Volume 2 No 1, 2026
Journal of Global Research in Multidisciplinary Studies (JGRMS)
Research Paper
Available online at https://saanvipublications.com/journals/index.php/jgrms/index

Smart Test Automation: Integrating AI and ML for Continuous Digital Transformation

Mr. Ram Pratap Singh
Department of Computer Science and Engineering
Lakshmi Narain College of Technology
Bhopal
rampratap@lnct.ac.in

***Abstract*—The high rate of digital transformation and the rising complexity of software developed a necessity to explore how Smart Test Automation combined with AI and ML would enhance continuous delivery pipelines. This paper explores the transition of manual testing to intelligent automation to gain insight into the efficiency and reliability of tests through AI-driven capabilities. The main aspects, including autonomous test generation, self-healing scripts, intelligent test prioritization, and defect prediction, contribute to stability, accuracy, and maintainability in testing ecosystems to a great degree. Other important issues in digital transformation identified in the research are cultural resistance, lack of digital skills, infrastructural constraints, and data privacy issues. The analysis of the recent literature shows how the innovations in the field of AI-based automation, Visual AI, script generation with the help of NLP, and simulation tools redefine contemporary testing processes in different industries. In general, the research highlights the fact that AI-enhanced smart automation is the key to facilitating continuous integration, continuous testing, and continuous deployment via human intervention minimization, faster feedback cycles, and scalable and reliable software delivery.**

Keywords*—Smart Test Automation, Artificial Intelligence (AI), Machine Learning (ML), Continuous Integration, Digital Transformation.

I. INTRODUCTION

In today's global and highly competitive business environment, Automation is essential for increasing production and efficiency, which enables businesses to keep a competitive advantage and swiftly address market needs [1]. Automation liberates human workers to do more strategic, creative and more complex tasks that involve critical thinking and problem-solving skills by streamlining the process and cutting down time and energy used in risky and repetitive tasks. Automation [2] has significant positive effects especially to the educated and talented employees since they are able to complete their tasks before the deadline set by the management, as well as absorb risky responsibilities such as heavy lifting, vital labor and complex assembly processes. Software test automation is the process of running pre-written tests on a software application using tools and frameworks prior to its deployment into production [3]. It seeks to verify functionality, performance and security and minimal human intervention.

The digital transformation [4] of the public sector institutions poses specific challenges, especially the infrastructure, organizational culture, and workforce readiness. The public sector institutions, with their inflexible bureaucracies, can be easily found having challenges with the realization of digital initiatives as swift as those held by institutions in the private sector [5]. The unwillingness to change among the employees is one of the main obstacles in this process, as the latter can view the digital transformation as a threat to their employment or the work habits that they have developed over a long time. Also, the failure to provide adequate digital infrastructure in the organizations of the public sector may become an obstacle to the effective deployment of new technologies, which may result in inefficiencies and delays in the process of operations. The automation testing [6] has been a critical element of the digital transformation. Due to the growing complexity of software updates, conventional manual testing is unable to keep up with development cycles. Automation testing makes use of special tools and procedures as a way of testing a software application according to the pre-defined ones where the tests are uniform and repeatable with a reduced duration taken to complete the test cycles [7]. Teams may spend more time on exploration and risk-based testing that required human interaction by automating repetitive processes like regression testing, load testing, and performance testing.

A significant amount of data is produced by digital transformation systems, creating a wealth of potential innovation opportunities, especially those powered by AI [8]. The amount of data generated by such systems is so enormous that it furnishes organizations with more information than ever before that can be extracted by AI algorithms and used to benefit them. Through the analysis and processing of this data, AI-based applications can access deep insights, can see under the hood to identify concealed patterns, and forecast future trends. This ability to extract meaning from massive amounts of data helps businesses make data-driven decisions and improve operations, and involves transformational change. With machine learning (ML) leading the pack [9]. Traditional automation systems' rigid rule sets and inflexible logic were not always able to handle the complexity and unpredictability of the contemporary production environment. ML-based intelligent automation has become a game-changer in the last ten years, providing systems with the capacity to learn based on both historical and live data, identify patterns, and forecasts and continually improve operations without the need for explicit reconfiguration.

A. Structure of the paper

The paper is structured as follows: Section II provides an overview on Digital transformation and smart test

automations, Section III discusses techniques of AI in Test Automation, Section IV outlines the key challenges in Continuous Digital Transformation, Section V presents Literature of Review of recent studies on the topic, and Section VI contains the future work and conclusion of the study.

II. Overview of Smart Test Automation and Digital Transformation

Scholars and practitioners are becoming more interested in sustainability and intelligence/automation through Digital Transformation (DT) [10], including smart homes, smart cities, smart governance, and smart production [11]. Specifically, the partnership between intelligence and sustainability is at the core of scholarly discourse, as illustrated in Fig. 1, which highlights topics like how digital technologies like IoT, cloud computing, big data, cyber-physical systems, AI, and others enable sustainable smart manufacturing.

Fig. 1. Role of Digital Transformation

A. Digital Transformation by Automation of Tests

Testing without automation is performed manually, which is highly time-consuming at times when testing large-scale applications. In manual testing, every stage involves human intervention that contributes to slowing down the release of the software [12]. Since applications are becoming more and more complex, to test every scenario that may arise, the amount of time required becomes unrealistic Automation helps in task as shown in Fig. 2.

Fig. 2. Automation help

1) *Manual to AI-Driven Automation*

Instead of manual work which takes more time AI can help to automate, AI-based automation produces superior operational performance by reducing completion duration as well as automatic removal of time-intensive task [13]. by obtaining quick better decisions through its power to provide real-time analysis and forecasting capabilities for pattern detection in future choice determination [14]. The automation of data organizations brings precise accurate results to healthcare and financial sectors by minimizing errors made by human staff. Flexible AI systems help companies manage expansion needs without needing extra workforce until business growth becomes necessary.

2) *Continuous Testing and Delivery*

This procedure involves executing automated tests as a component of the software delivery pipeline to get real-time input on a software release candidate's business risks [15]. In the field of software development known as Continuous Delivery, high-quality software is created so that it may be put into production whenever it's ready. delivers the application to client or production environments automatically and constantly. Additionally, the meaning and distinction of the terms continuous deployment and continuous delivery in the context of academia and industry.

B. Major Components of Smart Test Automation

Smart Test Automation Framework [16] that incorporates Advanced Intelligence trends to counter the weaknesses of classical strategies. This objective is to establish a framework to deal with dynamism in testing environment, cut on maintainability and enhance test effectiveness on the application under test. The smart test automation components are as test generation, self-healing scripts, optimization and defect prediction are discussed below also shown in Fig. 3:

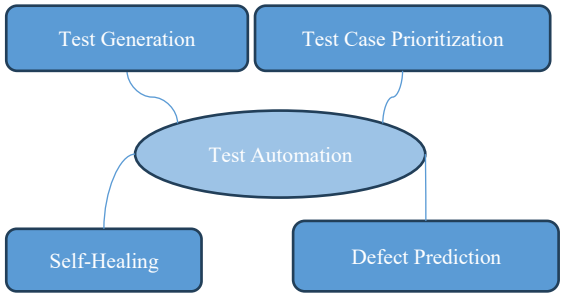

Fig. 3. Test Automation Components

1) *Autonomous Test Generation and Self-Healing Scripts*

Test generation is an essential step for automation as AI and ML use language-based techniques for automation. Self-healing test automation is the capacity of an automated testing system to detect, diagnose, and repair issues that cause test failures [17]. Self-healing frameworks with the use of AI and ML methods help to minimize human input, decrease the amount of maintenance, and increase the stability of test automation suites.

2) *Smart Test Prioritization and Optimization*

Test Case Prioritization (TCP) is a very important element of software testing, as it makes sure the test is run in a sequence to detect bugs as early as possible [18]. Traditional TCP approaches contain fundamental prioritization algorithms that leverage test adequacy criteria, including code coverage, to reflect various test case behaviour. These core TCP principles center on evaluating modified code segments as quickly as feasible.

3) *AI-Based Defect Prediction*

Defect prediction (DP) is a method that uses several machine learning techniques to create numerous

categorization or classification models in order to improve software quality and lower testing expenses [19]. Many software development businesses wish to anticipate issues in order to maintain quality for customer satisfaction and save testing expenses. As part of the software development life cycle, DP uses historical data and a machine learning (ML) technique to forecast the failure.

C. *Smart Automation role in the Ongoing Digital Transformation*

The following section provides the Smart Test Automation and Digital Transformation, that phase discussed in Fig. 4 and Table I.

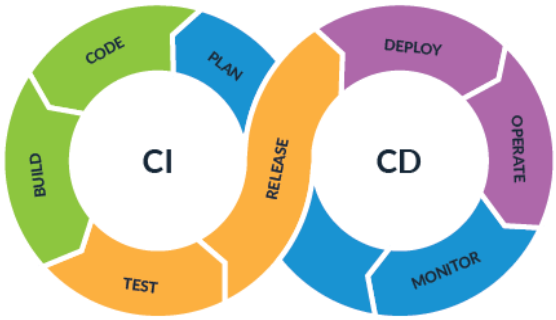

Fig. 4. CI/CD Pipelines for Automation

Continuous Integration (CI) and Continuous Deployment (CD) have grown in new significance in contemporary software development practices, especially within the realms of Agile and DevOps approaches [20]. Pipeline systems to increase productivity, improve code quality, and speed up software releases, CI/CD pipelines are essential [21]. Under CI, developers are able to deploy updates to the code on a regular basis and as such, bugs are detected early and integration problems are resolved quickly as shown in Fig. 4.

1) *Continuous Integration (CI)*

A well-known development technique in the software development industry is continuous integration (CI) [22], where team members regularly, for instance many times a day, integrate and combine development activity (such as code). CI helps software businesses improve software quality, enhance team efficiency, and have shorter and more frequent release cycles. Software building and testing are automated in this practice.

2) *Continuous Delivery (CD)*

Continuous Deployment (CD) is the procedure of deploying all the changes that successfully passed the production process's automated testing without the need for human intervention. It is a natural continuation of Continuous Integration (CI), and the objective is to automate the whole release process, enabling end users to get updates, bug fixes, and new features as soon as they are prepared.

TABLE I. OVERVIEW OF SMART TEST AUTOMATION AND DIGITAL TRANSFORMATION

Topic Area	Description	Key Technologies	Challenges Addressed	Outcomes / Benefits
Digital Transformation (DT)	Growth of smart systems across sectors like cities, homes, production, governments	IoT, Cloud, Big Data, CPS, AI	Need for sustainability, data-driven automation	Enables intelligent, sustainable operations
Test Automation in DT	Shift from manual to automated testing due to complexity of modern systems	DevOps, CI/CD Pipelines, Automated Testing Tools	Manual testing delays, scalability issues	Faster releases, reduced human effort
AI-Driven Automation	Replacing manual work with AI-driven and real-time decisions.	Real Time Decisions using AI and ML models	Prediction Systems Time-consuming processes, human error	Greater accuracy, quicker decision-making.
Continuous Testing & Delivery	Automated tests are part of CI/CD to provide instant feedback CT Pipelines	CD/Deployment Tools	Deployment delays, quality risks	Immediate feedback, deploy-ready software
Smart Test Automation Components	AI-enhanced testing framework elements	Autonomous Test Generation, Self-Healing Scripts, Optimization, Defect Prediction	Test maintenance overhead, dynamic UI changes	Higher test stability, reduced maintenance
Role in Continuous Digital Transformation	CI/CD supporting agile, high-frequency releases	Automated Build/Test/Deploy Systems	Integration issues, slow delivery cycles	Frequent releases, improved code quality

III. TEST AUTOMATION THROUGH AI AND ML TECHNIQUES

AI and ML techniques are very advanced in today's time as AI can help in fully automate things AI completely manages test creation, execution, maintenance, and defect detection without human involvement [23]. Test automation refers to the process of automating the running of the tests and comparing the actual results with the expected results. It encompasses the entire testing process inside an organization, aiming to improve software testing coverage, accuracy, and efficiency.

A. *ML-Based Test Optimization*

The capability to create and rank test cases efficiently is one of the most important characteristics of the software testing optimization in these settings. The AI and Machine Learning (ML) technologies offer effective tools in order to automate these processes, which allows conducting more comprehensive testing without wasting time and resources.

1) *Test Suite Reduction*

The method is tailored to a certain smart contract design; A smart contract's primary purpose is to determine whether certain requirements are satisfied in order to carry out an operation or transaction. All of the rules that have been placed on the smart contract must be followed for the operation or transaction to be completed, even if they are extremely complicated individually [24]. Consequently, a natural form of a system that confirms whether a smart contract may be executed is the logical result of conditions. The design pattern for smart contracts was created using this approach.

2) *Test Case Quality*

In optimizing the quality is also an important measure in software testing, test case quality is a critical factor. A well-

crafted test case can help improve the quality of software. Conversely, poorly designed test cases can be expensive and time-consuming to create and execute, and they may fail to identify flaws or errors. By eliminating errors that are not indicative of lingering software flaws, several research seek to enhance test case quality using predictive models.

B. Generation and Test Maintenance Built on AI

The first step in the testing process of any software is test case generating [25]. Conventionally, it consists of manually developing tests in accordance with prepared conditions, which, especially with large-scale and distributed systems, may be laborious and error-prone. This process is automated through AI-based test case generation by means of algorithms that analyze the source code of the system, past test outcome, and even system behavior to come up with relevant and diverse test cases. Based on past data, and system interaction, these AI models [26] are dynamic enough to produce tests that are likely to reveal bugs or vulnerabilities, and edge cases that might otherwise be ignored.

1) *AI/ML-based Test Case Generation*

This section is dedicated to the innovative use of AI in the test case generation process, in which more sophisticated algorithms, such as NLP and ML, enable process automation and optimization [27]. It describes AI models in terms of interpreting code, requirements, and past data to create in-depth test cases, and the application of predictive models to make predictions and confirm test cases [28]. The discussion highlights the possibility of AI to be more efficient, less redundant, and dynamically fit to changing software systems to transform the conventional method of testing.

2) *NLP-Based Test Script Development*

It is possible to use ML to process and understand the requirements documents, user stories or other textual sources to generate test cases that reflects its particular functionality. The primary requirements may be obtained by ML models using Natural Language Processing (NLP) techniques, and these requirements can then be transformed into test cases that are pertinent to the required application behaviour.

3) *Code Analysis*

ML models may be used to analyze code as well as comprehend the structure of the code, the places that may contain problems, and may provide test cases by looking into the code's dependencies and patterns. These models can be used to anticipate the most likely locations of the defects in the codebase by analyzing the codebase and generate test cases by focusing on high-risk regions.

IV. Challenges in Continuous Digital Transformation

The use of digital technology to alter corporate operations, activities, processes, and customer experiences is known as "digital transformation." Investing in Industry 4.0 technology, creating a transformation strategy, and exchanging information both inside and across businesses are all necessary for a successful digital transformation. Maturity and readiness models can be used to support this transition [29]. Differentiating between readiness and maturity is crucial; an organisation cannot mature unless it is prepared for adaptation.

- **Technological and Implementation Barrier:** Enterprises may find it difficult to choose the digital technologies, products, and vendors that best serve their needs. A cutting-edge solution that seems exciting and attractive might not be a great fit for an organization and could limit its ability to invest in more-transformative technologies.
- **Cultural and Skill-Related Challenges:** New digital technologies and processes are effective only to the extent that employees use them to maximum effect. For that reason, digital transformation projects typically require a company culture in which employees embrace new ways of doing things, are willing to collaborate, want to develop new digital skills, and regard digital systems as strategic assets.
- **Strategic Alignment and Sustainability:** Digital changes are more likely to fail if they don't help a business reach its strategic goals. When selecting the technologies and vendors for an initiative, carefully consider long-term financial objectives, employee satisfaction levels with current processes and systems, the desired customer experience, and growth strategies.
- **Data Privacy and Budgetary Constraints:** The sensors, applications, and devices associated with digital transformation can generate exponentially more data than legacy systems data that's then shared far more extensively than ever before across and outside the organization.

V. Literature Review

This literature review elaborates on the latest studies on AI-assisted learning, software test automation, and digital transformation specifying the methods and essential findings, as well as overarching issues. The section focus on the betterment of the AI integration, the correctness of the automation, and the development of effective digital transformation practices.

Wang, Yue and Zheng (2025) made up an AI-based simulation tool. This tool can resolve these instructional issues using Python, dynamic visualization methods, and customized feedback tools, as well as a specially created assistant through artificial intelligence. The findings show that the student engagement, understanding, and analysis can be significantly improved, and the overall teaching efficacy can be increased. Additionally proves that the application of AI technologies in higher education can be a viable way to ensure the gap between theoretical and applied knowledge is bridged, and this concept can offer a convincing example of how educational innovation and change, in general, can be applied [30].

Ranapana and Wijayanayake (2025) examined the impact of AI in software test automation, delving into the main methodologies, applications, and issues that appeared in the course of their implementation. The review establishes and discusses different AI-based methods, such as Machine Learning (ML), Neural Networks, and Genetic Algorithms, which are applied to streamline testing processes, which include the generation of test cases, the detection of defects, and the execution of the tests. The results have shown that AI can significantly enhance the software testing life cycle by automating redundant operations, lowering the number of human errors, or expanding the extent of testing [31].

Danquah et al. (2024) sought to understand the management roles in harmonising the information systems and organizational strategies in the lenses of sociotechnical

systems. The paper has investigated the theme of management responsibilities in the digital transformation of the electrical industry in Ghana through survey research design whereby the authors considered the views of a random population. The paper has brought to the fore management information and leadership roles in digital transformation of firms in the electricity industry. This paper makes contributions to the functions of management in adapting digital technology in transformation of firms [32].

Ateeq, Alzoraiki and Milhem (2024) examined the interplay of innovation and digital transformation and also pointed out the synergies and complexity of the journey towards success. It examines the most important factors and approaches that organizations can use to effectively incorporate innovation and digital transformation programs and the possible challenges and risks that can be encountered. Through understanding the connection between innovation and digital transformation, organizations would be able to come up with a holistic approach that harnesses the strength of technology and innovation to achieve sustainable development and long-term success [33].

The article by Ragel and Balahadia (2023) investigated the application of Visual AI and BDD in software test automation, trying to assess its effects on test creation, execution, and maintenance. The study uses both a mixed-method design, which consists of surveys and assessments of the Visual Test Framework using the Visual AI tools. The results present insights into the advantages and issues of the combination of Visual AI and BDD in the software test automation, which have the potential of facilitating testing procedures, enhancing accuracy, and removing technical challenges [34].

Mali, Singh and Gill (2023) proposed a new concept of automated software testing, which could be used to determine the accuracy, precision and reliability of the software in detecting the touch points through the use of a robotic arm to simulate the touch. Test cases shall be executed and observed in compliance with the guidelines. At the conclusion, a report containing pertinent data on the overall error %, accuracy, timestamp, and total number of touches produced [35].

Sagala et al. (2022) came up with a new concept of automated software testing to determine the accuracy, precision and reliability of the software used to detect the touch point, in which the touch point is simulated by a robotic arm. The test cases executed and followed within the specifications. Finally, a report containing the corresponding statistics on the number of touches done, the accuracy, the time when the touch occurred, the overall error percentage created [36].

Table II summarizes recent studies on Digital Transformation and AI Automation in different studies, highlighting the approaches used, key findings, challenges, and future directions. Showing how the smart automation is applied on continuous digital transformation.

TABLE II. SUMMARY OF RECENT STUDIES ON AI, AUTOMATION, AND DIGITAL TRANSFORMATION

Reference	Study On	Approach	Key Findings	Challenges / Limitations	Future Directions
Wang, Yue & Zheng (2025)	AI-inspired higher-education tools and system	Python-based simulation, dynamic visualization, customized feedback, AI assistant	Better student learning, understanding, analytical ability, teaching efficacy	Not mentioned explicitly; may need digital literacy and infrastructure	Becomes more common in all educational areas AI-based teaching tools
Ranapana & Wijayanayake (2025)	Role of AI in software test automation	Review of ML, Neural Networks, Genetic Algorithms to test generate, detect defects and execute tests	AI enhances automation, minimizes human error, enhances test coverage	Implementation, complexity, data availability, integration challenges	Enhance intelligent automation frameworks and adoption of AI in practice
Danquah et al. (2024)	Management roles in harmonising information systems with organisational strategy	Survey-based study in Ghana's electrical industry	Highlights key leadership and informational roles in digital transformation	Limited to one industry and region; survey-based constraints	Broader cross-industry analysis and expanded strategic digital transformation models
Ateeq, Alzoraiki & Milhem (2024)	Innovation and digital transformation integration	Conceptual & analytical review	Shows synergy between innovation and digital transformation; offers strategies for success	Complexity in coordinating innovation and digital initiatives	Develop comprehensive frameworks for sustainable long-term digital innovation
Ragel & Balahadia (2023)	Integration of Visual AI & BDD in software test automation	Mixed-methods: surveys + evaluation of Visual Test Framework	Visual AI + BDD improves accuracy, streamlines testing, reduces technical barriers	Tool dependency, integration challenges, limited generalizability	Enhance Visual AI-driven testing tools and improve large-scale adoption models
Mali, Singh & Gill (2023)	Robotic-arm-based automated software testing	Simulation of touch interactions, automated monitoring and reporting	Provides accurate, precise, dependable touch-based testing with detailed reporting	Requires robotic hardware; limited to specific types of software interfaces	Expand hardware-agnostic automated testing and refine robotic interaction accuracy
Sagala et al. (2022)	Digital transformation impact on IT roles & leadership in digital banking	Qualitative interviews + document analysis	Identifies changes in IT leadership/roles and provides lessons for transition to digital banking	Limited to Bank XYZ; qualitative scope	Broader benchmarking across more banks; develop frameworks for IT leadership evolution

VI. CONCLUSION AND FUTURE WORK

The high rate of digital transformation and the growing sophistication of contemporary software systems have necessitated the application of intelligent automation in ensuring that the quality, speed, and reliability of software are maintained. Manual testing methods are increasingly failing to match the pace of increasing release frequencies and dynamic application behavior as organizations continue to

adopt continuous deployment, continuous testing, and continuous integration. A way out of these limitations is through Smart Test Automation that is AI and ML-driven, which can be used to improve accuracy, adaptability, and efficiency throughout the software development lifecycle. The autonomous test generation, self-healing test scripts, predictive defect analytics, and intelligent test prioritization are considered key capabilities to reinforce CI/CD pipelines and ensure earlier defects detection and less workloads to maintain them. Recent research findings also indicate that AI-enhanced automation can enhance test coverage, operational productivity and compliance to the digital transformation goals in different industries. In spite of these advantages, the issues associated with cultural preparedness, proficiency construction, technology choice, and data confidentiality still affect adoption achievement.

In future the next step in work can be oriented on creating the single AI-driven testing systems, which will combine NLP, Visual AI, predictive modeling, and autonomous healing into a single intelligent system. Healthcare, financial, and governmental systems. Taxi-specific automation models could add to compliance and precision. Tests at large scale industrial level are required to test long-term reliability and adaptability. Other options are that generative AI should be used to perform automated documentation, interpretation of requirements and scenario modeling. Additional studies ought to also cover data ethics, enhanced privacy measures and employee upskilling policies to enable wider application of intelligent automation in ongoing digital revolution.

REFERENCES

[1] K. R. Limkar and F. A. Tamboli, "Impact of Automation," *Int. J. Sci. Res. Mod. Sci. Technol.*, vol. 3, no. 8, pp. 13–17, Aug. 2024, doi: 10.59828/ijsrmst.v3i8.243.

[2] R. Patel and P. Patel, "A Survey on AI-Driven Autonomous Robots for Smart Manufacturing and Industrial Automation," *Tech. Int. J. Eng. Res.*, vol. 9, no. 2, 2022, doi: 10.56975/tijer.v9i2.158819.

[3] L. Kashap, "Intelligent Automation in Software Testing," *Int. J. Adv. Res. Sci. Commun. Technol.*, vol. 5, 2025, doi: 10.48175/IJARSCT-27788.

[4] T. V. Shah, "Leadership in digital transformation: Enhancing customer value through AI-driven innovation in financial services marketing," *Int. J. Sci. Res. Arch.*, vol. 15, no. 3, pp. 618–627, Jun. 2025, doi: 10.30574/ijsra.2025.15.3.1767.

[5] Engkus, "The impact of digital transformation on public sector organizational commitment: A case study of public management practices," *Edelweiss Appl. Sci. Technol.*, vol. 9, no. 2, pp. 2256–2269, 2025, doi: 10.55214/25768484.v9i2.5062.

[6] J. R. Vummadi, H. Volikatla, and S. Dodda, "Smart HR for Smart Enterprises : A Machine Learning - Based Approach to Payroll Automation and Time Optimization," vol. 6, no. 3, pp. 80–89, 2025.

[7] S. K. Tiwari, "Integration of AI and Machine Learning with Automation Testing in Digital Transformation," *Int. J. Appl. Eng. Technol.*, vol. 5, no. 1, pp. 95–96, 2023.

[8] A. Aldoseri, K. N. Al-Khalifa, and A. M. Hamouda, "AI-Powered Innovation in Digital Transformation: Key Pillars and Industry Impact," *Sustainability*, vol. 16, no. 5, 2024, doi: 10.3390/su16051790.

[9] M. A. Rahman, M. F. Shahrior, K. Iqbal, and A. A. Abushaiba, "Enabling Intelligent Industrial Automation: A Review of Machine Learning Applications with Digital Twin and Edge AI Integration," *Automation*, vol. 6, no. 3, 2025, doi: 10.3390/automation6030037.

[10] K. Murugandi and R. Seetharaman, "Digital Transformation in Retail Sales : Analyzing the Impact of Omni-Channel Strategies on Customer Engagement," *J. Glob. Res. Math. Arch.*, vol. 10, no. 12, 2023.

[11] J. Reis and N. Melão, "Digital transformation: A meta-review and guidelines for future research," *Heliyon*, vol. 9, no. 1, 2023, doi: 10.1016/j.heliyon.2023.e12834.

[12] G. Agarwal, "Test Case Automation: Transforming Software Testing in the Digital Era," *Int. J. Comput. Eng.*, vol. 6, pp. 52–58, 2024, doi: 10.47941/ijce.2314.

[13] S. R. P. Madugula and N. Malali, "Adversarial Robustness of AI-Driven Claims Management Systems," *Int. J. Adv. Res. Sci. Commun. Technol.*, pp. 237–246, Mar. 2025, doi: 10.48175/IJARSCT-24430.

[14] O. Mercy, "From Manual to AI-Driven: The Evolution of Business Process Automation," *Int. Res. J. Mod. Eng. Technol. Sci.*, vol. Volume 12, pp. d49–d50, 2025.

[15] M. A. Mascheroni and E. Irrazábal, "Continuous Testing and Solutions for Testing Problems in Continuous Delivery: A Systematic Literature Review," *Comput. y Sist.*, vol. 22, no. 3, pp. 1009–1038, Sep. 2018, doi: 10.13053/cys-22-3-2794.

[16] R. Roy, "Smart Test Automation Framework Using AI," *Educ. Adm. Theory Pract.*, vol. 26, no. 1, pp. 261–274, 2020, doi: 10.53555/kuey.v26i1.7873.

[17] S. Saarathy, S. Bathrachalam, and R. Bharath, "Self-Healing Test Automation Framework using AI and ML," *Int. J. Strateg. Manag.*, vol. 3, pp. 45–77, 2024, doi: 10.47604/ijsm.2843.

[18] A. Karatayev, A. Ogorodova, and P. Shamoi, "Fuzzy Inference System for Test Case Prioritization in Software Testing," *SIST 2024 - 2024 IEEE 4th Int. Conf. Smart Inf. Syst. Technol. Proc.*, pp. 352–357, 2024, doi: 10.1109/SIST61555.2024.10629262.

[19] A. Khalid, G. Badshah, N. Ayub, M. Shiraz, and M. Ghouse, "Software Defect Prediction Analysis Using Machine Learning Techniques," *Sustain.* , 2023, doi: 10.3390/su15065517.

[20] P. Chandrashekar, "A Survey of Tools, Techniques, and Best Practices: CI/CD Integration in DevOps Workflows," *Int. J. Adv. Res. Sci. Commun. Technol.*, vol. 3, no. 3, pp. 1366–1376, Jul. 2023, doi: 10.48175/IJARSCT-11978V.

[21] V. U. Ugwueze and J. N. Chukwunweike, "Continuous Integration and Deployment Strategies for Streamlined DevOps in Software Engineering and Application Delivery," *Int. J. Comput. Appl. Technol. Res.*, vol. 14, no. 01, pp. 1–24, Jan. 2025, doi: 10.7753/IJCATR1401.1001.

[22] Y. Macha and S. K. Pulichikkunnu, "A Survey of DevOps Practices for Machine Learning and Artificial Intelligence Workflows in Modern Software Development," *ESP J. Eng. Technol. Adv.*, vol. 4, no. 3, pp. 200–208, 2024, doi: 10.56472/25832646/JETA-V4I3P121.

[23] F. Ricca, A. Marchetto, and A. Stocco, "A multi-year grey literature review on AI-assisted test automation," *Inf. Softw. Technol.*, vol. 186, no. Section 3, p. 107799, Oct. 2025, doi: 10.1016/j.infsof.2025.107799.

[24] T. Górski, "Pattern-Based Test Suite Reduction Method for Smart Contracts," *Appl. Sci.*, vol. 15, no. 2, 2025, doi: 10.3390/app15020620.

[25] J. Colton, "AI and ML-Driven Software Testing Automation: Optimizing Distributed Networks for High-Performance Software Systems." 2024. doi: 10.13140/RG.2.2.19856.42245.

[26] S. Garg, "Predictive Analytics and Auto Remediation using Artificial Inteligence and Machine learning in Cloud Computing Operations," *Int. J. Innov. Res. Eng. Multidiscip. Phys. Sci.*, vol. 7, no. 2, 2019.

[27] M. Baqar and R. Khanda, "The Future of Software Testing: AI–Powered Test Case Generation and Validation," in *Lecture Notes in Networks and Systems*, vol. 1424 LNNS, 2025, pp. 276–300. doi: 10.1007/978-3-031-92605-1_18.

[28] S. K. Chintagunta, "Generative AI Approaches to Automated Unit Test Case Generation in Large-Scale Software Projects," *ESP J. Eng. Technol. Adv.*, vol. 4, no. 1, pp. 150–157, 2024, doi: 10.56472/25832646/JETA-V4I1P121.

[29] M. Kans and J. Campos, "Digital capabilities driving industry 4.0 and 5.0 transformation: Insights from an interview study in the maintenance domain," *J. Open Innov. Technol. Mark. Complex.*, vol. 10, no. 4, p. 100384, 2024, doi: 10.1016/j.joitmc.2024.100384.

[30] X. Wang, P. Yue, and L. Zheng, "AI - Powered Digital Transformation in Higher Education: Intelligent Simulation Tool," in *2025 5th International Conference on Artificial Intelligence and Education (ICAIE)*, 2025, pp. 35–39. doi: 10.1109/ICAIE64856.2025.11158253.

[31] R. M. S. Ranapana and W. M. J. I. Wijayanayake, "The Role of AI in Software Test Automation," in *2025 5th International Conference on Advanced Research in Computing (ICARC)*, 2025, pp. 1–6. doi: 10.1109/ICARC64760.2025.10962814.

[32] I. O. Danquah, A. Bhaumik, G. Koi-Akrofi, D. A. Ali, and B. K. Acolatse, "Managerial roles in the digital transformation of firms in

Ghana's electricity industry," in *2024 IEEE 9th International Conference on Adaptive Science and Technology (ICAST)*, 2024, pp. 1–4. doi: 10.1109/ICAST61769.2024.10856467.

[33] A. Ateeq, M. Alzoraiki, and M. Milhem, "Exploring the Intersection of Innovation and Digital Transformation: Navigating the Path to Success," in *2024 International Conference on Open Innovation and Digital Transformation (OIDT)*, 2024, pp. 1–7. doi: 10.1109/OIDT59407.2024.11082694.

[34] R. K. C. Ragel and F. F. Balahadia, "Visual Test Framework: Enhancing Software Test Automation with Visual Artificial Intelligence and Behavioral Driven Development," in *2023 IEEE 15th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM)*, 2023, pp. 1–5. doi: 10.1109/HNICEM60674.2023.10589222.

[35] A. Mali, G. Singh, and H. S. Gill, "Robotic Arm Based Display Touch Test Automation," in *2023 International Conference on Advances in Computing, Communication and Applied Informatics (ACCAI)*, 2023, pp. 1–7. doi: 10.1109/ACCAI58221.2023.10201044.

[36] Y. P. Sagala *et al.*, "Digital Transformation Impact Analysis towards Transition in the Role of Information Technology for Organization in New Digital Bank," in *2022 Seventh International Conference on Informatics and Computing (ICIC)*, IEEE, Dec. 2022, pp. 1–6. doi: 10.1109/ICIC56845.2022.10007003.

