IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

AI-Enhanced Robotic Process Automation: A Review of Intelligent Automation Innovations

Vharkate Aniket, Nemane Gopal, Bhagat Tukaram, Gujar Dhananjay, Prof. P. V. Gaikwad
Student, Department of Computer Engineering
Professor, Dept, of Computer Engineering
Adsul Technical Campus, Chas, Ahilyanagar, Maharashtra, India

Abstract: *The rapid technological growth in recent decades due to the integration of robust technologies and automation have led to the rise of digital services and the emergence of Industry 4.0. This paper explores the concept and potential of AI-powered intelligent automation based on the synergistic use of Robotic Process Automation (RPA) and Artificial Intelligence (AI) to enhance organizational and business processes across various sectors. RPA automates routine, rules-based tasks, thereby allowing human workers to engage in more innovative activities. When integrated with AI, RPA systems gain the capacity to analyze data, identify patterns, classify information and forecast which leads to significant improvement in accuracy and productivity. This literature review investigates the current state of RPA and AI integration while highlighting its applications in different sectors such as manufacturing, agriculture, healthcare, finance, and retail. Along with discussing the drawbacks and restrictions, such as technological issues and moral dilemmas, this paper also discusses the advantages of this integration, which include decreased costs, increased output, and simplified operations. By leveraging AI techniques such as classification, text mining of neural network, RPA technologies optimize business operations and advance Industry 4.0. This study also illustrates the challenges and limitations of this integration such as technical difficulties and ethical considerations. The aim of this review is to provide a comprehensive understanding of the synergistic potential of RPA and AI while offering insights into their contribution in shaping the future of intelligent automation.*

Keywords: Aerial drones, artificial intelligence, environmental monitoring, machine learning, risk assessment, spatiotemporal data, wildfire detection, wildfire risk estimation

I. INTRODUCTION

The rapid advancement of technology in recent years has, in many ways, ushered in a new wave of digital transformation that is reshaping what organizations do, how they operate, and with whom they compete globally. At the heart of this shift is an integrated set of advanced automation technologies driving the emergence of a new industrial era—Industry 4.0. Central to this revolution are Robotic Process Automation (RPA) and Artificial Intelligence (AI), two complementary capabilities that, when combined, unlock remarkable potential to streamline business processes, enhance productivity, and reduce operational costs. Robotic Process Automation (RPA) is an emerging technology that enables organizations to easily automate routine, rules-based tasks traditionally performed by humans. These tasks often involve repetitive actions such as data entry, file transfers, and various back-office operations. By deploying RPA bots, organizations can execute such mundane activities far more quickly and accurately than human workers, thereby reducing errors and significantly boosting productivity. However, RPA lacks the cognitive capabilities associated with Artificial Intelligence; instead, it operates strictly on predefined rules and is therefore best suited for processes requiring little to no human judgment. According to Grand View Research, the RPA market is expected to grow at a compound annual growth rate (CAGR) of more than 40%, reaching $25 billion by 2027 [1]. With its strong potential for cost savings, error reduction, and overall process improvement, RPA has seen increasing adoption across a wide range of industries. When Robotic Process Automation (RPA) is integrated with Artificial Intelligence (AI), its full potential emerges, as AI provides cognitive capabilities that enhance automation. AI enables tasks that require human-like

DOI: 10.48175/IJARSCT-30194

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

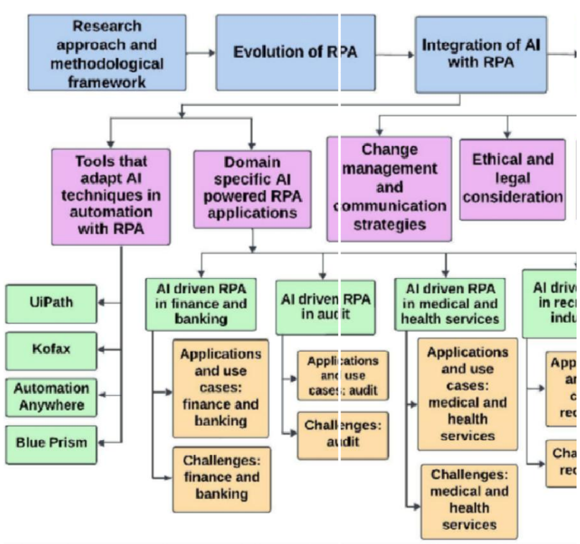
intelligence, such as data analytics, pattern recognition, and decision-making, allowing companies to elevate their automation from simple, rule-based workflows to complex

The popularity of both RPA and AI continues to rise each year as more enterprises adopt these technologies to support digitization across various industries. In the past, automation was a large, complex undertaking that required highly skilled professionals to design and deploy extensive systems. Today, the integration of AI with RPA has enabled the creation of lean, end-to-end business processes that empower companies to innovate and transform workplace practices. As a result, many industries now embed AI into advanced technologies to strengthen digital automation, improve operational efficiency, and enhance customer experience. This paper explores the evolution of RPA, tracing its shift from basic automation to becoming a key component of modern business processes. It examines how AI integrates with RPA to expand automation capabilities and support more intelligent and complex operations. Additionally, the paper reviews major tools that enable RPA–AI integration, including UiPath, Kofax, Automation Anywhere, and Blue Prism. An in-depth analysis of AI-driven RPA applications is presented across multiple sectors, particularly Finance and Banking—where AI-powered RPA automates loan processing, enhances fraud detection, performs automated credit checks, and improves customer service, along with addressing challenges related to data security, compliance, and system integration. The paper also covers the auditing sector, highlighting how AI-based RPA improves efficiency and accuracy, reduces human error, and enables continuous monitoring of financial activities, while also addressing issues involving large data volumes and the need for transparency in AI-driven decisions. The medical and health services sector has also benefited greatly from AI-enabled RPA, which simplifies patient data management, automates administrative functions, and streamlines diagnostic-related processes; however, this industry continues to face challenges such as data privacy concerns and ethical issues involving AI in healthcare, which are discussed later in this paper. In the recruitment industry, AI supports resume screening, candidate ranking, and interview scheduling, though concerns related to model bias and transparency in automated decisions persist. In manufacturing, AI-based RPA optimizes production processes, strengthens supply chain management, and enhances quality control, while challenges remain in integrating AI into existing manufacturing systems and handling the complexity of industrial operations. The paper also presents a real-world case study of AI-powered RPA in back-office operations, illustrating how automation can be implemented without disrupting current systems, followed by an examination of the technical hurdles associated with AI-RPA integration in data-intensive environments. Furthermore, this study discusses broader challenges and limitations in deploying AI-powered RPA, including technical complexity, integration difficulties, data privacy issues, and ethical considerations, emphasizing the need for robust planning, governance, and continuous improvement. The paper also explores open research challenges in AI-driven RPA, covering areas such as change management, ethical and legal implications, machine-learning model selection, and the explainability of AI-enhanced processes, while investigating future opportunities for Intelligent Process Automation in emerging sectors like agriculture. Ultimately, this paper aims to provide a comprehensive review of AI-powered RPA systems across multiple industries, as outlined in Figure 1, and offers a broader perspective compared to many existing literature reviews that focus on a single domain or technology, as reflected in Table 1. It further examines recent advancements in major RPA tools, including UiPath, Kofax, Automation Anywhere, and Blue Prism, and explains how AI improves their capabilities. By integrating findings across various sectors, analyzing use cases, identifying challenges and knowledge gaps, and proposing future research directions, this study also introduces an AI-powered RPA framework tailored for the agricultural sector—an area that has received limited attention in current literature.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

TABLE 1. A summary of the review papers focused on RPA and AI based systems.

Paper	Contribution
[illegible]	This paper attempts to focus on the theoretical and practical challenges in combin[illegible] scholarly literature review and an interview study.
[illegible]	Authors here provide an in-depth exploration of RPA, addresses the gap in guiding [illegible] The paper also examines the use of RPA across various business organizations and
[illegible]	This study presents theoretical and practical applications of AI, AI-based RPA and [illegible] some ways on how to choose RPA and AI technologies that align with the requirem[illegible] AI-based RPA techniques and RPA tools, it doesn't provide an in-depth analysis.
[illegible]	This paper explores potential RPA and AI challenges. They also presents a literature s[illegible] on Intelligent Process Automation, aiming to motivate researchers from RPA and [illegible] two technologies.
[illegible]	The authors here reviewed studies exploring the integration of AI and RPA, [illegible] efficiency and adaptability to increasing market demands. Additionally, they propose [illegible] impacts that may result from the adoption of these technologies.
[illegible]	The contribution of this paper is to highlight the key aspects of RPA and reviews it[illegible] potential in healthcare domain.
[illegible]	This paper explores the potential of RPA in the financial and insurance industries [illegible] challenges and discusses how advancements in AI could bring significant future b[illegible]
[illegible]	This paper focuses on how AI and RPA can transform the banking industry by [illegible] experience and operational inefficiencies. It highlights how AI with RPA can strea[illegible]
[illegible]	The authors of this paper attempt to provide an understanding of RPA as a transform[illegible] outlines challenges, and addresses the human impact of RPA adoption.
[illegible]	The purpose of this analysis is to gather data and research on the use of RPA, and [illegible] to develop more effective and suitable methods for application in people managem[illegible] requirements on its servers.
[illegible]	This paper explores the transformative role of AI and RPA in shaping smart cities an[illegible] 5G and future 6G technologies. Additionally, it outlines frameworks, such as RPA [illegible] in urban environments and improving digital infrastructure.



DOI: 10.48175/IJARSCT-30194

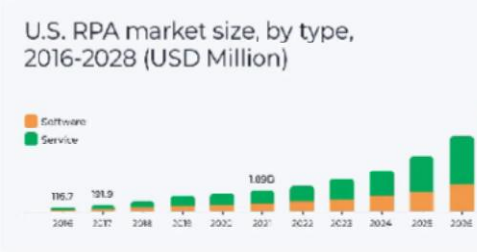
IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

III. RESEARCH APPROACH AND METHODOLOGICAL FRAMEWORK

This paper adopts a literature review approach inspired by the Systematic Literature Review (SLR) methodology, which is structured into three distinct phases:planning, conducting, and reporting as shown in Figure 2. In the planning phase, we identified the necessity for this study (as outlined above) and developed a comprehensive search protocol that includes inclusion/exclusion criteria. For identifying relevant articles, we applied these criteria using Google Scholar and reputable databases such as IEEE Xplore and SpringerLink. The search process was guided by two specific keywords: ‘‘RPA’’ and ‘‘AI.’’ The initial selection involved screening titles to evaluate their relevance against predefined inclusion criteria, followed by a detailed review of abstracts. Articles passing these stages were further checked for full-text accessibility. In the conducting phase, we systematically curated a final set of articles for review. These articles were analyzed with a specific focus on methodologies related to RPA and AI. Finally, in the reporting phase, we synthesized the findings, providing our interpretations, critical analyses and insights into the reviewed literature [15].

IV. EVOLUTION OF ROBOTIC PROCESS AUTOMATION (RPA)

As mentioned before, the RPA market is projected to reach $25 billion by 2027, with a CAGR of over 40%. And, USA alone will exceed $12B by 2028, with a CAGR growth of 32.8%. The growth is largely fueled by RPA service models, with the RPA-as-a-service segment capturing over 61% of the market share in 2022 and experiencing the fastest growth rate [16]. Figure 3 illustrates a market analysis or RPA.



The growth reflects the widespread recognition of RPA and its potential in different industries where automation can provide with transformational benefit [7].

RPA has a rich history that started from the early days of computing and automation in 1990s. It emerged with the use of screen scraping and workflow automation software. These technologies allowed the automation of repetitive tasks by capturing data from graphical user interface (GUI). The concept got more recognized when organization started adopting automation in their business process automation altering their IT infrastructure [17]. The term ‘‘Robotic Process Automation’’ was addressed as a separate automation category in the automation industry in 2010. The early adoption of RPA started with the use of automating simple, rule-based tasks.

Around 2012, companies like Blue Prism, Automation Anywhere and UiPath appeared to be as leading vendors that provides platform to design business automation pro- cesses [17]. The RPA market started to gain recognition for its potential of cost saving and operational efficiency during the year between 2013 and 2015 [18]. Gradually the adoption flowed across different industries such as financial, healthcare, manufacturing and so on. The flexibility of deploying RPA played a significant role into the growth of RPA.

During 2017, businesses started to publish report on high returns on investment (ROI) from their automation processes. Gradually, RPA’s evolution started to be advanced by the introduction of AI technologies which began enhancing the potential of RPA and leaded towards IPA [19]. That’s when UiPAth, Automation Anywhere, Blue Prism and other vendors started to receive funds to accelerate the development of RPA by integrating AI technologies. This advancement and integration of AI and RPA allowed bots to handle unstructured data and make complex predictive decisions. This development made significant shift in the automation industry during 2019 [20]. The COVID-19 accelerated the digital transformation across the organization with the need of maintaining social distancing [21]. [22] investigates the use of emerging RPA and AI in mitigating the negative impacts of the COVID-19 pandemic on the

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

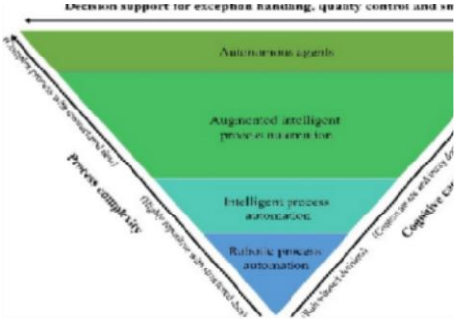
global economy and public health. It explores how these technologies can be applied across various industries to effectively manage the challenges posed by the pandemic.

V. INTEGRATION OF ARTIFICIAL INTELLIGENCE (AI) WITH RPA

In today's world, AI algorithms and Machine learning(ML) techniques has been implemented in almost all sectors where digital transformation is introduced. ML is used to train machine how to deal with large dataset efficiently. By using AI techniques, it is possible to explore data, get deep insight from the data, extract information, analyze and predict future trends. Having these scopes of AI, the implementation of RPA has been powerful than ever [23]. There are use cases where an outcome is not 100% guaranteed to be correct. For example, value of a property, analyzing the risk of a loan default, and predicting inventory. If we want to value a property, we need to consider some key factors such as the age of the house, the location and so on. Each of this needs to be analyzed against each other to forecast the value. Earlier, only human brain could do such complex calculation. Now, AI can help robots to accurately predict the results using its advanced techniques.There are cases where the outcome depends on multiple variables. For example, finding matching resume for job placements. This a hectic job for recruiters. With the help of AI, robots can automatically match candidate's skill sets for relevant job posting. Apart from that, robot alone cannot deal with unstructured data (images, video or text). But when advanced AI is combined with the robot, the robot can learn the pattern of unstructured data too. Also, RPA always provides a single kind of outcome. On the other hand, AI can work on both structured and unstructured data to produce different kind of outcomes and predictions.

To enhance the functionality of both of these technologies, there is a need to combine these two technologies.

[24] mentions the integration of RPA, AI and soft computing as Intelligent Automation (IA). The authors furthermore, categorize IPA as a part of IA. In our paper, we will mostly focus on IPA. An overview of IA technology is illustrated in figure 4.



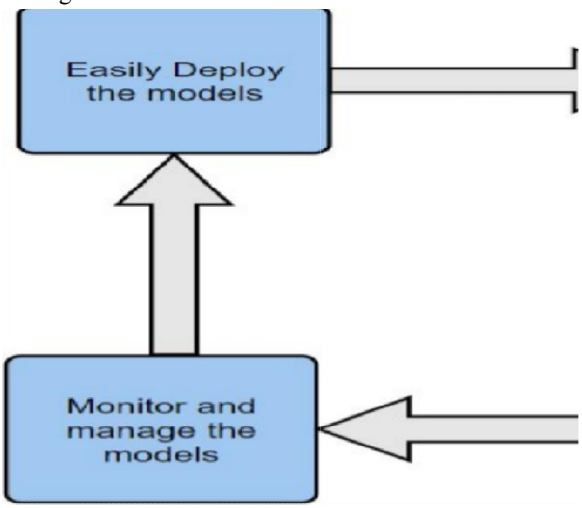
IPA [25] combines RPA and AI with other advanced technologies into one preconfigured software instance that is capable of executing processes that require routine tasks with minimal human input [26] as well as cognitive capabilities such as infusing NLP technology [27], [28], [29]. The IPA technology need low level of human intervention in compared to RPA process. However, they need fine tuning to select optimal ML models. IPA has been utilized in both internal (back office) and external (front office) services in industries such as banking [30]. In recent years, several studies have been conducted on the applicability, challenges and potential of IPA. These studies include case examples [31], such as automatic discovery and data transformation, auditing [32], business process management, and productivity optimiza- tion [33]. There have been studies on different tools that have made integrating AI in RPA easier. In our next section, we will focus on the tools.

VI. TOOLS THAT ADAPT AI TECHNIQUES IN RPA AUTOMATION

UiPath is a software company which provides platform to create software bots for business process automation. It has an architecture based on web Orchestrator that is built on .NET. It facilitates the development and execution of RPA function- alities through a block-based interface and various plugins for business process automation. The platform operates with three specific modules; UiPath Studio, UiPath Robot and UiPath Orchestrator. UiPath Studio is used to design, model and execute workflows, while ensuring the management and transfer of packages between robots. The

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

workflows are created by RPA developers. UiPath Orchestrator is used to upload bots in cloud, deploy them and manage the resources. Various configurations such as, saving login credentials of websites or platforms, scheduling the runs, storing multiple bots are managed in Orchestrator. An RPA admin usually takes care of such things. There are two kinds of robots; attended and unattended. The attended robots need human intervention to complete tasks whereas unattended bots can run independently. UiPath offers five types of recorders: basic recording for individual activities, desktop recording for



capturing multiple actions across different applications, web recording for recording activities in web browsers, and image and Citrix recording for virtual environments, which support image, text, and keyboard automation [34].
According to UiPath documentation [35], UiPath has now connected AI in the tool by introducing AI Center. AI Center allows to coordinate all the stages of AI life cycle, including deploying, utilizing, managing, and enhancing machine learning models as shown in the following image 5.

1) EASILY DEPLOY MODELS

It allows for seamless integration of AI into the automation processes. It has made possible to oversee the models, monitor their development, interact with them, and validate predictions to improve accuracy over time. AI Center simplifies the deployment and scaling of AI in production environments. Users can upload their own models or choose from a variety of pre-built models offered by UiPath, UiPath's partners or the open- source community.It has made deploying easy with just a few clicks. The user-friendly interface allows data scientists and RPA developers to focus more on addressing business challenges and less on development operations and engineering tasks.

2) DRAG AND DROP MODELS INTO AN RPA WORKFLOW

It allows injecting ML models with its simple drag and drop interface. It is easy to choose ML models from dropdown and inject them into the workflows developed in UiPath Studio. As the ML models get trained on data, they recognize unstructured data and their patterns to make predictions. This increases the scope of automation capacity by allowing companies to automate complex business models that has cognitive requirements. Also, as UiPath allows users to choose ML models, the data science team do not need to spend much time on implementing models. This will increase productivity and free up resources.

3) MONITOR AND MANAGE THE MODELS

updates to new versions and provides the ability to revert to previous versions if necessary. AI Center enhances understanding and engagement not only for data scientists and RPA developers but also is a beneficial tool for business users and leaders. By observing models and automation in action within a single platform, leaders and managers gets more visibility which helps them to understand what works for their business and what does not.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

4) CONSTANTLY MAKE THE MODELS SMARTER

The power of AI Center increases over time as models get improved with the validation and learning of experienced developers. Developers identify low-confidence predictions made by model and update the model by retraining and changing parameters. This eventually increases the potentials of automation.

A. Kofax

Kofax [36] is a company that automates business processes for companies and organizations. They have Kofax intelligent Automation platform that includes capabilities such as AI, RPA, Cognitive Capture, Process Orchestration, Advanced Analytics and so on. It allows data extraction from web, email, local files and ERP systems. It now incorporates AI techniques and algorithms for document content, context recognition, and information classification in emails, web portals and documents. The tool uses machine learning approaches for supervised learning in OCR document recog- nition and classification and natural language processing for both supervised and unsupervised learning to analyze content. Supervised learning is one of the versions of machine learning. The algorithm in supervised learning learns from the data about the labels during training phase by making repetitive prediction and correction. On the other hand, the algorithm in the unsupervised learning generates inferences without knowing the labels [37]. Natural language processing is considered as a type of both supervised and unsupervised machine learning which creates a way to analyze texts by computerized means [38].

C. AUTOMATION ANYWHERE

Automation Anywhere [34] is a leading provider of RPA tools. It offers a client-server-based architecture. It has three main components; Bot Creator, Control Room, and Bot Runner. The Bot Creator facilitates the easy design and automation of bots. The Control Room handles the execution and scheduling of bots, manages credentials, addresses security issues, and oversees client permissions and assessments. The Bot Runner is responsible for running bots and recording analytics which are then sent back to the Control Room. Automation Anywhere supports three types of bots which are Task Bots, Meta Bots, and IQ Bots. Task Bots are used for automating rule-based, repetitive tasks, while Meta Bots serve as reusable building blocks for other bots. IQ Bots, on the other hand, have cognitive and intelligent capabilities for processing unstructured data. The platform offers three types of recorders—Screen Recorder, Smart Recorder, and Web Recorder—to automate tasks which mimics user actions. Additional features of Automation Anywhere include BOT INSIGHTS, an analytics engine that visualizes user data to provide business insights. Then there is BOT FARM, which allows companies to purchase RPA tools based on usage rather than capacity or licenses. Lastly it offers BOT STORE, a marketplace where various plug-and- play bots are available.

Automation Anywhere has added a functionality called AI Agent Studio in their system to build AI Agents [39]. AI agents are software programs designed to interact with their operating environment that perform cognitive tasks and make decisions autonomously or semi-autonomously by analyzing data using machine learning algorithms. The features of AI agents are as follows [40]:

Purpose-Driven: AI agents are designed with specific objectives rather than following a set sequence of steps. They utilize all available capabilities and information, including organizational knowledge and environmental perceptions to conduct their assigned tasks.

Autonomy/Partial Autonomy: AI agents can operate based on their on intellectual without the need of any human intervention. They are smart enough to take decisions and act accordingly to target their goals.

Memory: AI agents keep track of their plans, experience and communication to ensure continuity of their work, inform future actions and update in their performance.

Planning: AI agent create sequence of their tasks and work according to the objective. Their planning capabilities have improved with the integration of Large Language Models (LLM).

Perception: AI agents continuously perceive and process new information in real-time. Using sensors and data inputs, they can assess their surroundings and adjust their actions when needed.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

Reasoning: AI agents have the ability to make decisions and solve problems. By processing new information and connecting their perceptions of the environment or situation to their foundational knowledge and predefined objectives, AI agents is able to determine the optimal course of action.

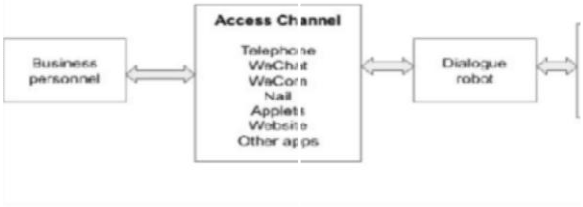
Action: AI agents are capable of taking action. They can interact with and influence their environment to meet their assigned goals and objectives by being con- nected to actuators and execution systems, such as ERP applications.

Reference [40] also describes different types of AI agents. Each AI agent type, whether simple reflex or hierarchical, possesses distinct strengths and characteristics that make them appropriate for different enterprise automation situations. AI agents are categorized based on traits like reactivity or proactivity, the characteristics of their environment, and whether they function individually or within multi- agent systems. For instance, static environments may need agents that can perform

APPLICATIONS AND USE CASES: FINANCE AND BANKING

Kai et al. [47] describe how AI and RPA are combined to enhance the financial office's intelligence and automation capabilities. This architecture utilizes RPA for conducting repetitive tasks accurately while AI provides cognitive abilities for intelligent decision-making. Here, they create a robot that includes dual architecture where RPA acts like ''hands'' and AI acts like ''brain'' of the robot.

This design is based on two main components: human-computer interaction and software workflow. The human-computer interaction focuses on how financial staff deal with software to ensure smooth communication and task completion. On the other hand, the software workflow component makes interaction between AI and RPA to execute.



1) USE CASE 1: LOAN PROCESSING

The loan process generally involves the customer completing numerous forms, which the bank then verifies. The bank checks customer's credit history before approving the loan and disbursing the funds. Intelligent automation powered by AI and RPA can play a major role here to automate the end-to- end processes and transform business operations. The figure 7 bellow depicts a recommended way for an automated load processing focusing on the applicability of AI and RPA.

a: LOAN APPLICATION AND DOCUMENT SUBMISSION

In the loan application process, while some banks have digitalized systems for submitting applications, others still rely on paper forms. For these banks, RPA using its OCR (Optical Character Recommendation) technology can automate data extraction and entry to bank's loan system. Since the data entry is a manual and error prone process, here RPA can help improving accuracy and efficiency. also, as loan. documents usually follow a standard format, using RPA is often sufficient without applying advanced AI. However, this approach should be assessed for feasibility.

1) DATA QUALITY AND INTEGRATION ISSUES

Both studies highlighted the critical role of data collection, processing and validation in the financial and banking areas. However financial institutions often rely on legacy systems that may not be compatible with modern AI and RPA technologies that leading to data inconsistencies and integration difficulties. And so ensuring high data quality and seamless integration across multiple systems is a critical challenge when implementing AI and RPA in banking. Inaccurate or

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

incomplete data entries can lead to incorrect AI predictions, which can be particularly problematic in processes like loan approval or risk assessment [47]. Integrating various systems and ensuring data flows seamlessly between AI and RPA components is also challenging due to legacy systems and fragmented IT environments.

2) REGULATORY COMPLIANCE AND RISK MANAGEMENT

When using AI and RPA to automate tasks like fraud detection and loan processing one must take into account the dynamic and complicated regulatory environment. A major problem in the banking business is that it adheres to tough regulations such as GDPR, AML (Anti-Money Laundering) and KYC (Know Your Customer) etc. For regulatory compliance it is imperative that AI predictions are auditable and explicable particularly when it comes to loan processing and fraud detection [48]. Furthermore, updating AI models and RPA workflows on a regular basis is necessary to maintain compliance due to the changing nature of regulatory environments. When it comes to the application of RPA in banking, Patri [52] explores the difficulties associated with regulatory compliance. Through the implementation of strong governance frameworks and transparent and explainable AI decisions, the paper offers insights into how banks may effectively manage these obstacles.

1) SECURITY AND PRIVACY CONCERNS

Security and privacy are major concerns since the banking industry uses AI and RPA to process massive amounts of sensitive personal and financial data. Financial institutions need to make sure that data protection laws are followed while safeguarding this information from cyberbullies. AI models used in fraud detection and other critical banking operations can become targets for adversarial attacks, where malicious actors attempt to deceive the AI system. Moreover the integration of AI and RPA increases the attack surface and potentially exposing banks to higher risks of data breaches [48]. The study by Iyamu and Mlambo [53] provides an analysis of security and privacy challenges in the context of RPA implementation in the banking sector. The authors emphasize the importance of addressing these concerns through robust security measures and privacy frameworks to protect sensitive data. The study by Choubey and Sharma [54] examines the impact of RPA on sustainable banking in India, highlighting that despite potential risks related to security and privacy, the adoption of RPA in banking is expected to grow significantly. The research emphasizes the future integration of robots with human workers, predicting that RPA will enhance efficiency and support sustainable economic models in the banking sector.

VII. AI DRIVEN RPA IN AUDIT

Auditors usually deal with heavy workloads as they have to meet strict deadlines in most cases. A survey of over 700 auditors examined the relationship between audit work- loads, perceived audit quality and job satisfaction. It shows that auditors need to work an average of five hours per week beyond their schedule which decreases the quality of their work [57]. Strict deadlines and the shortage in number of resources are considered to be the primary factors for the excessive workloads. Furthermore, the survey found that auditors' job satisfaction decreases significantly when workloads surpass the level that negatively impacts audit quality. These findings align with the PCAOB's concerns that heavy workloads threaten audit quality and suggest that the main drivers of excessive workloads could be the root cause of workload-related audit deficiencies. If the audit is conducted by external agencies, there is a possibility that there will be corruption and loopholes [58]. To address these challenges, public accounting firms are exploring the potentials of RPA [59], [60], [61], [62] and AI [63], [64], [65] to enhance the capability of their audit software. The term automation is not new to managers of auditing firms as it always requires multiple repetitive tasks such as reconciliations, internal testing and detail testing. Earlier audit firms were dependent on scripts written in Python or R language. For that they needed to hire developers or programmers which was a major investment of money. That's why audit firms are not eager to implement automation through RPA [58] that requires low code or no code. However, there have not many researches conducted on AI powered RPA audit processes. We will talk about some of the applications and use cases in our next section.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

A. APPLICATIONS AND USE CASES: AUDIT

Reference [66] provides a framework for implementing IPA in audit. They divide their framework in three sections; Ana- lyzing the audit workflow, automating individual audit tasks and forming the IPA structure. Analyzing the audit workflow involves determining the primary, secondary and lower-level workflows. They mention that, a detailed understanding

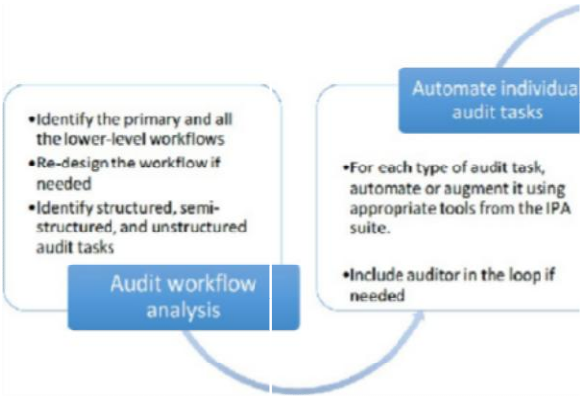


FIGURE 11. Framework of IPA implementation in audit

X . AI DRIVEN RPA IN RECRUITING INDUSTRY

Another excellent application for deploying an Intelligent Process Automation or AI enabled RPA system in large enterprises is in recruitment industry [49]. IPA can streamline the recruitment process by helping recruiters collect resumes from various online portals, analyze specific skill sets, assess candidate value, and filter out spam and unwanted appli- cations. This technology allows recruiting team to identify suitable candidates more efficiently and cost-effectively. IPA not only discards non suitable applications but also aids in sorting relevant resumes and ensure access to applications that closely match job requirements. It supports HR personnel throughout the entire recruitment process, from screening and evaluation to final integration and management. Recruitment industries get benefited not only in the hiring process but also in financial functions. According to Robert Half, the world's first and largest specialized talent solutions firm, many companies, including theirs, are now adopting IPA to streamline and enhance complex tasks, such as tax and com- pliance reporting and financial statement reconciliation [79].

A. APPLICATIONS AND USE CASES: RECRUITING

In this section we will talk about two use cases from two different studies.

1) USE CASE 1

Reference [80] proposes a system including RPA and AI that will help HR recruiters to rank resumes based on job descriptions. At first, the job requirements are sent to the bot called PrimeBot via emails. The robot then downloads the email to a specific folder. The description can be C++/SQL which will act as a keyword for the robot. The robot then scans

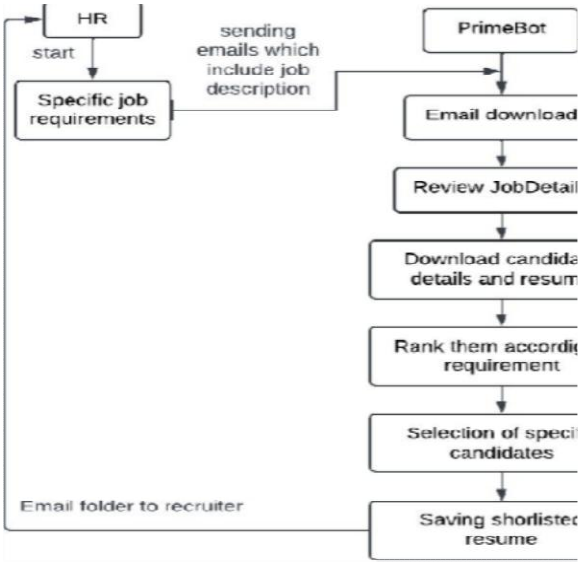
various resumes for these keywords and if a keyword is found in a resume, the resume is ranked based on the percentage of keyword matches. The robot parses resumes in any format(PDF, DOC, TXT) and ranks them accordingly. The output is generated in a CSV file. After that, the resumes are moved from one folder to a final folder based on the percentage criteria. The final folder including the resumes in CSV format is then emailed to the HR recruiter.

For ranking, they propose to use the SVM (Support Vector Machine) classifier. They describe the logic of how SVM works. Given two items, item1 and item2, the SVM classifier determines their order. If item1 is meant to be ranked

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

before item2, the input to the classifier is (item1, item2) and the output is 1. This signifies the correct order. Conversely, if the input is (item2, item1), the output is -1. This indicates that the order is incorrect.

The ranking process for a set of three items, (item1, item2, item3), using the SVM classifier is illustrated by assigning scores based on pairwise comparisons:.



1) USE CASE 2

Reference [81] provides a solution including artificial intelligence and robotic process automation to release some of the duties from recruiters. The whole solution is illustrated in two in 14 and 15.

Phase 1: The process starts with HR people deciding on the necessary job positions and required skill for the company. After they create the description, the system is able to make a list of technical skill and soft skill needed for the role from the description provided. An HR can modify the list as well. The proficiency of the skill is determined by rating on a scale of 1 to 5 stars. The system also allows job offers to be marked as inactive at any point which will result in removing the job offers from the system Once job offers are posted on the company's internal portal, it is expected to see several CVs and cover letters. The system will then traverse through candidate's CV search for key.

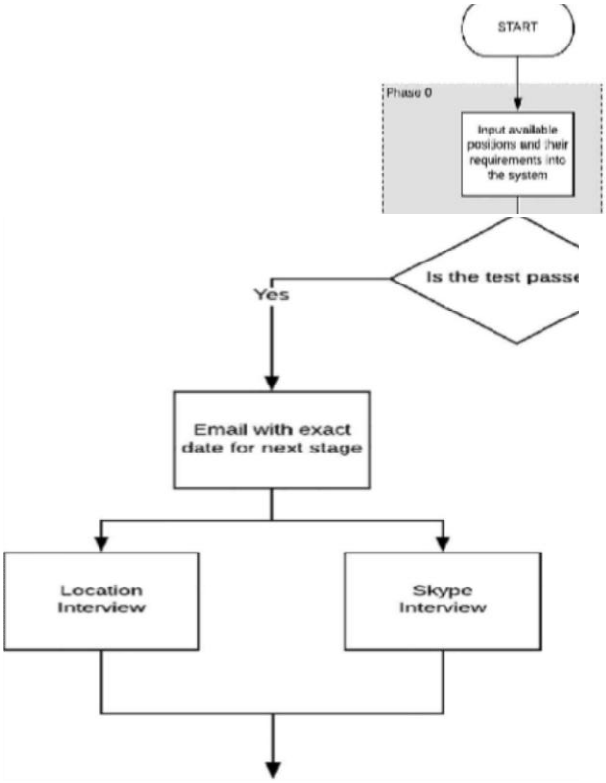
words to pull information such as their name, phone number, address and technical skills. An account will be created automatically in the portal with the information. At this point, the system should be able to determine whether the candidate is suitable for the position or not. If the candidate is not a good for the given position but possibly suited for a different position listed in their portal, they will be notified by email and encouraged to apply for the position. If the candidate is suitable for that position, an interview will be arranged virtually by the system. There will be options to choose time through the system that meets with HR's availability. The email will also suggest a set of times for the candidate to choose from.

Phase 2: Once the candidates are selected from the first phase, they will be asked to participate in the interview online. Their facial expressions can be assessed by using advanced software during the interview. Recruiters and interviewers will take tests in multiple stages to evaluate the candidates. At the end of the recruitment process candidate will discuss their salary expectations and benefits. System will then check if the expectations are reasonable based on the job descriptions and current market analysis. All results including camera reports collected from software will be saved in the database and can be evaluated again later if any positions open up. Here, RPA can again help to insert data into database and scheduling video interview with description on how to use the video platform [83]. Whereas, AI can help to do market analysis.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

CHALLENGES: RECRUITING

The implementation of AI-powered Robotic Process Automation for resume screening in recruitment processes, as described in the use case involving PrimeBot, introduces several significant challenges as well. One of the primary challenges is the risk of bias in the AI models used for ranking resumes. The SVM classifier, while effective in ordering resumes based on keyword matching, may inadvertently reinforce existing biases present in the training data. Based on the selection of keywords or the historical data used to train the model certain demographic groups might be overrepresented or underrepresented. To ensure that the automated system does not unfairly disadvantage certain candidates, bias mitigation is essential. Studies have shown that AI-based recruitment tools can perpetuate biases if not carefully managed [84].



The process involved in collecting, storing, and processing candidate data raises concerns about data privacy and security. Ensuring compliance with data protection standards like GDPR is important for RPA and AI systems since resumes often contain sensitive personal information. The public release of SVM classifiers could unintentionally expose private details of candidates if the support vectors used in the classification are not properly anonymized.

AI DRIVEN RPA IN MANUFACTURING

The manufacturing sector is utilizing AI-powered RPA systems at a growing rate in order to increase productivity and efficiency by automating repetitive and manual processes.

APPLICATIONS AND USE CASES IN MANUFACTURING

In [67], the author has mentioned several uses cases of intelligent automation in manufacturing. Some of them are listed below:

1. PRODUCT TRACKING

Product tracking is an approach that is used to measure, analyze and advance visibility across the manufacturing process. Using intelligent automation, manufacturers can create an almost real-time visualization of progress of orders

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

and ongoing needs of components and materials. This helps manufacturers optimize their process, utilize resource and keep margin low.

BILL OF MATERIALS

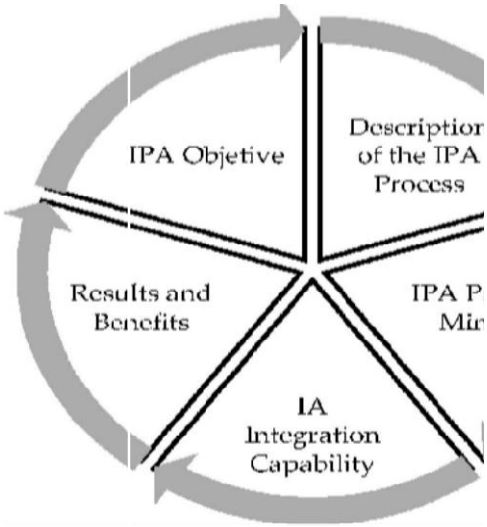
Maintaining an accurate bill of materials (BOM) is crucial for manufacturers because it gives them information about the parts, sub-components, intermediate assemblies, raw materials and their corresponding amounts that are required to make a high-quality final product. Manufacturers can effectively gather product data and replicate the human procedures required to build an accurate BOM quickly and with little errors by utilizing intelligent automation.

a: IPA OBJECTIVE

The purpose of this step is to create purchase orders for fabric stamping. Here, RPA robot follows a templated process to create the purchase order in SAP and generate an email response by attaching the order in a PDF format.

b: DESCRIPTION OF THE IPA PROCESS

The process starts with receiving a customer email which includes a file that has fabric purchasing requirements such as quality, color and type. This information is initially validated before being sent to the Orchestrator to activate the robot. If there are pending orders, the robot logs into SAP.



c: IPA PROCESS MINING

In this step they have described the sequence in which IPA carries out its tasks. They also mention exceptional cases where error may occur for example, when RPA robot receives an email it validates its information with the existing materials inserted in SAP. If information doesn't match, it sends out an email including the reason behind the error to a desired mailbox. The information that are sent to RPA Orchestrator are: material, delivery cycle, value, brand, quality, the quantity of fabric required, ID of the fabric supplier, minimum quantity to take, and priority of the order, among others.

D.CHALLENGES: MANUFACTURING

The integration of AI-powered RPA systems in manufac- turing presents several specific challenges, particularly in areas such as product tracking, supply chain demand planning and production automation. One of the key challenges is ensuring the accuracy and consistency of data throughout the manufacturing processes. Automated systems heavily rely on data integrity for tasks such as bill of materials (BOM) and product tracking. Any inconsistency or error in data could result in production delays, increased costs or faulty products. For example, as seen in the implementation of AI in fabric roll allocation, errors in data validation or processing could disrupt the entire workflow, causing significant inefficiencies [89].

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

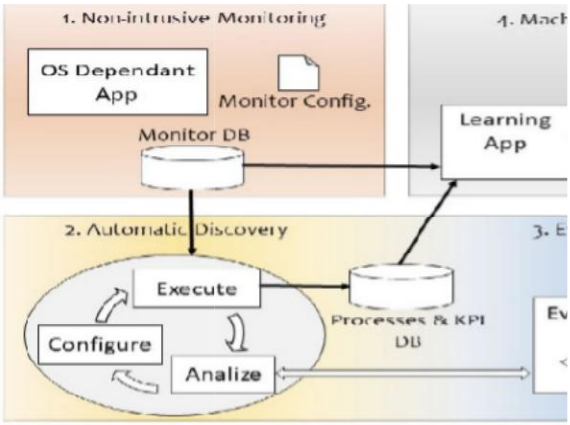


FIGURE 17. A global view of RAIL project [92].

XII. OPEN RESEARCH CHALLENGES

Based on our in depth review and survey we have identified the following areas where there are limited work or lack in research is noticeable:

A.CHANGE MANAGEMENT AND COMMUNICATION STRATEGIES

To adapt IPA technology in any organization, it is needed to make changes in change management through proper communication. Wherever, there is a need for digital transition, the structure of the team needs to be changed. If we combine technologies like RPA and AI then there should be an open communication channel between RPA team and AI engineers. While RPA team will take care of managing bots, their subscriptions and other configurations, AI engineers will focus on developing suitable ML models to advance the process. The whole process needs strategic movement, discussion and communication.

B.ETHICAL AND LEGAL CONSIDERATION

The data-driven nature of IPA raises important ethical and legal questions. This is particularly related to data privacy and algorithmic bias. It is important to do research into developing ethical guidelines and legal frameworks that address these issues. Ensuring that collecting data through RPA process is not impacting data security, AI algorithms are transparent, fair and compliant with regulations is crucial to gaining people's trust and ensuring the ethical deployment of IPA technologies.

C.SELECTING ML MODELS

Data curation is an important part of IPA process. Also, accessing to data through ML models is a significant step. However, there has not been much research on the selection process of ML models. Selecting biased or not suitable models will have negative impact on the output of IPA process. There is a pressing need for research on listed models in RPA tools. An open documentation on selecting optimal models for particular use cases should be published.

D.FUTURE APPLICATIONS

Adopting AI has evolved and increased recently in agricul- tural sector too [96]. Earlier researches were based on crop yield with regression and clustering based analysis [97]. Now, there are advanced ongoing researches on water management, seed or soil analysis with Deep Learning techniques [98]. For example, [99] and [100] describes how drones are used to collect image data from crop field which will eventually be used by vendor specific applications to analyze. However, predicting crop yield is one of the fields where we have found limited research conducted purely based on IPA. For example, [101] has used RPA to collect data from different websites (weather, soil) to feed the data into predictive model to do crop yield analysis. As technology advances, integrating smart drones and RPA can significantly enhance agricultural practices. Smart drones can collect real-time data on soil moisture, temperature, crop

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

health, and pest presence, which can be stored in a centralized database using RPA bots. These bots can automate data entry, ensuring timely and accurate updates. AI models analyze this data to assess soil conditions, predict crop yields and recommend appropriate fertilizers to farmers. Additionally, creating an AgroBot can be beneficial to answer basic questions related to planting, harvesting, and crop diseases which will provide farmers as well as local people expert advice.

With those data a model can analyze the soil condition, predict crop yield and recommend farmers for appropriate fertilizers. RPA bots can also inform farmers the exact time to use the fertilizers or pesticides by sending them alert. An agro bot can also be created for answering basic questions related to planting harvest or crop diseases.

Another future application can be, integrating RPA in applications using container technologies. This offers promising avenues for enhancing automation capabilities at the edge [102]. Containers, with their lightweight nature and flexibility, can facilitate deploying RPA processes on resource-constrained ARM- based edge devices, allowing automated tasks to be efficiently executed closer to data sources. This approach could significantly reduce latency and improve response times in environments where real-time data processing is essential. Research work [103] explores the potential and efficiency of container technology for AI application. They experimented with container for object detection application and shows that container is suitable for handling complex data.

XIV.CONCLUSION

Robotic process automation and artificial intelligence have come together to bring about a new phase of intelligent process automation, marking a significant advancement in the field of automation. In this paper we analyze how the integration of these technologies transforms business processes in several industries by incorporating cognitive capabilities into automation, rather than just automating repetitive activities. This change constitutes the core of the ongoing digital revolution under the name Industry 4.0, which is based on efficiency, precision, and adaptability.

RPA has broad application from enhancing productivity to reducing operational costs in the fields of finance, healthcare, manufacturing, and many other industries. But it actually sees its potent realization when subsumed into the application of AI, which brings along such abilities as data analysis, pattern recognition, and decision- making. Such synergy allows the automation of more intricate processes, thus letting businesses innovate and respond to market demands more effectively.

In this paper, we have discussed the journey that RPA has taken from its evolution and merging with AI to give insights into how it changes functions, from finance and banking to health, manufacture, and recruitment. Case studies and use cases have shown how AI-powered RPA is used to provide operational efficiencies, a better customer experience, and optimized decision-making. One such example is finance, where AI-driven RPA has modernized fraud detection and the processing of loans. Another one would be in healthcare, where it has revolutionized patient care and administrative workflows.

The benefits are clear, but there have been challenges following the implementation of AI-powered RPA. Some of these include data privacy, ethical considerations, bias in AI models, and complexity in integration with existing systems. This is only possible through multi-dimensional solutions, such as solid governance frameworks, relentless learning, and putting prime importance on transparency and accountability in AI-driven processes.

The future, or rather further transformation in industries, would be powered by AI RPA. However, it is extremely important to tread the waters carefully, whether within the ethical and legal environments, the kind of machine learning model used, and one needs to be explainable in order to trust the AI systems. With digital transformation speeding up, sectors like agriculture, at the very outset of massive technology adoption, offer fresh opportunities for growth and innovation.

In conclusion, the convergence of RPA and AI will deter- mine the future of intelligent automation by enabling firms with the tools they need to drive efficiency, cut costs, and foster innovation. With this understanding of their synergetic potentials, businesses can unlock new opportunities and, as a result, maintain a sustainable competitive advantage in the fast-moving digital ecosystem.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

REFERENCES

[1]F. Kanakov and I. Prokhorov, ''Analysis and applicability of artificial intelligence technologies in the field of RPA software robots for automat- ing business processes,'' Proc. Comput. Sci., vol. 213, pp. 296–300, Jan. 2022.
[2]R. Götzen, J. v. Stamm, R. Conrad, and V. Stich, ''Understanding the organizational impact of robotic process automation: A socio- technical perspective,'' in Proc. Working Conf. Virtual Enterprises. Cham, Switzerland: Springer, Jan. 2022, pp. 106–114, doi: 10.1007/978-3-031- 14844-6_9.
[3]R. Palaniappan, ''An overview on robot process automation: Advance- ments, design standards, its application, and limitations,'' Informatica, vol. 48, no. 1, Feb. 2024, doi: 10.31449/inf.v48i1.5058. [4]L.-V. Herm, C. Janiesch, H. A. Reijers, and F. Seubert, ''From symbolic RPA to intelligent RPA: Challenges for developing and operating intelligent software robots,'' in Proc. 19th Int. Conf. Bus. Process Manag., Rome, Italy. Cham, Switzerland: Springer, Jan. 2021, pp. 289–305.
[5]W. A. Ansari, P. Diya, S. Patil, and S. Patil, ''A review on robotic process automation-the future of business organizations,'' in Proc. 2nd Int. Conf. Adv. Sci. & Technol. (ICAST), 2019, doi: 10.2139/ssrn.3372171.
[6]N. T. Da, H.-S. Le, T.-D.-N. Nguyen, H.-T. Lam, T.-A. Tran, and Q.-T. Tran, ''A survey of AI-based robotic process automation for businesses and organizations,'' Sci. Technol. Develop. J., vol. 26, no. 3, pp. 2959–2966, Jan. 2023.
[7]T. Chakraborti, V. Isahagian, R. Khalaf, Y. Khazaeni, V. Muthusamy, Y. Rizk, and M. Unuvar, ''From robotic process automation to intelligent process automation: Emerging trends,'' in Proc. Int. Conf. Bus. Process Manag., Seville, Spain. Cham, Switzerland: Springer, Jan. 2020, pp. 215–228.
[8]L. Patrício, L. Varela, and Z. Silveira, ''Integration of artificial intelligence and robotic process automation: Literature review and proposal for a sustainable model,'' Appl. Sci., vol. 14, no. 21, p. 9648, Oct. 2024.
[9]R. Bhatnagar and R. Jain, ''Robotic process automation in healthcare—A review,'' Int. Robot. Autom. J., vol. 5, no. 1, pp. 12–14, Jan. 2019.
[10]C. Lamberton, D. Brigo, and D. Hoy, ''Impact of robotics, RPA and AI on the insurance industry: Challenges and opportunities,'' J. Financial Perspect., vol. 4, no. 1, pp. 8–20, Jan. 2017.
[11]S. Kumar, S. Khanna, N. Ghosh, and S. O. D. Kumar, ''Importance of artificial intelligence (AI) and robotic process automation (RPA) in the banking industry: A study from an Indian perspective,'' in Proc. Confluence Artif. Intell. Robotic Process Autom., Jan. 2023, pp. 231–266.
[12]S. Moreira, H. S. Mamede, and A. Santos, ''Process automation using RPA—A literature review,'' Proc. Comput. Sci., vol. 219, pp. 244–254, Jan. 2023.
[13]C. H. V. D. Moraes, J. Scolimoski, G. Lambert-Torres, M. Santini, A. L. A. Dias, F. A. Guerra, A. Pedretti, and M. P. Ramos, ''Robotic process automation and machine learning: A systematic review,'' Brazilian Arch. Biol. Technol., vol. 65, Jan. 2022, Art. no. e22220096. [14]J. K. Ray, R. Sultana, R. Bera, S. Sil, and Q. M. Alfred, ''A comprehensive review on artificial intelligence (AI) and robotic process automation (RPA) for the development of smart cities,'' in Proc. Confluence Artif. Intell. Robotic Process Autom., Jan. 2023, pp. 289–311.
[15]Miswar, Suhardi, and N. B. Kurniawan, ''A systematic literature review on survey data collection system,'' in Proc. Int. Conf. Inf. Technol. Syst. Innov. (ICITSI), Oct. 2018, pp. 177–181.
[16]G. V. Research. Robotic Process Automation (RPA) Market Analysis. AccessedAug10,2024. [Online] Available: https://www.grandviewresearch.com/industry-analysis/robotic-process- automation-rpa-market
[17]ElectroNeek. (2024). History of RPA: From Early Beginnings to Intelligent Automation.Accessed: Aug. 10, 2024. [Online]. Available: https://electroneek.com/rpa/history-of-rpa/