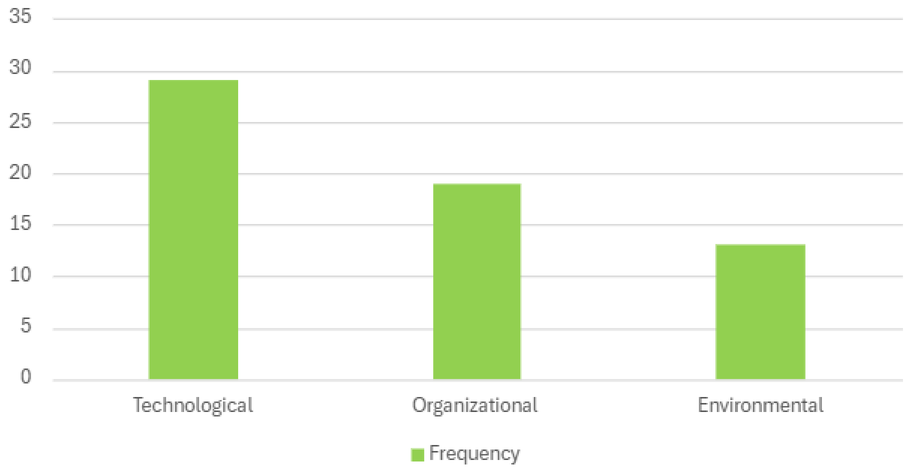

***Figure 2**. Factors identified under the TOE framework.*

Beyond factor identification, the dataset itself provides additional insights into the research landscape. The year-wise distribution of papers shows a steady growth in publications between 2015 and 2025, with a notable increase in the later years reflecting the rising interest in DevOps, continuous testing, and automation adoption. Thematic distribution indicates that technological antecedents dominate literature, followed by organizational factors, while environmental aspects remain comparatively underexplored. Methodologically, most studies adopted quantitative survey designs and structural modeling approaches, complemented by case studies and mixed-methods research in applied DevOps contexts. To supplement TOE's organizational-level perspective, a variety of frameworks were used outside of TOE, including TAM, UTAUT, TAM-TOE hybrids, and quality models. The theoretical foundations included both modern viewpoints like dynamic capacity theory and change management models as well as traditional adoption theories like Diffusion of Innovation (DOI). This variability demonstrates how methodological pluralism and theoretical cross-fertilization improve the larger study field, even while TOE continues to serve as the guiding framework for categorization. Together, these characteristics confirm that the reviewed dataset reflects both depth in TOE-based adoption studies and breadth in methodological and theoretical approaches.

3.1 Technological Factors

A statistical assessment was undertaken to evaluate the distribution of these factors across the 49 reviewed studies. Table 2 presents these results, showing how frequently each factor was addressed in all the total studies reviewed.

***Table 2**. Technological Factor Distribution.*

Technological Factor	Frequency
Relative Advantage	33
Compatibility	31
Complexity (negative influence)	27
Technological Readiness	23
Security / Security Concerns / Privacy Concerns	22
System Quality	8
IT Infrastructure / IT Infrastructure Readiness	7
Perceived Benefits (direct & indirect)	6
Perceived Usefulness (PU)	5
Ease of Use / Perceived Ease of Use (PEOU)	5
Scalability / Flexibility	5
Integration / System Integration	5
Perceived Risk	4
Service Quality / Reliability	4
Data Security & Privacy (separately stated)	4
Customization / System Customization Capability	3
Innovation Attributes / Innovative IT Capabilities	3
Interoperability / Compatibility Standards	3
Trialability	3
Information Quality	2
Observability	1
Technology Cost–Benefit Analysis	1
Technical Knowledge	1
Data Migration Complexity	1
Cloud Infrastructure Capabilities	1
Data-related Infrastructure Capabilities	1
Virtualization-based SaaS Architecture	1
Automation Tools (CI/CD, IaC, etc.)	1
Feature-level Usage (audit analytics tools)	1

Among the technological antecedents, Relative Advantage and Compatibility were the most frequently reported. As mentioned above, a total of 29 technological factors were identified across the reviewed studies, reflecting the wide range of technology-related considerations influencing adoption. However, to present these findings in a structured and meaningful way, the factors were consolidated into six sub-themes. Each sub-theme brings together factors that are conceptually and practically related, thereby reducing fragmentation and allowing for a clearer synthesis of technological aspects. This thematic grouping ensures that critical issues such as perceived value, integration, usability, quality, security, and infrastructure are addressed holistically rather than in isolation. Table 3 below gives how the technological factors are organized. By organizing the antecedents into these categories, the analysis provides a logical framework through which the technological dimension of adoption can be better understood and compared.

Table 3. *Proposed TOE Framework for Technological Factors.*

	Main Theme	Sub Themes	References
Technological Factors	Perceived Value & Utility	Relative Advantage	Chong & Olesen, 2017; Xiang et al., 2023
		Perceived Benefits	Jha et al., 2024; Salah et al., 2021
		Perceived Usefulness (PU)	Chong & Olesen, 2017; Fu et al., 2019
		Technology Cost–Benefit Analysis	Eze et al., 2018; Salah et al., 2021; Thanabalan et al., 2024
		Observability	Hsu & Lin, 2016
		Feature-level Usage	Ilias et al., 2020; Li et al., 2018
		Innovation Attributes/Innovative IT Capabilities	El-Haddadeh, 2020; Eze et al., 2018
	Integration, Interoperability & Customization	Compatibility	Pisirir et al., 2023; Siradhana & Arora, 2024; Teh et al., 2024; Zheng & Khalid, 2022
		System Integration	Fu et al., 2019; Khsroo et al., 2024
		Interoperability/Compatibility Standards	Gangwar et al., 2015; Khsroo et al., 2024
		Data Migration Complexity	Ilias et al., 2020; Marei, 2023; Zheng & Khalid, 2022
		Customization/System Customization Capability	Aligarh et al., 2023; Mehta et al., 2018
		Automation Tools (CI/CD, IaC, etc.)	Raut et al., 2017
	Complexity, Usability & Technological Readiness	Complexity (negative influence)	Pisirir et al., 2023; Teh et al., 2024
		Ease of Use	Ilias et al., 2020
		Trialability	Razzaq et al., 2021
		Technological Readiness	Masood & Egger, 2020; Palos-Sanchez et al., 2019
		Technical Knowledge	Jha et al., 2024
	Quality, Performance & Scalability	System Quality	Fu et al., 2019
		Service Quality/Reliability	Asante Boakye et al., 2024
		Information Quality	Sulaiman et al., 2023
		Scalability/Flexibility	Asante Boakye et al., 2024
	Security, Privacy & Risk	Security/Security Concerns/Privacy Concerns	Asante Boakye et al., 2024; Fülöp et al., 2024
		Data Security & Privacy	Pisirir et al., 2023
		Perceived Risk	Gui et al., 2021; Zheng & Khalid, 2022
	Infrastructure & Architecture Capability	IT Infrastructure/IT Infrastructure Readiness	Eze et al., 2018; Gutierrez et al., 2015; Zheng & Khalid, 2022
		Infrastructure Capabilities	Zheng & Khalid, 2022
		Data-related Infrastructure Capabilities	Pillai & Sivathanu, 2020
		Virtualization-based SaaS Architecture	Eze et al., 2018; Raut et al., 2017

The six sub-themes derived from the 29 identified factors collectively explain the technological aspect of the adoption context. Together, they capture the essential dimensions that shape how organizations evaluate and implement test automation in DevOps Continuous Testing. Themes such as perceived value and utility highlight the benefits and advantages driving adoption, while integration and interoperability emphasize the importance of seamless alignment with existing systems and tool chains. Similarly, complexity, usability, and readiness address the ease of adoption and the technical capability to support it, whereas quality and performance ensure trust in outcomes and long-term reliability. The inclusion of security, privacy, and risk reflects the critical role of safeguarding data and systems, and infrastructure and architecture capability underscore the foundational resources required for large-scale automation. Viewed together, these themes provide a comprehensive account of the technological considerations influencing adoption within the TOE framework.

3.2 Organizational Factors

The organizational dimension of the review produced several recurring factors that reflect the internal conditions shaping technology adoption. Statistical results from the 49 studies, mentioned in Table 4 show that top management support was the most frequently cited organizational driver, appearing in 46 papers, followed by organizational readiness and firm size. Other factors such as culture, employee competence, training, and change management also appeared, though with lower frequencies. The table above summarizes these findings, presenting the distribution of organizational antecedents and indicating the relative emphasis placed on each within the reviewed literature.

Table 4. *Organizational Factor Distribution.*

Organizational Factor	**Frequency**
Top Management Support	46
Organizational Readiness (financial, human, IT infrastructure)	30
Firm Size / Organization Size / Institution Scale	22
Organizational Culture / Innovativeness / Attitudes toward Innovation	14
Employee IT Competency / Knowledge / Skills / Expertise	13
Training & Education / Employee Readiness	12
Change Management Capability / Resistance to Change / Bureaucratic Inertia	9
Knowledge Sharing / Information Sharing / Learning Culture	6
IT Governance / Organizational IT Strategy & Alignment	5
Financial Readiness / Financial Resources	5
Interdepartmental Collaboration / Coordination	4
Resource Constraints / Lack of Skilled Personnel	4
Analytics Culture / Data-driven Decision-making	2
Presence of a Champion	1
Previous Experience with Systems	1
Procurement and Decision-making Processes	1
Attitude toward Use (TAM)	1
Standards / Compliance Encouragement	1
Professional Help / Availability of Support	1

A total of 19 organizational factors were identified from the reviewed literature, highlighting the diverse internal conditions that shape technology adoption. To provide greater clarity and avoid fragmentation, these factors were consolidated into five sub-themes that group together conceptually related elements as listed in table 5. This categorization ensures that the wide-ranging aspects of organizational influence such as leadership commitment, resource readiness, human competence, cultural orientation, and collaborative capability can be systematically addressed. By synthesizing the factors in this manner, the analysis captures the organizational dimension in a more coherent framework, allowing for a holistic understanding rather than a scattered listing of individual elements. These five themes therefore serve as an analytical lens through which organizational readiness and capability can be examined in relation to adoption decisions. Accordingly, the organizational context of test automation adoption in DevOps environments can now be meaningfully referred to through these identified factors as listed in Table 5.

***Table 5**. Proposed TOE Framework for organizational Factors.*

	Main Theme	Sub Theme	References
Organizational Factors	Leadership and Strategic Support	Top Management Support	Chong & Olesen, 2017; Gangwar et al., 2015; Lustenberger et al., 2021; Xiang et al., 2023
		Presence of a Champion	Bany Mohammad et al., 2022
		IT Governance/Organizational IT Strategy & Alignment	Alshahrani et al., 2023; Yaseen et al., 2023
		Procurement and Decision-making Processes	Martins et al., 2016; Palos-Sanchez et al., 2019
	Organizational Readiness and Resources	Organizational Readiness	Gangwar et al., 2015; Marei, 2023
		Financial Readiness/Resources	Hsu & Lin, 2016
		Firm Size/Institution Scale	Bahari et al., 2024; Hadi et al., 2021; Isiaku & Adalier, 2025; Jia et al., 2024; Thanabalan et al., 2024
		Resource Constraints/Lack of Skilled Personnel	Khsroo et al., 2024; Mehta et al., 2018
		Professional Help/Availability of Support	Alshahrani et al., 2023; Oni et al., 2020; Palos-Sanchez et al., 2019
	Human Capital and Competence	Employee IT Competency/Knowledge/Skills/Expertise	Asante Boakye et al., 2024; Martins et al., 2016
		Training & Education/Employee Readiness	Jia et al., 2024; Sulaiman et al., 2023
		Knowledge Sharing/Information Sharing/Learning Culture	Ilias et al., 2020; Isiaku & Adalier, 2025
	Organizational Culture and Change Management	Organizational Culture/Innovativeness/Attitudes toward Innovation	Fülöp et al., 2024; Gui et al., 2021
		Change Management Capability/Resistance to Change/Bureaucratic Inertia	Jia et al., 2024
		Attitude toward Use (TAM)	Gui et al., 2021
		Standards/Compliance Encouragement	Alshahrani et al., 2023; Yaseen et al., 2023
		Data-driven Decision-making	Pillai & Sivathanu, 2020
	Collaboration and Coordination	Interdepartmental Collaboration/Coordination	Fu et al., 2019
		Previous Experience with Systems	Chong & Olesen, 2017

3.3 Environmental Factors

A statistical assessment was undertaken to evaluate the distribution of the environmental factors across the 49 reviewed studies. Table 6 presents these results, showing how frequently each factor was addressed in the total studies reviewed.

***Table 6**. Environmental Factor Distribution.*

Environmental Factor	Frequency
Competitive Pressure (market, industry, external pressure from competitors)	42
Government Policy / Regulation / Support / Legal & Compliance Requirements	33
Vendor Support / Vendor Reliability / Vendor Ecosystem	31
Peer Influence / Trading Partner Pressure / External Partner Influence	17
External IT Infrastructure / Infrastructure Availability	14
Regulatory Support / Compliance Encouragement by Authorities	9
Market Trends / Industry Trends / Environmental Dynamism	8

Environmental Factor	Frequency
Customer Expectations / Customer Demands	4
External Consultants / Professional Body Influence	3
Cultural Barriers in Technology Use	1
Globalization / Value Chain Integration	1
Political Influence / Stability	1
Public Awareness / Confidence	1

From the review process, a total of 13 environmental factors were identified, each reflecting external forces that influence organizational technology adoption. To ensure analytical clarity, these factors were systematically consolidated into five sub-themes, grouping conceptually related elements under broader categories. This approach avoids fragmentation by aligning factors such as market competition, regulatory influences, customer demands, vendor support, and broader ecosystem readiness into coherent clusters. By organizing them in this manner, the environmental dimension is more effectively represented, allowing for a structured view of how external pressures and supports shape adoption outcomes. These sub-themes capture the diversity of environmental influences ranging from competitive and regulatory drivers to partner expectations and infrastructure availability while maintaining a focus on their collective impact. Table 7 depicts how the environmental framework is arranged.

Table 7. *Proposed TOE Framework for Environmental Factors.*

	Main Theme	**Sub Themes**	**References**
Environmental Factors	Market and Competitive Dynamics	Competitive Pressure	Bany Mohammad et al., 2022; Bouteraa, 2024; Chong & Olesen, 2017; Eze et al., 2018; Gutierrez et al., 2015; Salah et al., 2021; Xiang et al., 2023
		Market Trends/Industry Trends/Environmental Dynamism	Aligarh et al., 2023; Fu et al., 2019
		Globalization/Value Chain Integration	Ilias et al., 2020; Zheng & Khalid, 2022
		Public Awareness/Confidence	Pisirir et al., 2023; Teh et al., 2024
	Regulatory and Political Environment	Government Policy/Regulation/Support/Legal & Compliance Requirements	Bahari et al., 2024; Hadi et al., 2021; Isiaku & Adalier, 2025
		Regulatory Support/Compliance Encouragement by Authorities	Bany Mohammad et al., 2022; Khsroo et al., 2024
		Political Influence/Stability	Masood & Egger, 2020; Palos-Sanchez et al., 2019
	Customer and Partner Expectations	Customer Expectations/Customer Demands	Fu et al., 2019; Ilias et al., 2020
		Peer Influence/Trading Partner Pressure/External Partner Influence	Bahari et al., 2024; Yaseen et al., 2023
		Cultural Barriers in Technology Use	Asante Boakye et al., 2024; Fu et al., 2019
	External Support and Ecosystem Readiness	Vendor Support/Vendor Reliability/Vendor Ecosystem	Asante Boakye et al., 2024; Fülöp et al., 2024; Jia et al., 2024
		External IT Infrastructure/Infrastructure Availability	Bany Mohammad et al., 2022; Martins et al., 2016; Zheng & Khalid, 2022
		External Consultants/Professional Body Influence	Gangwar et al., 2015

3.4 Cross Domain Comparison

The three TOE dimensions highlight both the diversity of antecedents and the varying degrees of emphasis placed on each within the reviewed literature. The technological dimension emerged as the most extensively represented, with 29 factors consolidated into six sub-themes. These emphasize perceived value, integration capability, usability, quality, security, and infrastructure readiness, reflecting the central role of technical feasibility in shaping adoption decisions. The organizational dimension, represented by 19 factors grouped into five themes, focused more on internal enablers such as leadership, readiness, competencies, culture, and collaboration. This indicates that beyond technical fit, adoption success depends on organizational capacity and willingness to support change. By contrast, the environmental dimension, although narrower with 13 factors grouped into four sub-themes, underscores the external pressures and supports that guide adoption, including competition, regulatory influence, customer demands, and vendor ecosystems.

Collectively, the comparison reveals that technological and organizational factors dominate scholarly attention, while environmental drivers remain relatively underexplored. Nevertheless, the environmental context introduces essential external dynamics that can accelerate or constrain adoption. Together, the three domains provide a holistic account of the antecedents of test automation adoption in DevOps continuous testing, underscoring the need for balanced consideration across all dimensions. The final proposed TOE framework integrating all three dimensions is depicted in Figure 3.

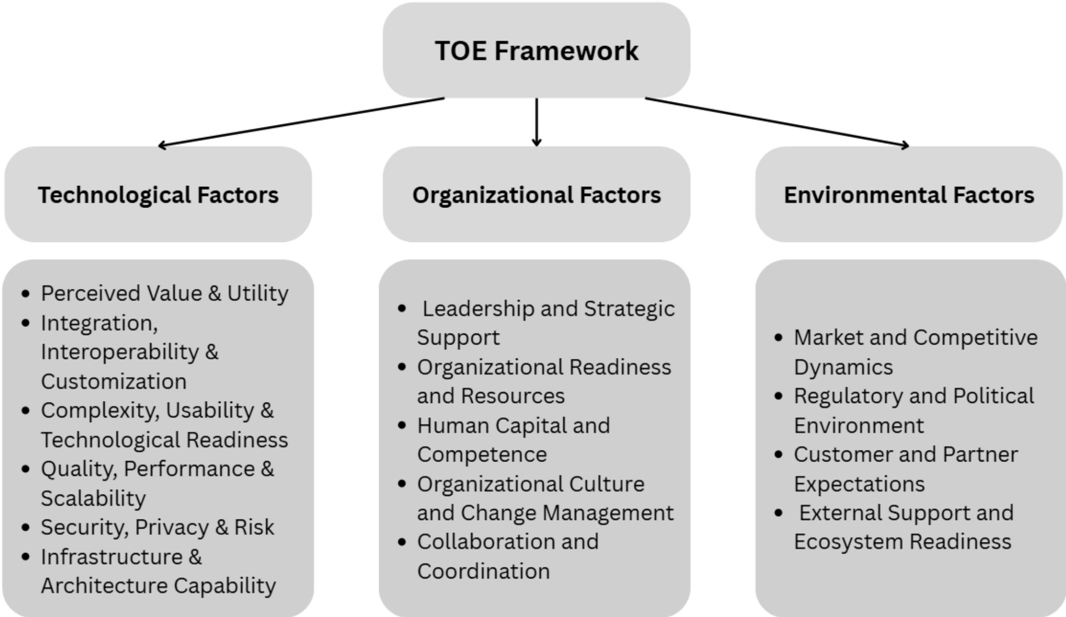

Figure 3. *Proposed TOE Framework.*

4 DISCUSSION

The aim of this systematic review was to consolidate and critically analyze the antecedents influencing the adoption of test automation for CT in DevOps environments through the lens of the TOE framework. The results revealed 61 factors (29 technological, 19 organizational, and 13 environmentally), which were synthesized into thematic clusters. This discussion interprets these findings with reference to the research questions, highlights their implications for theory and practice, and outlines strengths, limitations, and future research opportunities.

The first objective of this study was successfully achieved by systematically reviewing 49 theoretical and empirical studies from the software industry that explicitly applied the TOE framework. Through a rigorous screening process guided by the PRISMA protocol, a broad set of adoption antecedents were extracted, ensuring both breadth and consistency in capturing relevant findings. The TOE framework served as the analytical lens for organizing these antecedents, allowing the diverse technological, organizational, and environmental factors identified across studies to be mapped into the three core dimensions (Tornatzky & Fleischer, 1990; Oliveira & Martins, 2011). This approach ensured theoretical alignment and comparability across heterogeneous research contexts.

Subsequently, thematic coding was applied to consolidate the large number of extracted factors into simplified sub-themes, reducing redundancy while maintaining conceptual integrity. This process allowed the 29 technological, 19 organizational, and 13 environmental factors to be grouped into manageable clusters, enhancing analytical clarity and interpretability (Awa, Ojiabo, & Orokor, 2017). By completing this process, the review produced a structured framework of adoption antecedents, fulfilling the objective of identifying, categorizing, and simplifying TOE-based factors for further analysis in the context of test automation adoption.

This discussion will critically evaluate how the factors identified and categorized under the TOE framework influence the adoption of test automation in DevOps Continuous Testing. Having consolidated the wide range of antecedents into simplified sub-themes, is possible to interpret their implications within the DevOps context, where continuous integration and continuous delivery pipelines rely heavily on automation to ensure quality and speed. This critical evaluation will consider how technological enablers, organizational capacities, and environmental pressures collectively shape adoption outcomes, thereby extending insights from broader software industry studies into the specific domain of DevOps Continuous Testing.

4.1 Technological Factors Influencing Test Automation Adoption in DevOps Continuous Testing

Technological factors are central to the adoption of test automation in DevOps Continuous Testing because they directly shape whether automation tools can be embedded effectively into CI/CD pipelines. The technological dimension should be viewed as an interdependent system, where perceived value, integration quality, usability, and scalability collectively shape adoption outcomes.

Perceived Value and Utility highlights that organizations are more likely to adopt automation when relative advantages, usefulness, and cost benefit considerations are evident. Automated testing is expected to reduce cycle times, improve defect detection, and enhance release quality. When these advantages are visible and measurable, adoption is accelerated (Davis, 1989). However, technological benefits must be sustained by seamless integration and interoperability, otherwise, the perceived value diminishes.

Integration, Interoperability, and Customization determine whether test automation tools align with existing systems, workflows, and tool chains. In DevOps CT, seamless integration with CI/CD pipelines, build systems, and deployment automation is essential for ensuring end-to-end reliability. Compatibility and interoperability standards lower technical friction, while customization enables them to fit organizational workflows. Poor integration, on the other hand, can cause bottlenecks, fragmented pipelines, or additional manual interventions, undermining the very efficiency DevOps seeks to achieve (Oliveira & Martins, 2010). Data migration complexity further complicates transitions to new automation frameworks, delaying adoption or leading to partial implementations.

Complexity, Usability, and Technological Readiness, interact closely with integration concerns. Tools that are difficult to configure or maintain increase resistance, especially under DevOps' high-frequency release pressures. Ease of onboarding, modular architecture, comprehensive training and mentoring programs, tool standardization and documentation across CI/CD pipelines and continuous feedback loops and peer code reviews lower the learning curve and complement organizational readiness by enabling cross-team adoption. Technological readiness, including skilled personnel and organizational technical infrastructure plays a decisive role, as teams with sufficient expertise can better manage tool complexity and adapt processes (Davis, 1989). Lack of readiness leads to underutilization, creating gaps in the automation process.

Quality, Performance, and Scalability, ensures that automation tools deliver reliable outcomes at the scale required for DevOps CT. High system, service, and information quality builds trust that automated testing can replace manual checks without compromising coverage or accuracy (DeLone & McLean, 2003; Estdale & Georgiadou, 2018). Scalability and flexibility links back to infrastructure maturity cloud, containerization, and virtualized environments enable rapid, parallel execution of extensive test suites. Thus, quality attributes are not only enablers but also thresholds without them, adoption efforts stall.

Critical technological challenge influencing continuous testing reliability is test data management and environment configuration. In DevOps pipelines, inconsistent or unavailable test data often leads to unreliable test outcomes, false positives, and delayed feedback. Similarly, unstable or misconfigured environments cause integration failures that erode confidence in automation results. To mitigate these issues, organizations should establish centralized test data repositories and adopt data versioning and masking techniques to ensure accuracy, privacy, and repeatability of test executions. Employing infrastructure-as-code (IaC) for automated environment provisioning enhances consistency across development, testing, and production stages (Sezen et al., 2025). Furthermore, incorporating containerization tools such as Docker or Kubernetes enables environment parity, while continuous monitoring and validation scripts ensure that configurations remain aligned with CI/CD requirements. These practices improve test reliability, reduce maintenance overhead, and strengthen confidence in continuous testing pipelines.

As DevOps and CI/CD workflows evolve toward faster release cycles and higher automation maturity, traditional metrics of testing effectiveness such as defect density or test coverage alone are no longer sufficient. Modern continuous testing environments require adaptive, process-oriented metrics that capture both quality outcomes and pipeline performance. Key indicators should include build stability rates, automated test execution success ratios, mean time to detect (MTTD) and mean time to repair (MTTR) defects, as well as test flakiness trends that reveal instability in automation suites (Amaro & Iscte-iul, 2024). Moreover, measuring deployment frequency, lead time for changes, and feedback latency provides holistic visibility into how testing contributes to overall delivery efficiency. Integrating these metrics into CI/CD dashboards enables continuous monitoring and evidence-based improvement. Over time, organizations should adopt data-driven retrospectives that use these analytics to refine test design, reduce redundancy, and align automation objectives with business value delivery thereby ensuring that testing effectiveness evolves alongside the agility and complexity of DevOps practices.

Security, Privacy, and Risk, are particularly salient in data-intensive DevOps environments. Automated tests frequently handle production-like datasets, raising concerns about data protection, privacy compliance, and potential vulnerabilities. These risks often discourage adoption in highly regulated sectors. However, when robust security and privacy measures are embedded, automation adoption is strengthened as organizations gain confidence that compliance requirements are met. The perception of risk therefore acts both as a barrier and a gatekeeper, influencing the scope and pace of adoption.

Infrastructure and Architecture Capability provide the foundation on which automation in DevOps CT depends. Cloud infrastructure, virtualization, and containerization enable elastic computing power to run large-scale automated test suites efficiently, while strong IT infrastructure readiness ensures stable execution environments. Inadequate infrastructure leads to unstable pipelines, prolonged execution times, and reduced trust in automation outcomes, which can discourage continued adoption. Conversely, organizations with modern, scalable infrastructure are positioned to adopt and expand test automation effectively.

As discussed, technological factors present both opportunities and constraints for test automation adoption in DevOps Continuous Testing. Overall, the technological dimension functions as a reinforcing network rather than discrete variables. High integration strengthens perceived value; strong infrastructure enhances scalability and security; and effective usability increases readiness and acceptance. Where these synergies exist, organizations achieve sustainable automation maturity. Where they are weak or misaligned, technological barriers stall adoption and prevent DevOps teams from realizing the full potential of Continuous Testing.

4.2 Organizational Factors Influencing Test Automation Adoption in DevOps Continuous Testing

Organizational conditions are decisive for the successful adoption of test automation in DevOps CT because they determine whether technological capabilities can be embedded and sustained across the software delivery pipeline. Leadership, resources, competence, and culture function as an interconnected ecosystem, aligning people, strategy, and structure to sustain automation, instead of acting as separate drivers.

Leadership and Strategic Support emphasize the role of top management, governance, and decision-making in driving automation adoption. Strong executive sponsorship ensures alignment of automation initiatives with strategic goals, secures funding, and reduces uncertainty around large-scale process changes (Gangwar et al., 2015; Martins et al., 2016). In DevOps CT, leaders who champion automation can accelerate organizational buy-in and foster cross-team integration. Conversely, lack of leadership commitment or unclear governance can result in fragmented adoption efforts, where automation tools are piloted but not scaled, limiting their strategic value.

Organizational Readiness and Resources reflect the extent to which financial, human, and infrastructure capacities support adoption. Organizations with sufficient budgets and mature IT infrastructure are more capable of sustaining continuous testing pipelines, while smaller firms or resource-constrained environments may face adoption barriers (Dwivedi et al., 2012; Low et al., 2011). Readiness also interacts with clear decision structures to ensure resources are used to strengthen automation maturity rather than to fund fragmented efforts. In DevOps contexts, insufficient readiness often manifests as unstable pipelines, slow test execution, or overburdened staff, reducing confidence in automation outcomes.

Human Capital and Competence highlights that technical skills and knowledge-sharing practices are critical enablers of test automation. DevOps emphasize cross-functional collaboration, requiring testers, developers, and operations staff to collectively manage automation frameworks. Skilled employees and ongoing training programs reduce resistance and increase tool effectiveness (Ifinedo, 2011). Knowledge-sharing cultures encourage reuse of automation scripts and promote faster troubleshooting. However, when employees lack technical expertise or adequate training, automation tools may be underutilized, creating a dependency on manual testing that undermines CT objectives (Mikalef et al., 2019).

Organizational Culture and Change Management addresses the attitudinal and cultural context in which automation adoption occurs. A culture that encourages innovation, data-driven decision-making, and openness to change enhances adoption outcomes (Mikalef et al., 2019). Effective change management reduces bureaucratic inertia and employee resistance, which are common in organizations accustomed to manual testing processes. Conversely, cultures that resist change or view automation as a threat to job security can slow or derail adoption. In DevOps CT, cultural resistance often appears as reluctance to modify workflows, leading to inconsistent or superficial use of automation tools. Standards and compliance practices can further encourage adoption by formalizing expectations, though overly rigid compliance requirements may also create delays.

Promoting cross-functional collaboration and shared responsibility for test automation success in DevOps requires a shift from siloed practices to a systems-thinking culture where quality is a collective goal. This transformation begins with leadership modelling shared ownership and embedding testing objectives into team performance metrics. Forming cross-functional squads of developers, testers, and operations engineers fosters real-time collaboration and accountability (Azad & Hyrynsalmi, 2023). Encouraging continuous learning, psychological safety, and team-based recognition further strengthens transparency, trust, and joint problem-solving ensuring automation success is viewed as an organization-wide responsibility rather than a departmental task.

Collaboration and Coordination are essential in DevOps environments, where adoption of automation requires continuous communication between development, testing, and operations teams. Interdepartmental collaboration ensures that automation tools are integrated across the entire CI/CD pipeline, rather than confined to siloed functions (Low et al., 2011). Previous experience with similar systems also reduces the learning curve, increasing confidence in adoption. Conversely, lack of collaboration leads to inconsistent implementation, duplicated efforts, and poor alignment between automation scripts and deployment practices, undermining CT efficiency.

Overall, organizational factors operate synergistically rather than sequentially. Leadership commitment enhances readiness, readiness enables competence development, culture and collaboration translate competence into sustained practice. When these dynamics align, DevOps teams achieve automation maturity marked by shared ownership, stability, and continuous improvement. Where they fragment, organizational inertia negates technological potential and limits continuous testing scalability.

4.3 Environmental Factors Influencing Test Automation Adoption in DevOps Continuous Testing

Environmental factors represent external conditions that shape organizational decisions on adopting test automation in DevOps CT. Environmental forces operate in dynamic interaction, where market competition drives urgency, regulations impose direction, customer expectations amplify demand, and ecosystem readiness provides the means to act. The balance of these pressures determines both the pace and sustainability of adoption.

Market and Competitive Dynamics emphasize the role of competition, industry turbulence, globalization, and public expectations in driving adoption. In DevOps CT, competitive pressure accelerates automation as organizations seek to shorten release cycles, enhance quality, and maintain parity with rivals. Market dynamism and globalization compel firms to scale automation to remain agile in volatile environments (Zhu et al., 2006). Public awareness and customer confidence also increases the demand for reliable releases, positively reinforcing adoption. Conversely, rapid environmental change may pressure firms to adopt prematurely, leading to ineffective implementations or overreliance on immature tools (Gangwar et al., 2015).

Regulatory and Political Environment reflects the impact of compliance requirements, government policies, and political stability. For DevOps CT, adherence to legal and regulatory frameworks such as data privacy laws or industry-specific testing standards often necessitates the implementation of automation for traceability and auditability (Oliveira & Martins, 2010). Regulatory support can thus drive adoption by creating a compliance mandate. However, stringent or fragmented regulations may slow adoption, as organizations struggle with added overheads and fear of penalties in case of non-compliance. Political instability, in turn, undermines confidence in long-term technology investments.

Regulations and compliance requirements strongly influence the adoption and scalability of automated testing in DevOps, especially in sectors such as finance, healthcare, and government. Strict controls on data privacy, auditability, and traceability often require additional validation within CI/CD pipelines, initially slowing adoption. However, embedding compliance-as-code principles and using automated audit trails and test evidence management tools can transform compliance into an enabler of scalable, repeatable, and trustworthy automation aligned with standards like ISO 27001, GDPR, and HIPAA (Grünewald et al., 2023).

Customer and Partner Expectations underscore the importance of external relational pressures. High customer demands for reliability and responsiveness strongly incentivize firms to embed test automation into CI/CD pipelines, ensuring faster and higher-quality releases. Similarly, partner and trading network pressures promote harmonization of testing standards across ecosystems (Low et al., 2011). Yet, cultural barriers and differing norms in technology use across regions may reduce acceptance, slow global alignment and limit the scalability of automation practices (Awa et al., 2017).

External Support and Ecosystem Readiness highlight the enabling role of vendor reliability, external IT infrastructure, and consultancy services. Stable vendor ecosystems and accessible cloud infrastructure reduce risks, allowing organizations to confidently invest in automation frameworks (Low et al., 2011). Consultants and professional bodies also provide expertise to overcome capability gaps. However, dependence on external support may introduce long-term risks, including vendor lock-in or misalignment with organizational needs (Mikalef et al., 2019).

Environmental factors exert dual pressures on test automation adoption in DevOps CT. Competitive and regulatory forces often serve as strong motivators, while customer expectations and ecosystem readiness create additional incentives. At the same time, turbulence, overregulation, cultural barriers, and reliance on vendors may constrain adoption or reduce its sustainability. Recognizing and balancing these external influences is therefore essential for organizations seeking to embed test automation effectively in DevOps environments.

This synthesis reinforces the relevance of the TOE framework as a multidimensional lens for understanding DevOps CT adoption. By linking environmental dynamics to technological and organizational readiness, the TOE model explains not only what factors exist but how they interact to shape adoption outcomes across complex, evolving ecosystems. This combined lens highlights that successful CTA adoption is not purely a technical implementation, but an organizational transformation supported by strategic environmental responsiveness.

4.4 Practical and Theoretical Implications

The findings offer both managerial and theoretical contributions to understanding test automation adoption in DevOps CT. Practically, they highlight that successful adoption depends on aligning technological readiness with organizational enablers such as leadership commitment, cross-functional competence, and a culture supportive of continuous improvement. DevOps managers can use these insights to design structured automation strategies prioritizing integration, usability, and scalability while managing external pressures from customers, regulators, and competitors. Establishing collaborative, learning-oriented environments and investing in infrastructure maturity are essential for sustaining automation effectiveness.

Theoretically, the study extends the TOE framework by contextualizing it within DevOps CT, demonstrating how technological interoperability, organizational agility, and environmental dynamics jointly shape automation maturity. This synthesis reinforces TOE's applicability beyond traditional IT adoption contexts and provides a multidimensional foundation for future empirical studies exploring automation behavior in agile and DevOps ecosystems (Dwivedi et al., 2012).

4.5 Strengths and Limitations of the Review

A key strength of this study is its comprehensive and systematic methodology, which followed PRISMA guidelines to ensure transparency and replicability. The inclusion of 49 studies across diverse contexts enabled the identification of a wide array of antecedents, strengthening the breadth of the evidence base. The use of thematic coding ensured that fragmented factors were consolidated into meaningful clusters, facilitating clarity in presentation.

Several limitations must be acknowledged. Although all selected studies applied the TOE framework, many were conducted outside the DevOps or software testing domain. As such, the transferability of certain factors to test automation adoption may require empirical validation. The reliance on frequency counts may obscure contextual nuances factors less frequently cited may still be highly influential in specific DevOps environments. Only English-language, peer-reviewed journal articles were included, potentially excluding relevant grey literature or non-English studies.

The review highlights several avenues for further inquiry. First, empirical studies directly situated in DevOps and CT contexts are needed to validate whether the antecedents identified here hold true in practice. Such studies could apply surveys, case studies, or mixed methods approaches to assess the relative weight of TOE factors in real-world DevOps environments.

Future work could employ quantitative modelling techniques such as Structural Equation Modelling (SEM) or Partial Least Squares (PLS) to test hypothesized relationships between TOE factors and adoption outcomes. Future work should consider moderating factors such as organizational maturity in DevOps adoption, industry sector differences, or firm size. These may influence the strength of relationships between TOE antecedents and adoption outcomes.

In interpreting the findings, this study demonstrates that adoption of test automation in DevOps CT is shaped by a convergence of technological, organizational, and environmental factors. It highlights the importance of integrated strategies that balance technical feasibility, organizational readiness, and environmental responsiveness, thereby setting a foundation for future research and practice.

5 CONCLUSION

This study set out to systematically review the antecedents of test automation adoption for CT in DevOps environments using the TOE framework. Guided by the PRISMA protocol, 49 peer-reviewed studies published between 2015 and 2025 were identified, screened, and analyzed. Across these studies, a total of 61 factors were extracted and thematically categorized into 29 technological, 19 organizational, and 13 environmental antecedents. Through thematic coding, these factors were consolidated into meaningful clusters that highlight the multidimensional nature of adoption.

The findings reveal that technological and organizational factors dominate existing literature, with environmental considerations receiving comparatively less attention. Within the technological dimension, factors such as relative advantage, compatibility, complexity, and reliability consistently emerged as central to adoption. Organizationally, top management support and human resource competence were the most frequently cited enablers, underscoring the importance of leadership commitment and workforce readiness. Although fewer in number, environmental factors such as competitive pressure, stakeholder expectations, and regulatory requirements highlight the external drivers that can accelerate or constrain adoption.

Interpreting these findings in relation to the research questions demonstrates that the existing state of theory is fragmented. While the TOE framework has been widely applied, empirical applications tend to emphasize internal adoption determinants over external ones. When applied to DevOps CT, however, these antecedents collectively influence adoption decisions: technological factors shape feasibility and integration with CI/CD pipelines, organizational factors determine sustainability through leadership and skills, and environmental factors provide urgency through competitive and compliance demands.

The review makes several contributions. Theoretically, it validates the TOE framework as a robust lens for analysing adoption in DevOps contexts, while also highlighting the underrepresentation of environmental influences. Practically, the study provides a consolidated evidence base for managers and practitioners. By focusing on high-frequency antecedents' relative advantage, compatibility, top management support, human resource competence, competitive pressure, and stakeholder expectations, organizations can better prioritize interventions when implementing test automation within DevOps pipelines.

Methodologically, the study demonstrates the value of a rigorous and transparent systematic review process. By adhering to PRISMA and applying thematic coding, fragmented insights from diverse studies were synthesized into a coherent framework, thereby enhancing the robustness and credibility of the findings.

Nonetheless, the review also has limitations. The 49 studies, though unified by TOE, were not all directly situated in DevOps or software testing, raising questions of transferability. Additionally, reliance on frequency counts may obscure context-specific influences. Future research should empirically validate these antecedents within DevOps environments, employ quantitative modelling techniques, and pay greater attention to underexplored environmental drivers.

In conclusion, the adoption of test automation in DevOps CT is a multidimensional organizational challenge. Successful adoption requires balancing technological feasibility, organizational readiness, and environmental responsiveness. By systematically identifying and categorizing antecedents, this study provides both a theoretical foundation and a practical roadmap for advancing research and guiding industry practice in this rapidly evolving domain.

ADDITIONAL INFORMATION AND DECLARATIONS

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