



Artificial Intelligence - Robotic Process Automation on Enterprise Architecture in the Telecommunications Industry

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ABSTRACT

This paper explores the strategic impact of Artificial Intelligence (AI)-enhanced Robotic Process Automation (RPA) on Enterprise Architecture (EA) within the telecommunications industry. Traditionally, RPA has been applied to automate repetitive tasks without altering underlying IT infrastructure, focusing primarily on operational efficiency. However, the integration of AI introduces cognitive capabilities to RPA, enabling more dynamic interactions within complex organizational systems. This paper assesses how AI-driven RPA can influence EA by enhancing system efficiency, supporting business-IT alignment, and promoting digital transformation. Through case studies and analyses of various telecommunications operations, the paper investigates the dual role of AI-enhanced RPA in both streamlining enterprise-wide processes and maintaining adaptability to meet industry demands. The findings indicate that, while AI-RPA integration holds significant promise for accelerating operational improvements, it also presents unique challenges related to governance, scalability, and long-term sustainability. This work contributes insights into the adoption of AI-driven RPA as a transformative tool for telecommunications, offering guidance on best practices for aligning automated systems with enterprise strategic goals. Additionally, the study provides a structured framework for integrating AI-driven RPA into EA using ArchiMate and TOGAF modeling methodologies, emphasizing its potential to drive scalability, improve governance, and ensure alignment with strategic business objectives.

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1. INTRODUCTION

Process Automation (RPA) is a modern technology designed to improve efficiency and provide significant returns on investment for businesses and organizations. Contrary to the common misconception of physical robots replacing human workers, RPA operates as a software-based solution that automates repetitive, rule-based business tasks. This is achieved through the use of software bots that replicate human actions, such as entering, processing, or manipulating data across various systems. By mimicking these tasks, RPA reduces manual effort, enhances accuracy, and allows employees to focus on more strategic activities, making it a valuable tool for streamlining operations [1]. RPA has traditionally been employed to streamline business processes by automating interactions with the presentation layer of existing applications, thereby avoiding alterations to underlying systems and Enterprise Architectures (EAs). This early approach to RPA generally did not affect the structure or strategy of EA. However, with advancements in RPA technologies - especially the integration of Artificial Intelligence (AI) - the strategic impact on EA has become increasingly significant [2]. The combination of Robotic Process Automation (RPA) and Artificial Intelligence (AI) represents a

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significant advancement in banking operations. By merging the task-focused automation of RPA with the smart decision-making abilities of AI, this integration improves efficiency and accuracy in various processes. Financial institutions can leverage these technologies to enhance automation, analyze data, and deliver personalized services that align with the specific needs and preferences of individual customers, ultimately creating a more responsive and customer-centered approach to banking [3]. Enterprise Architecture (EA) is a structured approach designed to align an organization's Information Technology (IT) with its overall business goals. It serves as a detailed plan that involves careful planning, documentation, and analysis of how an organization operates. The primary aim is to provide a clear picture of the current state of the organization's business processes, information resources, systems, and technologies, enabling the identification of gaps or weaknesses within its operations. By addressing these gaps, EA supports better decision-making and prepares organizations for future growth and improvement. It is widely believed that implementing EA helps organizations create significant value by enhancing efficiency, adaptability, and strategic alignment [4]. By providing a structured approach, EA enables organizations to integrate their business and ICT strategies, ensuring that processes and technologies work together seamlessly. This alignment is essential for achieving successful digital transformation, allowing organizations to adapt to changes, optimize their operations, and meet their objectives efficiently [5].

Integrating artificial intelligence (AI) with Enterprise Architecture (EA) frameworks improves decision-making, streamlines operations, and supports strategic planning. By incorporating AI, organizations can optimize processes, enhance automation, and drive innovation across various EA domains. This combination not only improves efficiency but also enables smarter and faster responses to changing business needs, making it a valuable approach for modern enterprises [6]. Artificial Intelligence (AI) improves Robotic Process Automation (RPA) by adding features like machine learning and natural language processing. RPA focuses on automating simple and repetitive tasks, but with AI, these systems can go beyond basic automation. AI enables bots to analyze data, make informed decisions, adjust to new conditions, and continuously improve through learning. Together, AI and RPA create smarter and more efficient automation solutions that can handle complex and dynamic processes [7].

2. METHOD

The procedures adopted in assessing the strategic impact of artificial intelligence-driven robotic process automation (AI-RPA) on enterprise architecture (EA) in the telecommunications industry are discussed as follows:

2.1. Casestudy

The case study focuses on the telecommunication industry, following a structured case study approach. This includes background research, data collection using questionnaires and analysis based on responses and relevant industry documentation. The aim is to explore how AI-driven RPA impacts EA within the telecommunications industry, particularly in areas like business-IT alignment, process optimization, scalability and governance. The study will assess the extent to which RPA can improve the telecommunications industry operational efficiency and strategic alignment through the automation of core processes. The study examines how RPA streamlines customer onboarding processes by automating data verification and integration, reducing the average processing time by 40%, as indicated in similar deployments within the industry. The average processing time by 40%, as indicated in similar deployments within the industry. Figure 1 is RPA implementation cases

2.2. Data collection

Using a structured questionnaire with targeted questions aimed at industry employees familiar with RPA and also targeted IT managers assess the success of RPA deployments in reducing manual interventions in network incident management, such as automated ticket generation and resolution prioritization. Table 1 is RPA questionnaire targeted at industry employees. The questions explore:

- a) Familiarity with RPA in daily operations
- b) Processes automated through RPA (e.g., customer service, billing, network management)
- c) Perceived optimization of key processes
- d) Workflow impacts, alignment between IT and business processes and the influence on strategic goals
- e) Areas of IT infrastructure most affected by AI-driven RPA (e.g., data management, network infrastructure, security)

2.3. Analytical Procedures

The analysis and modeling of Enterprise Architecture (EA) for AI-driven Robotic Process Automation (RPA) implementation in the telecommunications industry involves structured methods and tools to assess EA components, alignment, scalability, governance and long-term implications. This section provides an analytical breakdown detailing ArchiMate modeling, presented in Figure 2, and The Open Group Architecture Framework (TOGAF), illustrated in Table 2, application on the objectives.

Use Case	Process	Description	Frequency
1 Network Monitoring	Management	- Monitoring and management of packets - Management and allocation of resources	Daily
2 Customer Service	Troubleshoot	- Bot respond to question or create tickets for human escalation 10,000 to 25,000 issue tickets created within 6 months	Daily
3 Billing and Revenue	Purchase	- Extraction of data from purchase invoices - AI-based text recognition - Start of excel transaction entry associated fields with information for analysis	Daily
4 Regulatory Compliance	Governance	- Prioritization of keyword for protection and data security - AI-generated audit trail for managing data processes securely - Auto flagging for human-activity escalation	Daily
5 Fraud Detection	Security	- Download of relevant document from application - Extraction of data per user through text field recognition - AI-based analysis and recognition of anomalies	Daily

Figure 1. RPA implementation cases

2.3.1 Identify key EA components affected by RPA

The integration of RPA into EA influences fundamental components that drive operations and technology. Business processes, such as customer service and billing, undergo automation, streamlining workflows and minimizing manual efforts. ArchiMate models can map these processes, showing the points where RPA improves efficiency. ArchiMate's Application and Data Models can illustrate how RPA optimizes customer service workflows by automating complaint resolution tracking and escalation management. IT systems are directly impacted by RPA as it interacts with applications and databases, altering data flows and IT structures. Automated data processes, such as billing and network monitoring, require robust data management strategies, which can be effectively represented using ArchiMate's Application and Data Models.

2.3.2 Evaluate strategic alignment between IT and business

The alignment of IT capabilities with business objectives is crucial for RPA's success. Using ArchiMate, strategic layers can visualize how RPA-enabled automation supports goals like enhanced customer experience. In TOGAF's Business Architecture phase, RPA integration into customer billing systems ensures real-time invoice generation, directly supporting the strategic goal of reducing billing errors. TOGAF's Architecture Vision and Business Architecture phases provide frameworks to assess whether RPA aligns IT initiatives with broader organizational strategies. These tools identify areas where RPA strengthens strategic coherence or presents challenges in meeting long-term objectives.

Table 1. RPA questionnaire targeted at industry employees

Category	Field of deployment	Highest Response
Operations	How familiar are you with Robotic Process Automation (RPA) in your organization's daily operations?	Somewhat familiar
	Has the implementation of AI-driven RPA impacted your organization's ability to achieve strategic goals?	Yes, but with some challenges
	How would you rate the overall impact of RPA on your organization's operational efficiency?	Moderately positive
Business Processes	Which business processes in your organization have been automated using RPA?	Network management
	To what extent has RPA optimized your organization's key processes?	Moderately
System Workflow	How has the integration of RPA affected system workflows within your organization?	Improved workflow efficiency
RPA Influence	In your experience, how does RPA influence the alignment between IT infrastructure and business processes?	Moderately improves alignment
Infrastructure	Which areas of the IT infrastructure have seen the most significant change since the introduction of AI-driven RPA?	Application systems
Support	Has RPA reduced the reliance on IT support for business process automation in your organization?	Yes, somewhat
Sustainability	Do you believe the integration of AI into RPA systems is necessary for improving your organization's long-term sustainability?	Yes

2.3.3 Assess scalability and adaptability of EA

In the fast-paced telecommunications sector, EA must accommodate technological changes and scaling needs. ArchiMate Technology Models visualize the technology stack required for scalable RPA processes, such as cloud infrastructure. ArchiMate models detail the transition from on-premise to cloud-hosted RPA solutions to manage increased data traffic during seasonal peaks. TOGAF's Opportunities and Solutions phase evaluates the scalability of RPA tools and their interaction with evolving architectures, ensuring that RPA handles increased workloads without significant disruptions.

2.3.4 Examine IT governance and control

The implementation of RPA introduces challenges for IT governance, particularly in monitoring and controlling automated processes. ArchiMate models can depict governance structures, illustrating process ownership and accountability frameworks. TOGAF's Risk and Compliance phase assesses governance policies, determining whether RPA integrates seamlessly into traditional workflows or bypasses established controls, potentially creating risks. These assessments ensure that automated processes remain compliant and well-regulated within the EA.

2.3.5 Analyze long-term implications on EA

RPA has long-term implications for EA, including potential impacts on system coherence and fragmentation. While it can standardize processes and enhance coherence, it may also create isolated automations that are difficult to manage. TOGAF's Architecture Change Management phase ensures that RPA implementations are reviewed periodically to prevent redundancies and ensure sustainability. ArchiMate modeling evaluates the sustainability of system interactions, ensuring that RPA interventions do not lead to redundancy or isolated processes that require future consolidation.

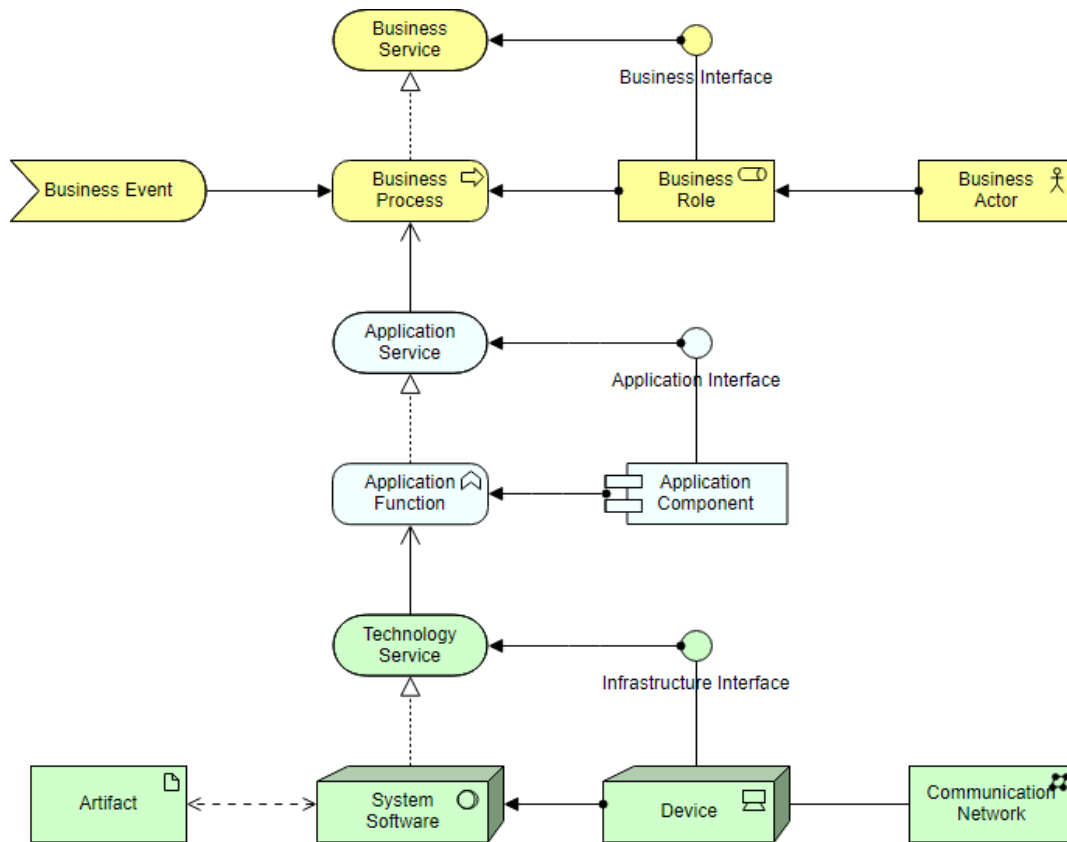


Figure 2. ArchiMate Model for Evaluating RPA's Impact on Enterprise Architecture (EA)

3. COMPREHENSIVE THEORETICAL BASIS

3.1. Robotic Process Automation in Theory and Practice

Robotic Process Automation (RPA) refers to software designed to perform tasks, processes, and transactions across various software systems based on predefined rules and activity sequences, with minimal human involvement. As defined by IEEE, RPA enables automation by mimicking human-computer interactions without altering an organization's existing IT infrastructure, making it faster to implement than many traditional digital transformation technologies. This technology supports three main models: attended RPA, which works alongside human operators; unattended RPA, which operates independently; and hybrid RPA, which combines both approaches [8]. RPA involves using software bots to handle repetitive and routine tasks in business processes. While organizations widely adopt RPA to improve efficiency, individuals looking to automate their tasks often struggle due to limited knowledge about which tasks are suitable for automation, particularly if they have little experience with RPA [9].

Many companies adopted a structured framework for implementing robotic process automation (RPA), typically consisting of four main stages: identifying tasks, redesigning workflows from their current state (AS-IS) to the desired future state (TO-BE), creating the bot, and monitoring its performance. Some companies extended this approach with an additional stage for testing the bot after development and before deployment. A common strategy for adoption involved starting with a proof of concept (PoC) to showcase the potential benefits of RPA for the organization. Simple, high-volume, or high-value processes were often selected for the PoC to achieve quick and noticeable results, referred to in some studies as "quick wins". The implementation framework for RPA projects typically follows three key phases: initialization, implementation, and scaling. Some tasks are carried out once for each project, while others are repeated continuously. During the initialization phase, activities such as identifying processes, aligning goals, and screening technologies are performed. This is followed by the implementation phase, which includes selecting processes for automation, choosing suitable RPA software, running a pilot, and evaluating the business case. External consultants may be involved in these stages unless the entire project is managed by a consultancy. The implementation phase

concludes with the rollout of the RPA solution. Once the project is complete, the scaling phase begins, focusing on expanding and applying the results to additional RPA implementations. Throughout all phases, ongoing support processes and a Centre of Excellence (CoE) play a crucial role in maintaining and enhancing RPA performance [10]

Table 2. TOGAF-based Approach for Evaluating RPA's Impact on Enterprise Architecture (EA)

TOGAF ADM Phase	Objectives	Steps Involved
Preliminary Phase	Establish RPA's relevance to strategic goals and EA requirements.	- Assess alignment of RPA with organizational goals. - Set EA principles for RPA's integration.
Architecture Vision	Define how RPA supports the strategic vision and objectives.	- Develop an initial vision of RPA's impact. - Identify high-level benefits, such as cost reduction or efficiency.
Business Architecture	Analyze business processes affected by RPA and align with organizational objectives.	- Model current business processes. - Identify processes for RPA integration, e.g., customer service, billing.
Information Systems Architecture (Data)	Evaluate RPA's effect on data management, data flow, and quality.	- Map RPA data flows within the system. - Assess data integration, security, and consistency across automated systems.
Information Systems Architecture (Application)	Assess how RPA applications interface with existing IT and business applications.	- Map RPA applications' roles in processes. - Analyze compatibility and integration requirements.
Technology Architecture	Identify the infrastructure needed to support RPA scalability, security, and reliability.	- Specify RPA technology components (e.g., servers, cloud support). - Evaluate resource allocation for scalability.
Opportunities and Solutions	Develop RPA implementation plans aligned with EA improvements and identify any gaps.	- Outline phased RPA deployment. - Address EA gaps or dependencies.
Migration Planning	Create a roadmap for deploying RPA across EA, focusing on seamless integration and scalability.	- Prioritize RPA initiatives. - Establish migration timelines and assess risk mitigation.
Implementation Governance	Oversee RPA integration, ensuring alignment with EA governance standards and ongoing IT monitoring.	- Set governance policies for RPA. - Monitor compliance with IT and EA standards during implementation.
Architecture Change Management	Maintain RPA's alignment with EA, ensuring adaptability to changing requirements and technological updates.	- Periodically review RPA impact on EA. - Adjust RPA deployments for evolving business and technology needs.

Robotic Process Automation (RPA) uses software robots to handle repetitive tasks that follow specific rules. Appian, a popular cloud-based Business Process Management (BPM) tool, offers strong RPA features that help organizations improve their productivity, ensure accurate processes, and work more efficiently [11]. RPA operates in two primary modes, shown in Figure 3: attended and unattended. Attended automation works alongside humans to help complete simple and repetitive tasks, making their work more efficient. On the other hand, unattended automation handles specific tasks entirely on its own without requiring any human involvement [12].

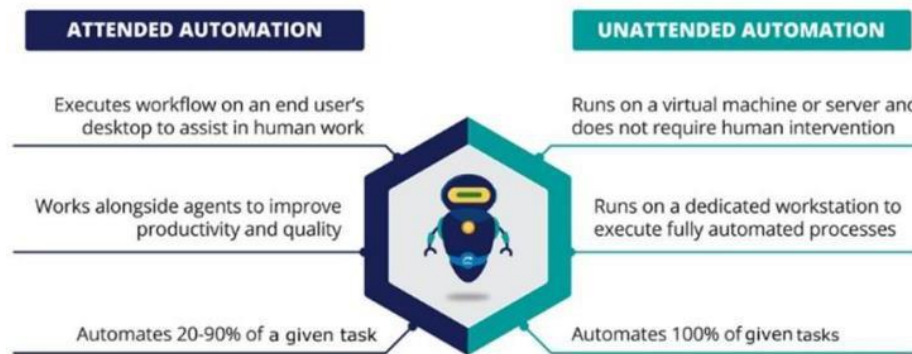


Figure 3. Key difference in automation [13]

3.2. Enterprise Architecture (EA)

Enterprise Architecture (EA) artifacts serve as tools for communication and collaboration, acting as connecting points between different professional groups. These artifacts can bridge gaps, enabling shared understanding and cooperation during strategic planning and the implementation of IT systems in organizations [13]. Enterprise architecture plays an important role in helping businesses understand the connections and dependencies within their operations. This broader view supports decision-makers in making informed strategic decisions and adopting coordinated technology solutions [14]. The COVID-19 pandemic has however brought significant changes and challenges to businesses worldwide. Enterprise Architecture (EA) plays a crucial role in providing flexible solutions that equip organizations with the tools needed to adapt and succeed during difficult times [15]. Various well-known EA frameworks have helped organizations deal with the challenges of implementation. For successful EA implementation, it is important for organizations to focus on the core aspects of the EA approach [4].

Enterprise Architecture (EA) is recognized for its importance, but its use in the healthcare sector faces several challenges. Healthcare organizations often struggle to integrate different information systems, improve internal processes, and protect patient data. The complexity of balancing technological advancements, operational workflows, and data security in a constantly evolving environment contributes to these challenges. Additionally, some organizations may find it difficult to choose the right EA framework or apply it effectively, especially considering the sensitive nature of healthcare and strict regulations. EA enhances information system standardization, interoperability, and security, breaking down integration barriers and enabling seamless data exchange. It also improves security standards to ensure patient data protection and regulatory compliance. While implementing EA is complex, it provides a clear path for understanding, planning, and executing a unified integration strategy. By focusing on data security and interoperability, EA helps healthcare organizations overcome challenges in system integration, allowing for secure, efficient, and compliant data exchange [16].

3.3. Artificial Intelligence

Artificial intelligence has been defined in various ways over time, reflecting its evolving nature and applications. The Turing test describes AI as the ability of machines to interact with humans through electronic output in a way that conceals their non-human identity, using a binary criterion for evaluation. Marvin Minsky, a pioneer in the field, described AI as empowering machines to perform tasks that typically require human intelligence. Additionally, the symbolic school of thought views AI as the manipulation of symbols, where these symbols represent basic physical entities. These perspectives highlight the diverse approaches to understanding and developing artificial intelligence [17]. It provides a strong basis for application in many fields, including understanding and processing human languages, interpreting images and videos, and creating connections between computers and the human brain [18].

The use of AI has improved efficiency and reduced costs, positively impacting economic growth, social progress, and overall well-being. AI chatbots, for example, provide round-the-clock responses to customer inquiries, enhancing satisfaction and boosting business sales. In healthcare, AI enables doctors to offer telemedicine services, making medical care accessible to patients in remote areas. The rapid growth and

widespread use of AI are clearly shaping various aspects of daily life, society, and human experiences [19]. A key aspect of Artificial Intelligence is its ability to perform better when provided with larger datasets. However, this improvement has a threshold, as the model's learning capacity is limited [20].

3.4. Telecommunication

In today's world, the telecommunications industry plays a key role in driving economic growth, social development, and advancements in technology. The rules and policies that regulate this important sector are essential for shaping communication services, encouraging fair competition, safeguarding consumer rights, and promoting innovation. However, Africa's diverse social, economic, and technological environments create distinct challenges and opportunities in regulating telecommunications [21]. Customers are the most important part of the telecommunications industry, as they ensure the continued operation of companies. A decline in the number of customers is an unexpected challenge for businesses [22]. A survey revealed that if the current trends in subscriber losses and retention continued, Globacom would keep 35% of Nigeria's GSM users, 9Mobile would retain 16%, Airtel would hold 27%, MTN would maintain 21%, and other operators would retain just 1% [23].

The telecommunications industry is highly competitive, with companies constantly striving to gain customers and maintain their market position. However, customers often switch between service providers because it is relatively inexpensive to do so. Since acquiring new customers is both challenging and costly, it is more practical for companies to focus on keeping their existing valuable customers and reducing churn rather than prioritizing efforts to attract new ones [24]. Research in the telecommunications sector has grown significantly in analyzing customer churn, focusing on understanding the main reasons that influence customers' decisions [25]. Loyal customers play a key role in improving the performance of the telecommunication industry by lowering the costs associated with advertising, building trust, and attracting new customers, while negative customer feedback often leads to customer churn [26]. "Customer churn" refers to the process where customers switch from one service provider to another [27]. Using feature optimization methods to predict customer behavior helps marketers adjust their strategies and products to better meet customer needs, improve satisfaction, and strengthen relationships. By analyzing and optimizing features, future behaviors like repeat purchases and customer churn can be anticipated, leading to more focused and efficient marketing efforts [28]. The telecommunications sector faces significant risks of revenue loss due to customer turnover and external factors. To address this, effective management of customer churn focuses on strategies like personalized marketing campaigns, exclusive offers, and other benefits designed to maintain customer interest and loyalty in line with ongoing technological advancements [29].

4. RESULTS AND DISCUSSION

4.1. Result from case study

This case study approach provided a detailed, real-world analysis of the effects of AI-driven RPA on EA within the telecoms industry. By combining multiple data sources, including interviews, questionnaires and document analysis, the study offered a comprehensive view of the strategic impact of RPA on different levels of IT operations. Figure 4 shows extracted levels of automated processes in an IT operation. The study adopted a descriptive research methodology and conducted a field survey between September and October 2024. The study population included information and communication technology (ICT) experts in Nigeria, from which 100 ICT experts were purposively selected from academia and industry, establishing the sample size at 100. A ten-point questionnaire served as the primary instrument for data collection. Questionnaires were distributed to the sampled population and all were filled out and returned, achieving a 100% response rate. Secondary data was collected through review of relevant internal documents on RPA.

4.2. Results from data collection

To gain a comprehensive understanding of how RPA impacts Enterprise Architecture (EA), multiple sources of data were used, these include:

4.2.1 Interviews

In-depth interviews were conducted with key stakeholders such as IT architects, RPA developers, business analysts and senior management. These interviews explore the strategic objectives behind RPA adoption, the integration of RPA into the existing EA framework and the perceived long-term benefits and challenges.

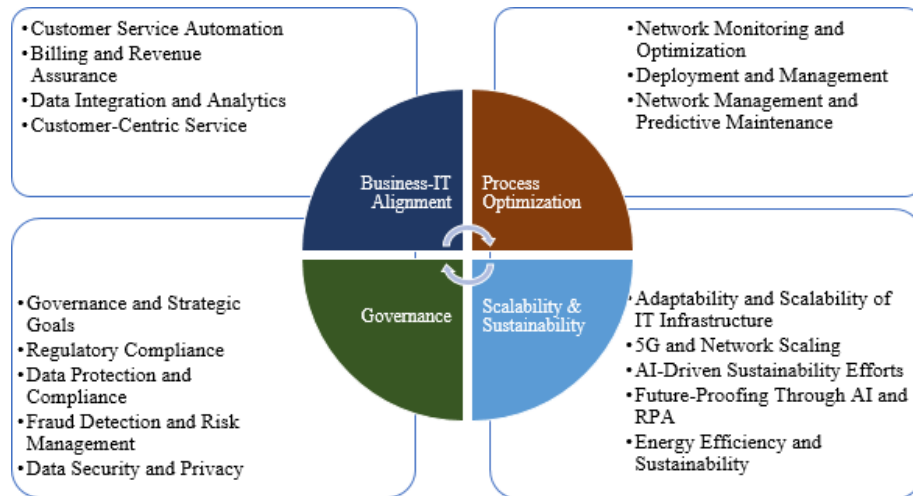


Figure 4. Extracted levels of automated processes in an IT operation

4.2.2 Questionnaires

Structured questionnaires were distributed to employees across various departments to gather insights on how RPA influences day-to-day operations, system workflows and the relationship between business processes and IT infrastructure. This helps assess whether RPA is improving or disrupting the alignment between IT and business goals. Figure 5 Shows RPA Automated Processes Analysis.

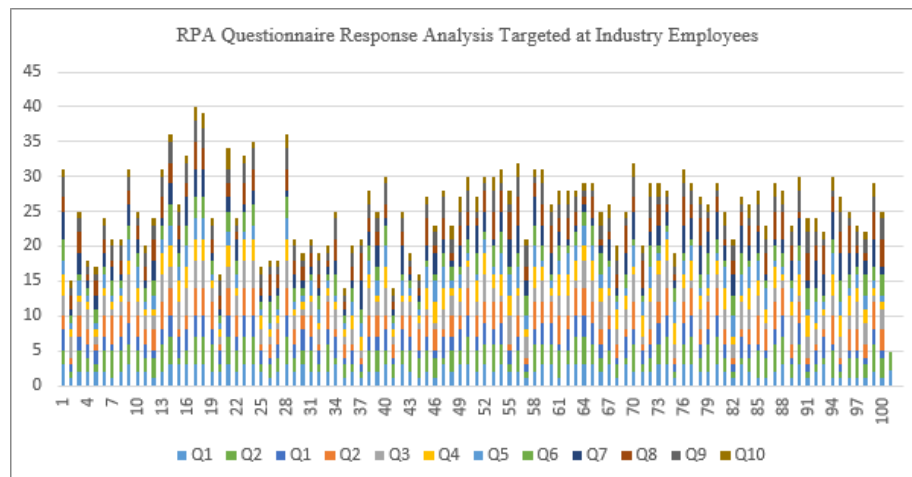


Figure 5. RPA automated processes analysis

4.2.3 Document analysis

Internal documentation such as Enterprise Architecture (EA) blueprints, RPA implementation roadmaps and IT governance policies were reviewed to understand how RPA is positioned within the company's strategic framework summarized in Table 3. This provided insights into the architectural changes that may result from RPA adoption.

4.2.4 Observational evidence

Direct observation of RPA-driven processes were conducted to evaluate the real-time impact of automation on workflows, system integration and overall business efficiency. This provided empirical evidence of how RPA interacts with the existing IT infrastructure and whether it enhances or complicates the architecture.

Table 3. Traditional RPA and advanced digital technologies integration

Area of Operation	Category of Deployment	Technology
Process Optimization	- Network Monitoring and Optimization - Deployment and Management - Network Management and Predictive Maintenance	Machine learning
Business-IT Alignment	- Customer Service Automation - Billing and Revenue Assurance - Data Integration and Analytics - Customer-Centric Service	Machine vision / image, screen, voice, pattern recognition
Scalability and Sustainability	- Adaptability and Scalability of IT Infrastructure - 5G and Network Scaling - AI-Driven Sustainability Efforts - Future-Proofing Through AI and RPA - Energy Efficiency and Sustainability	Machine learning
Governance	- Governance and Strategic Goals - Regulatory Compliance - Data Protection and Compliance - Fraud Detection and Risk Management - Data Security and Privacy	Natural language processing

4.3. Analytical Procedures

The simulated procedure using ArchiMate simulation software helps in visualizing and simulating an automated system, typically the “Customer Service Process”, making it easier to identify potential improvements and measure process effectiveness. Figure 6 shows RPA in customer service automation process model in ArchiMate.

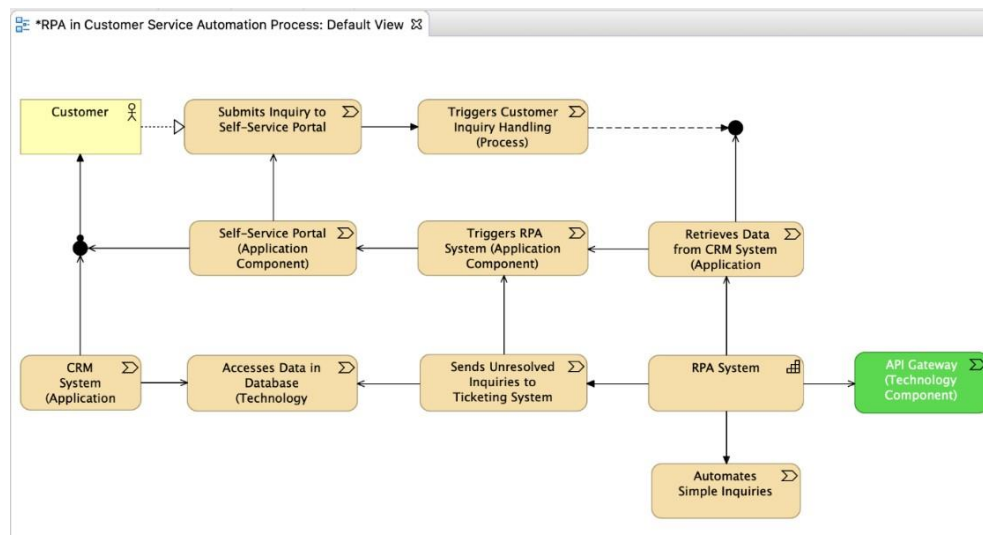


Figure 6. RPA in customer service automation process model in ArchiMate

5. CONCLUSION AND LIMITATION

This research, titled "Assessing the Strategic Impact of Artificial Intelligence - Robotic Process Automation on Enterprise Architecture in the Telecommunications Industry," introduced a refined framework for analyzing how AI-driven RPA integrates with Enterprise Architecture (EA) in telecommunications. While traditional RPA focused on automating routine and rule-based tasks, this study highlighted how combining AI with RPA enables more complex, cognitive functions that transform enterprise automation. The framework demonstrates how this integration enhances telecom operations by

improving system efficiency, aligning IT structures with business objectives, and advancing digital transformation. Adopting AI-driven RPA strategies allows telecommunications organizations to achieve higher levels of operational efficiency, agility, and sustainability within their EA. However, the extent of these benefits may depend on the specific processes and needs of individual organizations, necessitating expert consultation to develop tailored solutions. Despite its contributions, the study faced limitations. The survey relied on a small group of ICT professionals from academia and industry, which may not fully represent the broader telecommunications sector. Additionally, the use of structured questionnaires and interviews, though effective in capturing responses, might have overlooked deeper qualitative insights. Lastly, the rapidly evolving nature of AI and RPA technologies could render some findings less relevant as advancements continue to emerge. To address these limitations, future research should explore broader geographical regions and conduct longitudinal studies to assess how RPA integration affects the adaptability and sustainability of EA in dynamic industries. Continuous updates to frameworks and methodologies will also be essential as these technologies develop.

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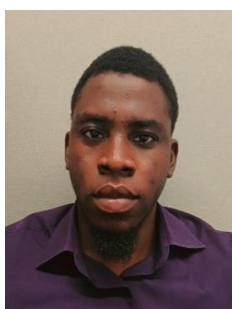
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