Journal of Artificial Intelligence and Autonomous Intelligence Received 22-10-2024; Accepted 23-12-2024; Published 30-12-2024

Literature Review and Proposal Framework for Assessing Robotic Process Automation and Artificial Intelligence Projects in Healthcare Services

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Abstract

The integration of Robotic Process Automation (RPA) and Artificial Intelligence (AI) in healthcare offers transformative potential to enhance operational efficiency, improve patient outcomes, and ensure financial sustainability. To support their effective implementation, this study proposes a multidimensional framework for evaluating the feasibility, benefits, and risks of these technologies within the healthcare sector. The framework is structured around five key dimensions: Contextualization and Definition, Technical Analysis, Patient-Care Impact, Economic Evaluation, and Monitoring and Governance. It adopts a comprehensive approach that combines measurable metrics with qualitative assessments, ensuring alignment with strategic goals, stakeholder engagement, and ethical standards. Key findings underscore the potential of RPA and AI to streamline administrative workflows, enhance diagnostic precision, and optimize resource utilization, while addressing critical issues such as regulatory compliance and data protection. Although constrained by the scope of its literature review and the need for further empirical validation, this framework offers a systematic tool for evidence-based decision-making and risk management. Future research should priorities real-world application and explore broader ethical and social implications. This study provides a significant contribution towards fostering the sustainable, equitable, and innovative adoption of RPA and AI technologies in healthcare systems.

Keywords: Robotic Process Automation (RPA), Artificial Intelligence (AI), Healthcare, Review literature, Framework, Project assessment.

Citation: Leonel Patrício, et al. Literature review and proposal framework for assessing robotic process automation and artificial intelligence projects in healthcare services. Journal of Artificial Intelligence and Autonomous Intelligence. Research. 2024;1(2):11.
Pages: 155-171

1. INTRODUCTION

The Technological evolution has driven significant changes across various areas of society, with particular prominence in the healthcare sector. Emerging technologies such as Robotic Process Automation (RPA) and Artificial Intelligence (AI) have taken on a pivotal role, offering innovative solutions that promise to enhance efficiency, reduce costs, and improve the quality of healthcare services. This article addresses a highly pertinent subject: a literature review and the proposal of a methodological framework for assessing projects that leverage these technologies in healthcare services [1].

The choice of this topic is justified by the growing need for technological solutions to tackle the challenges faced by healthcare systems worldwide, including an ageing population, the rise in chronic diseases, and the pressure to deliver more accessible and personalized care. In this context, RPA and AI emerge as powerful tools to automate repetitive processes, enhance large-scale data analysis, and support clinical and administrative decision-making [2].

The integration of these technologies requires a carefully planned approach, as their effective application depends on various factors, including alignment with organizational contexts, economic sustainability, and user acceptance. Furthermore, the interaction between RPA and AI is particularly significant, as these technologies, when implemented together, can amplify their benefits. While RPA is effective in automating structured and repetitive tasks, AI broadens the possibilities through predictive analytics, natural language processing, and machine learning, enabling systems to evolve and adapt to emerging needs [3].

However, despite the enthusiasm surrounding these technologies, their large-scale adoption in the healthcare sector faces substantial challenges, such as the absence of robust methodological frameworks to evaluate the feasibility and impact of the projects in question. Indiscriminate or poorly founded implementation could lead to ineffective investments, resource wastage, and resistance from healthcare professionals. This is where the importance of the present study lies: to propose a framework that allows for the systematic and rigorous assessment of RPA and AI projects in healthcare, considering both their potential benefits and associated risks [4].

The development of a well-founded assessment framework is essential for guiding managers, researchers, and policymakers in identifying the most promising projects, aligning them with the strategic objectives of healthcare organizations. This study also aims to fill gaps in the existing literature, providing both a theoretical foundation and practical guidance for future research and implementations in this field.

Subsequently, the core research question guiding this study is introduced.

- ***How is it possible to evaluate candidate projects for the implementation of Robotic Process Automation (RPA) and Artificial Intelligence (AI) technologies in healthcare services?***

Through this proposal, it is anticipated that the responsible and efficient adoption of these technologies will be facilitated, fostering a positive impact on healthcare services and, ultimately, on the quality of life of populations. Thus, this article not only reviews the state of the art regarding the applications of RPA and AI in healthcare but also presents an innovative model for assessing candidate projects, combining scientific rigor, practical applicability, and social relevance.

The objective of this work is to conduct a comprehensive literature review to analyses studies aligned with the theme of Robotic Process Automation (RPA) and Artificial Intelligence (AI) in healthcare services. This review aims to identify existing gaps in the literature, providing a foundation for the development and discussion of a framework designed to evaluate candidate projects for the implementation of these technologies in healthcare settings. The proposed framework seeks to address critical aspects such as feasibility, benefits, and risks, offering a structured approach to guide decision-making and promote the responsible adoption of RPA and AI in healthcare services.

The remainder of this paper is structured as follows. Section 2 presents the research methodology used, outlining the approach for conducting the literature review and the criteria for selecting relevant works. Section 3 provides a synthesis and analysis of the articles reviewed, summarizing the key findings from the studies identified. Section 4 introduces the proposed framework for assessing RPA and AI projects in healthcare services. Subsection 4.1 details the framework proposal, while Subsection 4.2 discusses its characteristics and benefits. Section 5 presents a discussion of the results, analyzing the implications of the proposed framework and its applicability in real-world healthcare settings. Finally, Section 6 offers the conclusions, summarizing the main outcomes of the research and suggesting avenues for future work.

2. METHODOLOGY

The methodology employed in this work was based on the analysis of a set of data sources considered relevant to the topic under study. Throughout the study, pertinent information will be presented, drawn from the set of contributions analyzed, provided by leading authors who have addressed this theme or parts of it. The selection of the reviewed articles was carried out using the “B-on” online library database. This platform was chosen due to its ability to provide full access to a wide range of scientific publications in relevant indexed journals, as well as papers presented at international scientific conferences, also indexed in ISI WOS and/or Scopus systems. “B-on” is one of the most extensive databases, including thousands of peer-reviewed journals across various scientific fields. Through the “B-on” online scientific library, managed by the Portuguese Foundation for Science and Technology, researchers have access to the most renowned international scientific databases, which is why it was used to carry out the search process underlying this work, based on the three groups shown in TABLE 1 (Group 1, Group 2, and Group 3).

Four research tests were conducted using the ”B-on” platform, employing the three groups (Group 1 AND Group 2 AND Group 3) and the OR operator as a connector between the titles or keywords (KW) or abstracts (AB) of the intended sets. The number of articles found in each research test is shown in TABLE 2.

Next, throughout the research process, a set of filters was applied based on the sets of publications retrieved, and the results obtained, in terms of the number of publications, are summarized in TABLE 3.

After the filters were applied, a review of the title, key terms, and abstract of each article was conducted to determine which ones were directly related to the research. From the research conducted, 374 papers were obtained, and after applying the filters, a total of 261 articles were identified, of

Table 1: Groups of searched through “B-on”

Group 1	Group 2	Group 3
“RPA” Or “Robotic Process Automation” Or “Intelligent Process Automation” Or “Tools Process Automation” Or “Artificial Intelligence In Business Process” Or “Machine Learning In Business Process” Or “Cognitive Process Automation”	“Medical” Or “Healthcare” Or “Medicine” Or “Health” Or “Medical Services” Or “Healthcare Services” Or “Medicine Services” Or “Health Services” Or “Medical Service” Or “Healthcare Service” Or “Medicine Service” Or “Health Service” Or “Medical and Healthcare Services” Or “Medical and Healthcare Service” Or “Medicine and Healthcare Services” Or “Medicine and Healthcare Service” Or “Medical and Health Services” Or “Medical and Health Service” Or “Medicine and Health Services” Or “Medicine and Health Service” Or “Medical Administrative Services” Or “Healthcare Administrative Services” Or “Medicine Administrative Services” Or “Health Administrative Services” Or ”Medical and healthcare Administrative services”	“Model” Or “Model Evaluation” Or “Tool” Or “Tool Evaluation” Or “Evaluation” Or “Framework”

Table 2: Research tests performed through the “B-on”.

Title	Keywords (KW)	Abstract (AB)
n = 6 articles	n = 2 articles	n = 366 articles

Table 3: Publications obtained through the B-on, after the application of some filters

	Set 1	Set 2	Set 3
Initial result:	6	2	366
1 - Restrict to: Peer Reviewed	4	2	300
2 - Type of fonts: Academic Journals; Conference Materials; Books	4	2	300
3 - From: 2000 to 2024	4	2	296
4 - Language: English	4	2	268
5 - Restrict to: Full Text	3	2	256
Final result:	3	2	256

which only 21 were relevant to the theme. FIGURE 1 illustrates the flowchart of the literature search carried out, along with the screening process of the methodology used in this research.

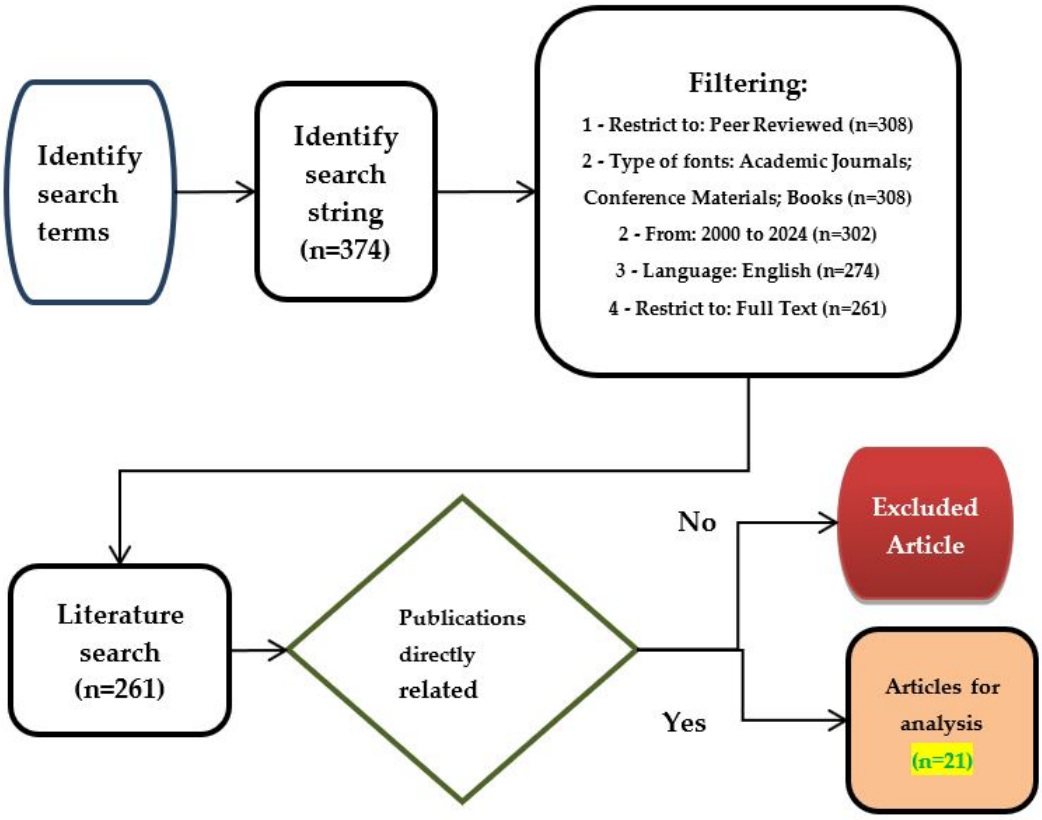

Figure 1: Flow diagram of literature search and respective screening.

The following section, Section 3, presents the analysis and synthesis of the articles.

3. ARTICLES SYNTHESIS AND ANALYSIS

The following table (TABLE 4) provides a comprehensive overview of the key aspects covered in the literature, and in the subsequent table, a comparative analysis will be conducted to further evaluate the similarities and differences across the studies.

The analysis of the table provides a comprehensive overview of the existing literature. The main findings and limitations are identified to justify the framework proposal.

The analysis reveals several critical insights that justify the proposed framework for evaluating RPA and AI projects in healthcare:

- Strong Focus on Healthcare (76%): The majority of the reviewed articles concentrate on healthcare, underscoring the importance of RPA and AI in enhancing operational efficiency,

patient outcomes, and resource utilization. This alignment supports the development of a tailored framework specifically for the healthcare sector.

Table 4: Analysis of the articles selected in the research

	Focus on Healthcare	Empirical Evidence	Technological Framework	Type of contributions
Wiljer, D. et al. (2019) [5]	x			Literature review
Soeny, K. et al. (2021) [6]	x	x		Case study
Pramod, D. (2021) [7]			x	Literature review
Thainimit, S. et al. (2022) [8]	x	x		Case study
Ratia, M. et al. (2018) [9]	x	x		Case study
Zou, K. et al. (2020) [10]	x			Literature review
Khan, Z. et al. (2020) [11]	x			Literature review
Saiya, H. et al. (2022) [12]	x			Literature review
Davenport, T. and Kalakota, R. (2019) [13]	x			Literature review
Shwetha, R. and Kirubanand, V. (2021) [14]	x	x		Case study
Bhatnagar, N. (2019) [15]			x	Framework
Wang, F. (2020) [16]	x			Literature review
Ganesh, S. et al. (2019) [17]	x			Literature review
Afriliana, N. and Ramadhan, A. (2022) [18]			x	Literature review
Madakam, S. et al. (2019) [19]			x	Literature review
Sobczak, A. (2022) [20]	x			Literature review
Cresswell, K. et al. (2018) [21]	x			Literature review
Lievano-Martínez, F. et al. (2022) [22]		x	x	Framework
Long, Y., et al. (2022) [23]	x			Case study
Joseph, A., et al. (2018) [24]	x			Literature review
Morley, J., et al. (2020)[25]	x			Literature review
% / Article	**76%**	**24%**	**24%**	

- Limited Empirical Evidence (24%): A significant gap exists in practical validation, with only a few articles offering empirical data or case studies. This highlights the need for tools that facilitate evidence-based decision-making, which the proposed framework aims to address.
- Scarcity of Technological Frameworks (24%): Few studies propose structured frameworks, indicating an opportunity to introduce a multidimensional model that addresses feasibility, technical requirements, and broader impacts. This lack of guidance in existing literature further validates the necessity of the proposed framework.
- Prevalence of Literature Reviews (67%): Many studies focus on theoretical analysis, leaving a gap in actionable insights or applied methodologies. The proposed framework bridges this divide by translating theoretical findings into practical strategies.
- Consensus on Expected Benefits: The literature consistently highlights benefits such as administrative streamlining, diagnostic precision, and resource optimization. These insights directly inform key dimensions of the framework, including Technical Analysis, Patient-Care Impact, and Economic Evaluation.

While the findings provide a solid foundation, several limitations of the existing literature must be addressed:

- **Lack of Practical Validation:** The low proportion of empirical studies limits the ability to generalize findings. The proposed framework incorporates validation mechanisms to ensure applicability in real-world contexts.
- **Limited Focus on Structured Approaches:** Existing research rarely offers comprehensive frameworks, necessitating the creation of a robust model that guides RPA and AI implementation in healthcare.
- **Theoretical Bias in Literature:** With a high reliance on literature reviews, there is a need to integrate practical applications, measurable outcomes, and ethical considerations. The proposed framework incorporates these elements to offer a balanced approach.
- **Interdisciplinary Gaps:** The current studies often neglect the integration of technical, patient-centered, and governance perspectives. The proposed framework overcomes this by including dimensions such as Monitoring and Governance alongside Technical Analysis.

The findings and limitations from the analysis justify the creation of a multidimensional framework. It addresses gaps in practical validation, aligns with healthcare-specific needs, and provides actionable guidance for evaluating RPA and AI projects. By incorporating technical, patient-care, economic, and governance dimensions, the framework ensures a holistic assessment that supports sustainable and ethical technology adoption in healthcare systems.

It is crucial to enhance the understanding of how technologies such as RPA and AI are being applied in various healthcare contexts, considering the multiple challenges and impacts associated with these innovations. The integration of advanced solutions, such as artificial intelligence and automation technologies, into medical and surgical procedures has demonstrated significant potential to improve accuracy and efficiency in critical areas, while simultaneously reducing time and risks involved. However, advancements of this magnitude require a robust technological infrastructure, specialized training for professionals, and significant investments—factors that make a detailed analysis from both technical and economic perspectives indispensable.

At the same time, ethical issues emerge as a central component in the use of AI in healthcare. Transparency in algorithms, biases present in machine learning models, and the impact on patient trust are aspects that require continuous attention. Instances where automated systems have failed to provide accurate diagnoses or have excluded minority groups from critical processes highlight the need for efficient governance and the integration of ethical monitoring mechanisms. This approach not only mitigates risks but also contributes to fostering trust in the use of these technologies in sensitive environments such as healthcare.

Another example of the application of these technologies is the use of robotics for patient care, such as support for the elderly or in specific therapies. In a scenario of increasing population ageing, solutions like humanoid robots have played a significant role in alleviating the burden on caregivers and personalizing therapies. However, challenges such as user acceptance, high implementation and maintenance costs, and the need for practical evaluations prior to widespread adoption underscore

the complexity of this integration. The ability to anticipate and address such issues demands a structured, multidimensional approach.

Therefore, when considering these multiple dimensions, the importance of a comprehensive framework becomes evident—one that not only evaluates the technical and economic feasibility of these technologies but also their ethical and practical implications. This approach ensures that the adoption process is sustainable, aligned with the needs of the sector, and capable of delivering tangible benefits to healthcare systems. A framework that integrates these aspects provides a solid foundation for strategic decision-making and contributes to bridging gaps in both literature and practice, strengthening trust and efficiency in the use of emerging technologies within the healthcare sector.

4. FRAMEWORK FOR ASSESSING RPA AND AI PROJECTS

4.1 Proposal Framework

The proposed framework for assessing Robotic Process Automation (RPA) and Artificial Intelligence (AI) projects in healthcare services integrates five critical dimensions: Contextualization and Definition, Technical Analysis, Patient-Care Impact, Economic Evaluation, and Monitoring and Governance. This structure provides a systematic and comprehensive method to evaluate the feasibility, implementation, and outcomes of RPA and AI initiatives. By addressing these dimensions, healthcare organizations can ensure alignment with strategic objectives, mitigate potential risks, and enhance decision-making.

This framework recognizes the unique challenges and opportunities of the healthcare sector, including stringent regulatory requirements, the sensitive nature of patient data, and the complexities of integrating emerging technologies into existing systems. It is designed to balance technical feasibility with clinical outcomes, patient satisfaction, and organizational sustainability.

Each dimension is supported by specific criteria and measurable indicators, facilitating a balanced evaluation that encompasses both qualitative and quantitative factors. This multidimensional approach ensures a thorough assessment of the potential value and risks associated with RPA and AI projects. This framework is structured around five primary dimensions, each encompassing relevant criteria and indicators:

4.1.1 Project contextualization and definition

- **Objective:** Establish a solid foundation for the project, ensuring alignment with healthcare sector needs.

  Criteria:

  - **Clinical or operational necessity:** What problem is being addressed?
  - **Strategic objectives:** How does the project align with institutional goals?
  - **Stakeholder involvement:** Including medical teams, administrative staff, patients, and technology providers.

Indicators:

- Clarity of the identified problem.
- Strategic alignment with organizational objectives.
- Level of stakeholder engagement.

4.1.2 Technical analysis

- **Objective:** Assess the technological suitability of the project.
  Criteria:
  - **Technology selection:** Justification for employing RPA and/or AI.
  - **System integration:** Compatibility with hospital management systems.
  - **Scalability and flexibility:** Capacity to adapt to evolving demands.

  Indicators:
  - Technical feasibility of the project.
  - Degree of achievable automation.
  - Potential for integration with existing technologies.

4.1.3 Impact on patient care

- **Objective:** Evaluate how the solution enhances patient experience and outcomes.
  Criteria:
  - **Service efficiency:** Reduction of time spent on processes such as scheduling, billing, or clinical analysis.
  - **Diagnostic and therapeutic accuracy:** Improvement in the precision of clinical decisions.
  - **Patient satisfaction:** How the project influences patient perception and well-being.

  Indicators:
  - Reduction in medical or administrative errors.
  - Improvement in patient satisfaction scores.
  - Adoption rates of new technologies by professionals and patients.

4.1.4 Economic evaluation

- **Objective:** Analyze the financial sustainability of the project.
  Criteria:
  - **Cost-benefit analysis:** Cost reductions compared to the initial investment.

- **Return on Investment (ROI):** Projected medium- and long-term returns.
- **Operational efficiency:** Reduction in waste and optimization of resources.

Indicators:

- Projected savings versus initial costs.
- Estimated project payback period.
- Utilization rates of automated systems.

4.1.5 Monitoring and governance

- **Objective:** Ensure the project is implemented ethically, securely, and sustainably.
  Criteria:
  - **Regulation and compliance:** Adherence to standards such as GDPR and healthcare directives.
  - **Data security:** Mechanisms for safeguarding sensitive patient information.
  - **Sustainability:** Capacity to maintain the technology in the long term.

  Indicators:
  - Regulatory and security compliance levels.
  - Frequency of audits and reviews.
  - Success rates in achieving sustainability goals.

The proposed framework provides a structured and comprehensive methodology for assessing RPA and AI projects in healthcare, addressing both technical and organizational dimensions. By integrating critical areas such as Contextualization, Technical Analysis, Patient-Care Impact, Economic Evaluation, and Monitoring and Governance, it ensures that projects are strategically aligned, technically feasible, and capable of delivering measurable benefits.

This multidimensional approach allows healthcare organizations to navigate the complexities of emerging technologies while safeguarding patient care quality, data security, and regulatory compliance. Ultimately, the framework serves as a guiding tool for informed decision-making, promoting innovation that is both impactful and sustainable.

4.2 Framework: Characteristics and Benefits

The framework's design reflects a structured approach to assessing RPA and AI projects, characterized by its comprehensiveness, adaptability, and stakeholder focus. Below, its characteristics and benefits are explored in detail (TABLE 5).

The framework encompasses the following key characteristics, ensuring its utility across diverse healthcare contexts:

Table 5: Framework – Characteristic and Description

Characteristic	Description
Comprehensive Approach	Examines technical, clinical, economic, and governance aspects of RPA and AI projects.
Adaptability	Can be customized to suit the needs of various healthcare settings, such as hospitals, clinics, or specialized care centers.
Quantitative and Qualitative	Combines measurable indicators (e.g., cost savings, diagnostic accuracy) with narrative insights for a holistic evaluation.
Stakeholder Focused	Prioritizes feedback from clinicians, administrators, and patients to ensure alignment with their needs.
Ethical Alignment	Incorporates considerations for patient data protection, equity, and compliance with ethical standards.

The framework provides a range of benefits, ensuring that healthcare organizations maximize the potential of RPA and AI while safeguarding against associated risks:

1. **Informed Decision-Making:** Through its structured and multidimensional approach, the framework enables healthcare leaders to make evidence-based decisions regarding RPA and AI adoption. It reduces uncertainty by considering all critical factors, from technical viability to patient-centered outcomes.
2. **Risk Management:** The healthcare sector is inherently risk-averse due to its impact on human lives and its regulatory landscape. By including dimensions such as monitoring and governance, the framework ensures that potential risks, such as compliance violations or data breaches, are systematically identified and mitigated.
3. **Improved Patient Outcomes:** The patient-care impact dimension highlights the importance of improving the quality of care. By focusing on efficiency, accuracy, and satisfaction, the framework ensures that technological advancements directly contribute to better health outcomes.
4. **Financial Sustainability:** Economic evaluation is central to the framework, enabling organizations to weigh the costs and benefits of their projects. Metrics such as Return on Investment (ROI) and cost-benefit analysis provide a clear view of the financial implications, ensuring long-term sustainability.
5. **Organizational Alignment:** By grounding projects in the organization's strategic goals and engaging stakeholders from the outset, the framework fosters alignment across teams. This collaborative approach increases the likelihood of successful implementation and adoption.

The table below (TABLE 6) outlines the dimensions, criteria, and benefits of the proposed framework, designed to enhance the adoption and management of RPA and AI in healthcare organizations. It provides a structured approach to ensuring that technology implementations align with strategic objectives, promote patient-centric outcomes, and maintain financial sustainability. By addressing key aspects such as technical integration, economic assessment, and governance, the framework

Table 6: Framework – Dimension, Criteria and Description

Dimension	Criteria	Benefits
Contextualization and Definition	Alignment with organizational goals; Stakeholder involvement	Ensures strategic relevance and stakeholder buy-in.
Technical Analysis	Integration with existing systems; Scalability	Reduces implementation challenges and ensures adaptability for future needs.
Patient-Care Impact	Efficiency improvements; Diagnostic accuracy	Improves patient outcomes and satisfaction while reducing errors.
Economic Evaluation	Cost-benefit analysis; ROI	Ensures financial sustainability and informed investment decisions.
Monitoring and Governance	Regulatory compliance; Data security	Safeguards organizational reputation and ensures ethical project execution.

supports informed decision-making and risk mitigation while maximizing the benefits of healthcare innovation.

In summary, the proposed framework is designed to guide healthcare organizations in evaluating and implementing RPA and AI projects. By addressing technical, economic, clinical, and governance factors, it ensures a balanced and practical assessment process. This enables organizations to harness the potential of automation and artificial intelligence to enhance efficiency, improve patient care, and achieve long-term sustainability.

5. DISCUSSION OF RESULTS

The proposed framework for evaluating Robotic Process Automation (RPA) and Artificial Intelligence (AI) initiatives in healthcare services provides a systematic and comprehensive method of assessment. This article examines the implications of applying the framework, its alignment with the distinct needs of the healthcare sector, and the outcomes it facilitates.

Healthcare systems face numerous challenges, including regulatory complexities, the management of sensitive patient data, and the integration of emerging technologies with existing systems. The framework adeptly addresses these issues by incorporating dimensions that evaluate strategic alignment, technical feasibility, patient outcomes, financial sustainability, and governance.

The Contextualization and Definition dimension ensures that projects are aligned with the overarching goals of healthcare organizations. By engaging a broad spectrum of stakeholders—such as clinicians, administrators, and patients—the framework fosters a holistic understanding of a project's relevance. This collaborative approach not only promotes stakeholder buy-in but also accommodates the diverse priorities within the healthcare ecosystem. For instance, engaging stakeholders ensures that RPA and AI solutions are tailored to address both clinical and administrative challenges effectively.

The Technical Analysis dimension enables a thorough evaluation of the technologies in question. By focusing on system integration and scalability, it ensures that projects are compatible with existing

hospital management systems and can adapt to future requirements. This is particularly critical in healthcare, where outdated or poorly integrated systems can lead to inefficiencies or pose risks to patient safety.

A notable strength of the framework is its emphasis on the Impact on Patient Care. The criteria of service efficiency, diagnostic accuracy, and patient satisfaction highlight the importance of ensuring that technological advancements directly improve patient outcomes. For example, the use of RPA in administrative tasks, such as appointment scheduling or billing, reduces the time spent on manual processes, allowing staff to concentrate on patient care. Similarly, AI applications in diagnostics and treatment planning enhance clinical precision, resulting in better health outcomes. The inclusion of measurable indicators, such as patient satisfaction scores and error reduction rates, ensures that these impacts are systematically monitored.

A key finding from the application of the framework is the potential for AI-powered diagnostics to reduce human errors, particularly in fields like radiology and pathology. By improving accuracy and efficiency, these technologies not only benefit patients but also alleviate the workload of healthcare professionals.

The Economic Evaluation dimension provides a robust methodology for analyzing the financial viability of RPA and AI projects. Through cost-benefit analysis and return on investment (ROI) calculations, healthcare organizations can assess short-term investments against long-term savings and operational efficiencies. In practice, this enables the identification of cost-reduction opportunities, such as waste minimization and optimized resource allocation. For instance, case studies on RPA adoption in hospital administration demonstrate significant operational cost reductions by automating repetitive tasks like claims processing. Such efficiencies validate the framework's emphasis on financial evaluation.

The Monitoring and Governance dimension is particularly crucial in healthcare, given the sector's stringent regulatory environment. By prioritizing compliance with standards such as the General Data Protection Regulation (GDPR) and ensuring robust data security measures, the framework safeguards patient privacy and organizational reputation. Furthermore, ethical considerations, including equity and access, are integrated into this dimension. This ensures that RPA and AI projects promote equitable access to quality care rather than exacerbating existing disparities. The framework's focus on sustainability ensures that technological solutions remain effective and maintainable in the long term.

In conclusion, the proposed framework represents a robust tool for evaluating RPA and AI initiatives in healthcare, balancing technical feasibility with clinical impact, financial viability, and ethical governance. By addressing the complexities inherent in the healthcare environment, it ensures that projects are strategically aligned, patient-centered, and sustainable. The findings demonstrate that adopting such a structured approach enables healthcare organizations to navigate the challenges posed by emerging technologies effectively. Ultimately, the framework facilitates informed decision-making, mitigates risks, and maximizes the value of RPA and AI initiatives in enhancing patient care and operational efficiency.

6. CONCLUSION

The present study addressed the central research question by developing and proposing a robust and systematic methodological framework. This framework provides a multidimensional approach to assessing the feasibility, benefits, and risks associated with these technologies in the healthcare sector, addressing technical, clinical, economic, and ethical dimensions. The key findings are summarized as follows:

6.1 Alignment with Healthcare Sector Needs

The framework integrates five critical dimensions: Contextualization and Definition, Technical Analysis, Patient Care Impact, Economic Evaluation, and Monitoring and Governance. These dimensions encompass the identification of clinical and operational needs through to the assessment of financial and ethical impacts. This methodology ensures that RPA and AI projects are strategically aligned, technically feasible, and promote positive outcomes for patients and organizations alike.

6.2 Impact on Patient Care

One of the most significant conclusions highlights the importance of evaluating how these technologies influence service efficiency, diagnostic accuracy, and patient satisfaction. The adoption of RPA and AI solutions has the potential to reduce administrative and clinical errors, enhance patient experience, and build trust in digital health systems.

6.3 Economic Feasibility and Sustainability

Economic analysis proved essential for ensuring the sustainability of projects. The findings underscore that employing ROI and cost-benefit analyses can identify significant operational savings and opportunities for resource optimization, thereby fostering financially viable implementation.

6.4 Importance of Monitoring and Governance

The study emphasized the necessity of prioritizing regulatory compliance and data security, particularly in sensitive sectors like healthcare. By integrating ethical and sustainability criteria into the framework, the proposed approach ensures that adopted solutions adhere to standards of equity and promote accessible, high-quality healthcare.

This work faced certain limitations inherent to the research process. The literature review was confined to the articles available in the ”B-on” database, potentially excluding relevant contributions from outside this repository. Furthermore, although the proposed framework is evidence-based, it has not been extensively tested in practical scenarios, limiting its empirical validation.

To expand the impact of this study, the following future research directions are proposed:

- Practical Validation of the Framework: Implement the model in real-world cases of RPA and AI adoption within healthcare organizations, assessing its effectiveness and refining the criteria and indicators.
- Expansion of Ethical and Social Dimensions: Explore the impact of these technologies on equity of access and patient experience across diverse cultural and economic contexts.
- Interdisciplinary Approach: Incorporate perspectives from fields such as law, medical ethics, and social sciences to enrich the application of the framework.
- Automation of Assessment: Investigate the use of AI to automate the application of the framework, optimizing the project evaluation process.

This study represents a significant step forward in developing tools for the rigorous evaluation of RPA and AI projects in healthcare. The proposed framework, by addressing the sector's challenges and opportunities, contributes to the responsible implementation of these technologies, maximizing their benefits for patients, healthcare professionals, and managers. With this structured approach, it is anticipated that sustainable and ethical adoption will be fostered, driving innovation and improving the quality of healthcare services.

References

[1] Neves A, Godina R, Azevedo SG, Matias JC. A Comprehensive Review of Industrial Symbiosis. J. Clean. Prod. 2020;247:119113.

[2] Melville NP. Information Systems Innovation for Environmental Sustainability. MIS quarterly. Management Information Systems Research Center (MISRC). 2010;34:1-21.

[3] Achmad GN, Fitriyana RN, Pratamaputra E. Robotic Process Automation Development Model and Application of Tripple Bottom Line in Village Accounting Systems as an Effort to Reach Advanced Villages by 2045. In Annual International Conference on Islamic Economics and Business (AICIEB). 2022;2:168-178.

[4] Tomlinson B. Greening through IT: Information Technology for Environmental Sustainability. MIT Press. 2010.

[5] Wiljer D, Hakim Z. Developing an Artificial Intelligence–Enabled Health Care Practice: Rewiring Health Care Professions for Better Care. J. Med. Radiat. Sci. 2019;50:S8-S14.

[6] Soeny K, Pandey G, Gupta U, Trivedi A, Gupta M, et al. Attended Robotic Process Automation of Prescriptions' Digitization. Smart Health. 2021;20:100189.

[7] Pramod D. Robotic Process Automation for Industry: Adoption Status, Benefits, Challenges and Research Agenda. Benchmarking: an international journal. 2021;29:1562-1586.

[8] Thainimit S, Chaipayom P, Sa-arnwong N, Gansawat D, Petchyim S, et al. Robotic Process Automation Support in Telemedicine: Glaucoma Screening Usage Case. Informatics in Medicine Unlocked (IMU). 2022;31:101001.

[9] Ratia M, Myllärniemi J, Helander N. Robotic Process Automation-Creating Value by Digitalizing Work in the Private Healthcare?. In Proceedings of the 22nd International Academic Mindtrek Conference. 2018:222-227.

[10] Zou KH, Li JZ, Imperato J, Potkar CN, Sethi N, et al. Harnessing Real-World Data for Regulatory Use and Applying Innovative Applications. J. Multidiscip. Healthc. 2020;13:671-679.

[11] Khan ZH, Siddique A, Lee CW. Robotics Utilization for Healthcare Digitization in Global COVID-19 Management. Int. J. Environ. Res. Public Health. 2020;17:3819.

[12] Saiya H, Doshi S, Seth J, Badgujar V, Kalme G. Automation of Supply Chain Management for Healthcare. In International Conference on Deep Learning, Artificial Intelligence and Robotics (ICDLAIR). Progresses in Artificial Intelligence Robotics: Algorithms Applications. 2021:35-41.

[13] Davenport T, Kalakota R. The Potential for Artificial Intelligence in Healthcare. Future Healthc. J. 2019;6:94-98.

[14] Shwetha R, Kirubanand VB. Remote Monitoring of Heart Patients Using Robotic Process Automation (RPA). In ITM Web of Conferences. International Conference on Innovative Technology for Sustainable Development (ICITSD). 2021;37:01002.

[15] Bhatnagar N. Role of Robotic Process Automation in Pharmaceutical Industries. In The International Conference on Advanced Machine Learning Technologies and Applications (AMLTA2019). 2019:497-504.

[16] Wang FY. Parallel Healthcare: Robotic Medical and Health Process Automation for Secured and Smart Social Healthcares. IEEE Trans. Comput. Soc. Syst. 2020;7:581-586.

[17] Ganesh S, Celestina AP, Jayashree R, HariPriya KV. Web Automation in Health Care. In 2019 IEEE International Conference on Innovations in Communication, Computing and Instrumentation (ICCI). IEEE. 2019.

[18] Afriliana N, Ramadhan A. The Trends and Roles of Robotic Process Automation Technology in Digital Transformation: A Literature. Journal of system and management sciences (JSMS). 2022;12:51-73.

[19] Madakam S, Holmukhe RM, Jaiswal DK. The Future Digital Work Force: Robotic Process Automation (RPA). JISTEM-Journal of Information Systems and Technology Management. 2019 ;16:e201916001.

[20] Sobczak A. Robotic Process Automation as a Digital Transformation Tool for Increasing Organizational Resilience in Polish Enterprises. Sustain. 2022;14:1333.

[21] Cresswell K, Cunningham-Burley S, Sheikh A. Health Care Robotics: Qualitative Exploration of Key Challenges and Future Directions. J. Med. Internet Res. 2018;20:e10410.

[22] Lievano-Martínez FA, Fernández-Ledesma JD, Burgos D, Branch-Bedoya JW, Jimenez-Builes JA. Intelligent Process Automation: An Application in Manufacturing Industry. Sustain. 2022;14:8804.

[23] Long Y, Cao J, Deguet A, Taylor RH, Dou Q. Integrating Artificial Intelligence and Augmented Reality in Robotic Surgery: An Initial dVRK Study Using a Surgical Education Scenario. In 2022 International Symposium on Medical Robotics (ISMR). IEEE. 2022.

[24] Joseph A, Christian B, Abiodun AA, Oyawale F. A Review on Humanoid Robotics in Healthcare. In MATEC Web of Conferences. 2018;153:02004.

[25] Morley J, Machado CC, Burr C, Cowls J, Joshi I, et al. The Ethics of AI in Health Care: A Mapping Review. Soc. Sci. Med. 2020;260:113172.