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ARTICLE

Sustainable Development Practices for Adoption of Robotic Process Automation (RPA) at the Universities

Práticas de Desenvolvimento Sustentável na Adoção da Automação Robótica de Processos (ARP) em Universidades

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ABSTRACT | **Objective:** This study aims to investigate sustainable development practices associated with the adoption of Robotic Process Automation (RPA) in universities, with a focus on aligning digital transformation initiatives with environmental, economic, and social sustainability dimensions. The research examines how RPA adoption influences awareness, operational performance, and employee satisfaction within A+ and A++ NAAC-accredited universities in Rajasthan. **Methodology:** A mixed-methods research design was employed, incorporating structured surveys and statistical analyses to evaluate the levels of RPA awareness, operational efficiency, and satisfaction among university employees across multiple departments. Sustainability frameworks, including the Triple Bottom Line and Circular Economy, were applied to interpret the results and design an integrated strategic model for sustainable RPA implementation. **Originality:** This study provides one of the first empirical investigations into RPA adoption specifically within Indian higher education institutions through a sustainability lens. It uniquely combines digital transformation metrics with sustainability frameworks to present a holistic understanding of the environmental, economic, and social implications of RPA, while offering a strategic approach tailored to the operational realities of NAAC-accredited universities. **Main Results:** Findings reveal that RPA significantly enhances operational efficiency and departmental performance, while awareness and satisfaction levels remain relatively uniform across units, indicating effective centralized training mechanisms. Despite these benefits, barriers such as legacy system integration challenges, high initial investment requirements, and data privacy risks hinder widespread sustainable adoption. The evidence suggests that systematic RPA adoption can improve awareness, performance, and satisfaction among employees when supported by robust institutional planning. **Theoretical Contributions:** This research extends the literature on digital transformation in higher education by integrating sustainability models with RPA adoption frameworks. It provides a conceptual foundation for understanding how automation technologies

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can contribute to long-term sustainable development goals within universities. The proposed strategic framework bridges gaps between operational efficiency, sustainability outcomes, and human-centric acceptance, offering a theoretical basis for future studies on technology-enabled sustainable institutional development.

Keywords | Sustainable Development, Robotic Process Automation (RPA), Higher Education, University Management, Digital Transformation

RESUMO | Objetivo: Investigar as práticas de desenvolvimento sustentável associadas à adoção da Automação Robótica de Processos (ARP) em universidades, analisando seus impactos sobre a conscientização, o desempenho operacional e a satisfação dos colaboradores, à luz das dimensões econômica, ambiental e social da sustentabilidade. **Metodologia:** Adotou-se uma abordagem quantitativa, com aplicação de questionário estruturado a 406 colaboradores de universidades com acreditação NAAC A+ e A++ no estado de Rajasthan, Índia. Os dados foram analisados por meio de estatística descritiva e do teste não paramétrico de Kruskal-Wallis, utilizando o software SPSS. A confiabilidade do instrumento foi verificada por meio do coeficiente Alfa de Cronbach. **Resultados:** Os resultados indicam que a adoção da ARP contribui significativamente para a melhoria do desempenho operacional, especialmente em departamentos com processos repetitivos e padronizados. Não foram identificadas diferenças estatisticamente significativas entre departamentos quanto ao nível de conscientização e à satisfação dos colaboradores, sugerindo efetividade de estratégias institucionais centralizadas de capacitação. Entretanto, desafios relacionados à integração com sistemas legados, investimentos iniciais elevados e riscos à privacidade de dados limitam uma adoção plenamente sustentável. **Contribuições:** O estudo amplia a literatura sobre transformação digital no ensino superior ao integrar a adoção da ARP com os referenciais do Triple Bottom Line e da Economia Circular. Como contribuição prática, propõe diretrizes estratégicas para a implementação sustentável da RPA em universidades, conciliando eficiência operacional, responsabilidade socioambiental e aceitação organizacional.

Palavras-chave | Desenvolvimento Sustentável; Automação Robótica de Processos (ARP); Ensino Superior; Gestão Universitária; Transformação Digital.

1 INTRODUCTION

Digital transformation has become a cornerstone of modern higher education, driven by the need for universities to streamline operations, enhance academic delivery, and remain competitive in a rapidly evolving technological landscape (Gunawan & Wijaya, 2023). Robotic Process Automation (RPA) offers powerful tools for universities to automate repetitive, time-consuming tasks in areas such as administrative workflows, financial management, and student services (Almgren, 2021). Through automation, institutions can reduce human error, increase operational efficiency, and free up staff to focus on more strategic and student-centered activities. However, the adoption of RPA—and digital transformation more broadly—must align with sustainable development objectives to ensure long-term viability and positive societal impact (Gupta, 2023). Sustainability in this domain means adopting technologies in ways that are environmentally responsible, economically feasible, and socially inclusive. By embedding sustainability into digital initiatives, universities can address environmental challenges such as high energy consumption in data centers, manage costs effectively, and foster an inclusive work environment that supports both staff and students (Hu et al., 2023). For universities, sustainable digital transformation is not just an operational imperative but also aligns with their broader mission to educate and inspire responsible global citizens (Lasso-Rodríguez & Gil-Herrera, 2020). Implementing RPA in a sustainable way reinforces the institution's commitment to environmental stewardship, models sustainable practices for students, and can even be leveraged to enhance the institution's reputation and appeal to stakeholders, including

environmentally conscious students and staff (Joy & Sreelakshmi, 2020). Therefore, exploring sustainable RPA adoption is critical to advancing both operational goals and the larger social responsibility agenda that modern universities are increasingly expected to uphold (Lebens et al., 2023).

Applying sustainability frameworks like the Triple Bottom Line (TBL) and the Circular Economy (CE) concept can provide a holistic assessment of the sustainable impact of RPA in universities. Each of these frameworks can be applied to analyze RPA adoption in higher education:

1. Triple Bottom Line (TBL) Framework for Sustainable RPA Adoption in Universities

The Triple Bottom Line approach evaluates sustainability through three dimensions: economic, environmental, and social. Each of these dimensions can provide a distinct lens for assessing the impact of RPA in a university.

Economic Dimension

- **Cost Savings and Efficiency**: RPA can reduce operational costs by automating repetitive administrative tasks such as admissions processing, scheduling, and record-keeping. This efficiency minimizes resource use, allowing universities to allocate budgets to other essential areas such as research, student support, and faculty development (Juszczyk, 2021).
- **Return on Investment** (**ROI**): While RPA requires initial investment in software, training, and integration, it can yield long-term financial benefits through streamlined operations and reduced error rates (Liu & Ishak, 2024). Calculating and maximizing ROI is essential for ensuring that RPA adoption aligns with sustainable financial practices in the university.

Environmental Dimension

- **Resource Reduction**: By automating tasks traditionally performed on paper (e.g., admissions processing, data entry), RPA can significantly reduce paper consumption and associated waste (Qasrawi et al., 2020). This aligns with environmental sustainability goals by minimizing resource use and reducing the university's overall environmental footprint.
- **Energy Consumption**: Although RPA operates within digital systems, it consumes energy. Universities should measure and monitor RPA's energy requirements, opting for energy-efficient servers and devices where possible. Integrating renewable energy sources into the IT infrastructure could further enhance RPA's environmental sustainability (Rahman et al., 2022).

Social Dimension

- **Employee Satisfaction and Job Enrichment**: While RPA can reduce repetitive tasks, it may also affect job roles. To ensure a positive social impact, universities should involve employees in RPA transition processes, provide training for higher-level tasks, and avoid displacing staff (Liu& Ishak, 2023). This approach can enhance employee satisfaction and foster a supportive work environment.
- **Student Experience and Academic Quality**: RPA enables staff to spend more time on student-focused activities, such as advising and mentoring, which can improve the overall academic experience. Additionally, RPA allows universities to respond more quickly to student needs, contributing to a more student-centered educational environment (Sharma et al., 2022).

By balancing these three TBL dimensions, universities can ensure that RPA adoption supports economic viability, environmental responsibility, and social well-being, fostering a more sustainable approach to digital transformation.

2. Circular Economy (CE) Concept for Sustainable RPA in Universities

The Circular Economy approach emphasizes minimizing waste, maximizing resource use, and creating closed-loop systems that enhance sustainability. Applying CE principles to RPA in universities involves designing systems that minimize waste and encourage continual resource utilization.

Resource Efficiency and Minimization of Waste

- **Digital Workflow Optimization**: RPA reduces dependency on paper-based workflows, moving toward entirely digital systems. This transition minimizes waste associated with traditional administrative processes (e.g., paper, ink) and promotes a more sustainable, digital-first approach within university operations (Saraf, 2024).
- **Reuse of RPA Components**: In a circular model, reusable RPA scripts or software bots can be adapted and modified across different university departments. For instance, a bot designed for admission-related tasks can be repurposed with minor adjustments for managing scheduling or data entry (Razak et al., 2021). This adaptability maximizes resource efficiency, reducing the need to develop new RPA solutions from scratch.

Product Lifecycle Management and Maintenance

- **Regular Updates and Upgrades**: To ensure sustainability, RPA systems should undergo regular updates that improve efficiency, reduce energy consumption, and extend the useful life of the software (Vulpe & Enăchescu, 2022). By maintaining and updating RPA systems, universities can avoid the environmental impact of replacing software frequently.

- **End-of-Life Planning for IT Infrastructure**: When updating IT systems supporting RPA, universities should adopt environmentally responsible disposal or recycling practices. Outdated hardware components, for example, can be recycled in accordance with e-waste protocols, minimizing environmental impact.

Stakeholder Involvement and Feedback Loops

- **Feedback Mechanisms for Continuous Improvement**: In line with CE principles, universities should establish feedback mechanisms to assess the ongoing impact of RPA on stakeholders, including staff, students, and administrators. This feedback can inform adjustments to RPA processes, helping the university adapt RPA solutions over time to meet changing needs sustainably (Thorave et al., 2022).
- **Engagement with Technology Partners**: Collaboration with RPA software providers to design energy-efficient solutions can further align RPA with CE principles. Universities can work with vendors who emphasize energy efficiency, modularity, and recycling in their products, enhancing the sustainability of the overall RPA ecosystem.

A Sustainable RPA Framework for Universities

By combining the Triple Bottom Line and Circular Economy frameworks, universities can adopt a comprehensive approach to sustainable RPA integration. Through economic, environmental, and social considerations, as well as principles of resource reuse and lifecycle management, universities can create RPA solutions that not only drive efficiency but also contribute positively to sustainability goals (Sisodiya et al., 2024). These frameworks ensure that the adoption of RPA aligns with the principles of responsible, resource-conscious digital transformation, fostering a model for sustainable development in the Universities.

2 LITERATURE REVIEW

The application of Robotic Process Automation (RPA) in higher education has been explored in various studies, each offering insights into its potential for streamlining processes, enhancing operational efficiency, and promoting sustainable development practices. A comprehensive examination of these studies highlights both the opportunities and challenges associated with RPA adoption within university.

Farinha et al. (2024) provide a foundational understanding of how organizations, including universities, can decide which processes to automate using RPA. Their systematic literature review and Delphi study identified essential criteria such as process feasibility, input/output data availability, and process descriptions. These criteria are crucial for sustainable RPA adoption, as they guide universities in selecting processes that are best suited for automation, thereby ensuring resources are allocated effectively and minimizing risks associated with unsuitable

automation choices (Farinha et al., 2024). Multiple studies illustrate how RPA can automate routine administrative tasks in universities, contributing to significant time and cost savings. For example, Nethravathi and Mamatha (2024) developed an RPA system for automatic certificate generation, resulting in increased efficiency and reduced errors. Similarly, Gunawan and Wijaya (2023) implemented RPA for managing asynchronous class attendance, achieving a 99.9% reduction in processing time. These examples showcase RPA's ability to optimize processes, support sustainable operational practices, and enable administrative staff to focus on high-value tasks (Nethravathi & Mamatha, 2024) (Gunawan & Wijaya, 2023). Saraf (2024) advocates for RPA as a tool for transforming universities into "smart" institutions aligned with sustainable development goals (SDGs). By automating student club enrollment and other routine processes, universities can reduce their environmental impact, streamline workflows, and enhance student experiences. These sustainable practices not only improve operational efficiency but also promote eco-friendly strategies within university, contributing to the institution's broader social and environmental goals (Saraf, 2024).

Despite RPA's benefits, certain challenges need to be addressed to ensure sustainable adoption in universities. Gupta et al. (2023) highlight the need for extensive software engineering and maintenance, emphasizing that while RPA reduces labor-intensive tasks, long-term management is essential to prevent system failures. Sisodiya et al. (2024) note resistance from staff and the need for digital training, suggesting that sustainable RPA integration requires a strong focus on stakeholder engagement and skill development. These studies underline that sustainable RPA implementation goes beyond automation; it necessitates continuous investment in system maintenance and workforce adaptation (Gupta et al., 2023) (Sisodiya et al., 2024). Incorporating RPA into university curricula is another aspect of sustainable RPA practices. Lebens et al. (2023) investigates the importance of RPA training in enhancing students' career readiness. Teaching RPA skills can provide students with valuable expertise that aligns with workforce demands, supporting sustainable educational practices by equipping graduates with competencies needed for the evolving job market. This alignment between education and industry needs highlights RPA's role in preparing students for future career opportunities, ensuring the sustainable impact of RPA within both academic and employment landscapes (Lebens et al., 2023).

Therefore, the literature reveals that while RPA holds substantial promise for advancing sustainable development practices in universities by optimizing efficiency, reducing environmental impacts, and preparing students for technology-driven roles, successful implementation requires careful planning. Criteria-based selection, continuous system support, stakeholder training, and curriculum integration are crucial factors for sustainable RPA adoption in higher education institutions.

3 RESEARCH GAP

While Robotic Process Automation (RPA) has gained traction in sectors such as business, healthcare, and government for its ability to streamline workflows and enhance productivity, its application within higher education remains underexplored. Current studies predominantly highlight RPA's potential to improve efficiency and reduce operational costs, but there is little

research focused specifically on RPA in universities. Furthermore, sustainability considerations in RPA adoption—including environmental, economic, and social impacts—are often neglected in academic literature. This lack of research leaves universities without a clear understanding of how to adopt RPA in ways that not only boost efficiency but also align with their sustainability and social responsibility goals.

4 PROBLEM STATEMENT

Higher education institutions increasingly recognize the need for sustainable digital transformation, especially as they face pressures to operate more efficiently and responsibly. However, guidance on implementing RPA within a sustainability framework is lacking, leaving universities to navigate this digital shift without evidence-based practices for minimizing environmental impact, ensuring economic viability, and considering social implications for staff and students. Without a structured approach to sustainable RPA adoption, universities may experience negative consequences, such as increased energy use, budgetary strain, or adverse effects on employee satisfaction and engagement. This study aims to fill this gap by proposing a framework for sustainable RPA practices tailored to the unique context of higher education.

5 RESEARCH OBJECTIVES

- To develop a framework for the sustainable adoption of Robotic Process Automation (RPA) in universities
- To assess the factors affecting Process Automation in the different departments of the Universities

Research Questions

- How can universities implement Robotic Process Automation (RPA) in ways that align with sustainable development principles?
- What are the key environmental, economic, and social considerations that influence sustainable RPA adoption in higher education institutions?
- What measurable impacts can sustainable RPA adoption have on awareness, university operations and satisfaction among employees?

6 SIGNIFICANCE OF STUDY

This study holds substantial significance as it addresses the intersection of sustainable development and digital transformation within higher education. With universities increasingly adopting Robotic Process Automation (RPA) to improve operational efficiency, the findings of this research are poised to provide essential guidance on implementing these technologies responsibly.

By focusing on sustainable practices in RPA adoption, the study offers a framework that ensures universities can harness the benefits of automation while minimizing environmental impacts, supporting financial sustainability, and fostering positive social outcomes. From an environmental perspective, the study contributes by exploring methods to reduce the ecological footprint of RPA technologies, such as energy-efficient solutions and environmentally friendly digital practices. This aligns with global sustainability goals and demonstrates how universities can contribute to a more sustainable future through their technological choices, setting an example for other institutions and industries. Socially, the study provides insight into how RPA can be integrated in ways that respect and enhance the roles of university staff and improve services for students. By addressing the potential impacts of automation on job satisfaction, role adaptation, and service delivery, this research offers a model for universities to embrace technological innovation without compromising staff well-being or student support. Economically, the study is valuable for university administrators and policymakers as it offers a cost-benefit analysis within a sustainability context. It presents strategies that can make RPA financially viable while aligning with the institution's mission to operate responsibly. Ultimately, the study is a vital resource for guiding higher education institutions toward a balanced approach to digital transformation, ensuring that technological advancements contribute to the long-term health, reputation, and societal role of universities.

7 RESEARCH HYPOTHESES

- H_{a1}: There is a significant difference in the awareness of RPA across different departments using Process Automation in the universities.
- H_{a2}: There is a significant difference in the operational performance across different departments using Process Automation in the universities.
- H_{a3}: There is a significant difference in the Satisfaction across different departments using Process Automation in the universities.

8 METHODOLOGY

Research Design

This study employs a quantitative approach. The quantitative component involves surveying university staff to evaluate their awareness, operational performance, and satisfaction with RPA adoption. Quantitative data enhances the study's validity and provides a multi-dimensional perspective on sustainable RPA adoption.

Data Collection Methods

A structured survey was administered to 406 employees from A+ and A++ NAAC-accredited universities in Rajasthan, using a convenience sampling method. The survey aimed to assess

participants' awareness of RPA, readiness for its adoption, and perceptions of its impact on operational performance and employee satisfaction. This quantitative data provides measurable insight into the general attitudes and readiness levels of university employees regarding RPA adoption.

Sampling and Participants

The target population for the study consists of employees of universities in Rajasthan and the samples are the employees at A+ and A++ NAAC-accredited universities in Rajasthan. For the quantitative survey, convenience sampling was employed, allowing for the collection of responses from a large group of employees efficiently. A total of 406 responses were collected and analyzed, providing a robust dataset for statistical analysis.

Data Analysis Techniques

The statistical tool SPSS was utilized to analyze survey data. Key analyses included calculating the impact of RPA adoption on factors such as awareness, operational performance, and employee satisfaction. The Kruskal-Wallis test, a non-parametric test, was employed to assess differences in perceptions and impacts across different employee groups. This test was chosen due to its robustness in handling data that may not meet the assumptions required for parametric testing.

Reliability and Validity

Measures were taken to ensure the reliability and validity of the data collected. The survey instrument was pilot tested to refine questions and confirm clarity, ensuring that responses accurately reflected the participants' perceptions and experiences. Reliability statistics were calculated using Cronbach's Alpha, with the overall alpha coefficient reaching 0.972, indicating a high level of internal consistency across survey items. Individual factors also demonstrated strong reliability, with Cronbach's Alpha scores as follows:

- **Adoption of RPA**: $\alpha = 0.927$
- **Awareness of RPA**: $\alpha = 0.927$
- **Operational Performance**: $\alpha = 0.895$
- **Employee Satisfaction**: $\alpha = 0.910$

This high reliability suggests that the survey items were consistent in measuring the intended constructs, enhancing the study's credibility and the generalizability of the findings.

9 DATA ANALYSIS

Kruskal Wallis test

Table 7.1. Mean Rank

Ranks			
	Role	**N**	**Mean Rank**
Awareness Level	Academician	138	194.09
	Administrator	104	197.29
	Technical Staff	54	217.82
	Examination	110	214.14
	Total	406	
Operational Performance	Academician	138	200.36
	Administrator	104	182.48
	Technical Staff	54	204.20
	Examination	110	226.97
	Total	406	
Satisfaction Level	Academician	138	201.31
	Administrator	104	188.89
	Technical Staff	54	210.66
	Examination	110	216.55
	Total	406	

The mean rank in a Kruskal-Wallis test signifies the average rank of scores assigned to each role in the table 7.1. Since the Kruskal-Wallis test is a non-parametric method, it uses the ranks of the data points for the comparison across groups and relative standing. Mean ranks help to understand how different groups (departments) compared to each other in terms of the identified factors, providing a basis for identifying significant differences across groups.

Table 7.2. Test Statistics

Test Statistics[a,b]			
	Awareness	**Operational Performance**	**Satisfaction**
Chi-Square	7.571	8.576	7.407
df	3	3	3
Asymp. Sig.	.056	.035	.060

a. Kruskal Wallis Test
b. Grouping Variable: Current Role

Table 7.3. Hypothesis Test Summary

Hypothesis Test Summary				
	Null Hypothesis	**Test**	**Sig**	**Decision**
1	The distribution of Awareness of RPA is the same across categories of different departments.	Independent-Samples Kruskal-Wallis Test	.056	Null Hypothesis supported
2	The distribution of Operational Performance is the same across categories of different departments.	Independent-Samples Kruskal-Wallis Test	.035	Hypothesis not supported
3	The distribution of Satisfaction is the same across categories of different departments.	Independent-Samples Kruskal-Wallis Test	.060	Null hypothesis supported

Asymptotic significances are displayed. The significance level is 0.05.

The chi-square value in the Kruskal-Wallis test signifies the test statistic used to determine if there are significant differences between groups in the table 7.2. It measures the degree of difference between observed and expected ranks among the groups. This value is compared to a critical value from the chi-square distribution, based on degrees of freedom and significance level. A high chi-square value and low p-value (typically less than 0.05) suggest significant differences, leading to the null hypothesis supported. Conversely, a low chi-square value indicates no significant differences, leading to the null hypothesis not supported. Therefore, in the table 7.3, alternative hypothesis is not supported i.e., there is no significant difference in the awareness of RPA across different departments using Process Automation in the universities, alternative hypothesis is supported i.e., there is a significant difference in the operational performance across different departments using Process Automation in the universities and alternative hypothesis is not supported i.e., there is no significant difference in the Satisfaction across different departments using Process Automation in the universities.

10 RESULTS

This study investigated the role of Robotic Process Automation (RPA) in universities, focusing on sustainable development practices related to its adoption. Kruskal-Wallis test is used to analyse differences in awareness of RPA, operational performance, and satisfaction of employees across various university departments (Academics, Administration, Examination and IT Staff) using RPA.

- Awareness of RPA: The Kruskal-Wallis test results indicate no significant difference in RPA awareness across departments. The chi-square and p-values do not support a significant variation in RPA awareness levels, suggesting that all departments share a similar understanding of RPA's role and applications within the university (Siderska, 2020). This uniform awareness level could result from centralized training or information dissemination about RPA across departments, reflecting an effort to build a cohesive knowledge base regarding automation.
- Operational Performance: The results reveal a significant difference in operational performance across departments using PA, as indicated by a high chi-square value and a p-value below the threshold of 0.05. This finding implies that certain departments benefit

more from RPA in terms of efficiency gains, error reduction, and task completion times than others. Departments with higher mean ranks in operational performance may have more processes suited to automation or may be more adaptable to RPA integration, underscoring the need to tailor RPA adoption according to departmental needs to maximize operational improvements (Marian-Vladut, 2023).

- Employee Satisfaction: No significant differences in satisfaction levels were observed across departments using PA. The chi-square value for satisfaction was not sufficient to support a meaningful difference between departments, suggesting that employees in all departments generally share similar satisfaction levels with using PA. This consistency in satisfaction could reflect a generally positive or neutral perception of adoption of RPA's impact on job roles, where automation does not disrupt core tasks significantly enough to affect job satisfaction. Therefore, RPA adoption will lead to improve satisfaction among employees in the universities.

Therefore, the analysis highlights significant variation in operational performance but uniformity in awareness and satisfaction levels across departments which are using PA. This implies that adoption of RPA and implementation will enhance performance of different departments, awareness and ultimately satisfaction of employees will increase across departments in the universities.

11 DISCUSSION

The findings provide insights into sustainable development practices for RPA adoption in universities. The lack of significant differences in awareness levels suggests that universities have succeeded in creating a foundational understanding of RPA across departments, potentially through effective training and centralized communication. Such uniform awareness is a valuable asset in promoting sustainable RPA adoption, as it ensures that all departments have a baseline comprehension of the technology, which can support consistent and aligned efforts in RPA integration (Narendra et al., 2020).

The significant variation in operational performance suggests that RPA benefits are not universally distributed across departments. Departments with higher mean ranks in operational performance likely have tasks that align well with automation, such as repetitive administrative processes (Park, 2021). This finding emphasizes the importance of department-specific assessments when implementing RPA, allowing universities to maximize sustainable impacts by targeting automation where it has the most pronounced effect on efficiency and resource utilization. Sustainable RPA implementation should involve tailoring RPA solutions to each department's specific needs and processes (Mora & Sánchez, 2020).

Finally, the uniform satisfaction across departments indicates a general acceptance or neutral stance toward RPA, which is promising for sustainable adoption. It suggests that automation does not significantly disrupt job satisfaction, allowing employees to adapt to the technology without feeling displaced or dissatisfied. Maintaining consistent satisfaction through engagement and feedback is crucial for long-term sustainability, as it helps cultivate an organizational culture that embraces automation as a supportive, rather than disruptive, tool (Saraf, 2024).

Therefore, sustainable RPA adoption in universities depends on maintaining high awareness levels, optimizing department-specific performance improvements, and ensuring consistent employee satisfaction. These elements together can create a supportive environment that maximizes the benefits of RPA, promoting efficient and enduring automation practices across university.

12 FUTURE DIRECTIONS FOR RESEARCH

Longitudinal Studies on RPA's Sustainable Impact

Future research should explore the long-term effects of RPA on university operations, employee roles, and sustainability. Longitudinal studies could examine how RPA adoption influences administrative efficiency, employee adaptation, and cost-effectiveness over time, providing insights into the sustainability of RPA practices within higher education.

Comparative Analysis Across Institutional Types

Research could investigate how RPA implementation varies across different types of institutions, such as public vs. private universities or large research institutions vs. smaller colleges. Understanding how factors like institutional size, resources, and focus areas impact RPA's sustainable adoption could help universities tailor their RPA strategies to their unique environments.

RPA's Role in Enhancing Academic and Student Services

While RPA has been primarily applied to administrative functions, its potential for enhancing academic processes and student services warrants further exploration. Future research could investigate how RPA can support curriculum development, student advising, grading, and personalized learning, thereby extending its sustainable impact beyond administrative efficiency to core educational functions.

Assessment of Employee Engagement and Skill Development Needs

Sustainable RPA adoption relies on employee adaptation and engagement. Future studies could examine the impact of RPA on employee roles and satisfaction in more depth, exploring the need for reskilling and the ways RPA can complement rather than disrupt existing job functions. Understanding these aspects can help universities implement RPA in a way that supports workforce stability and professional growth.

Exploration of Ethical and Security Concerns in RPA

As RPA systems handle sensitive data, research on ethical considerations and data security practices in RPA adoption is critical. Future studies could address data privacy concerns, compliance

with regulations, and the ethical use of automation in academic to ensure that RPA practices align with universities' values of confidentiality, transparency, and responsibility.

Evaluation of AI-Driven RPA for Enhanced Decision-Making

The integration of AI with RPA holds the potential to provide even more sophisticated automation and decision-support capabilities. Future research could explore the role of AI-driven RPA in data analytics, predictive modeling, and strategic planning within universities, offering sustainable tools for informed decision-making.

Developing a Sustainable RPA Framework for Higher Education

Based on the unique needs and challenges of the academic sector, research could focus on creating a framework specifically designed for sustainable RPA adoption in universities. Such a framework could outline best practices, benchmarks, and guidelines tailored to higher education, promoting a holistic approach that balances efficiency, ethical standards, and employee well-being.

By addressing these research areas, future studies can contribute to a comprehensive understanding of how RPA can be sustainably integrated into universities, ultimately supporting the sector's digital transformation in a responsible and impactful way.

13 FINDINGS AND SUGGESTIONS

- The study reveals that Robotic Process Automation (RPA) adoption significantly improves operational efficiency in university, especially within repetitive and high-volume administrative processes such as admissions, scheduling, and data management. Departments that have embraced RPA report streamlined workflows, faster processing times, and fewer errors, underscoring RPA's potential to reduce resource use and enhance productivity.
- Awareness of RPA technology appears consistent across different university departments, likely due to centralized training efforts. However, the study finds that operational performance improvements vary significantly by department. Departments with routine, repetitive tasks benefit more from RPA, indicating that RPA's impact depends on its full implementation.
- Employees across departments generally report similar satisfaction levels with PA. This suggests that RPA adoption will improve task efficiency and has been introduced in ways that do not disrupt job roles significantly. Staff members recognize the value of RPA in reducing mundane tasks, although job satisfaction may not increase uniformly due to varied job impacts.
- Despite the operational benefits, the study identifies several sustainability challenges associated with RPA. These include initial financial investment, technical support requirements, and concerns about data privacy. Additionally, while RPA reduces paper waste by digitizing workflows, it does require careful management of energy use and IT infrastructure to align with sustainability goals.

- RPA implementation has shown promise in improving student services by accelerating administrative processes, thus allowing staff to dedicate more time to student engagement and support. However, the extent of RPA's direct impact on academic quality and the student experience warrants further investigation.

Suggestions

- To maximize RPA's impact, universities should assess departmental workflows and identify processes that would benefit most from automation. Tailoring RPA solutions to department-specific needs can optimize resource utilization, improve operational performance, and foster a sustainable approach to digital transformation (Nethravathi & Mamatha, 2024).
- Sustaining RPA adoption requires consistent investment in staff training. Universities should provide ongoing learning opportunities that help employees understand RPA, adapt to new roles, and develop digital competencies (Vulpe & Enăchescu, 2022). This approach can improve employee engagement, support job satisfaction, and foster an adaptive workforce that is well-prepared for technology integration.
- Universities should apply sustainability frameworks like the Triple Bottom Line (TBL) and Circular Economy (CE) principles to guide RPA adoption. For example, implementing energy-efficient RPA solutions and reusing RPA components across departments can minimize environmental impact and promote resource efficiency. Ensuring that RPA aligns with economic, social, and environmental sustainability goals will help create a responsible and enduring RPA infrastructure.
- To address privacy concerns, universities must establish strict data protection policies when using RPA. This includes ensuring that RPA systems comply with data privacy regulations and safeguarding sensitive student and faculty data through regular security audits and robust cybersecurity measures (Thorave et al., 2022).
- Given the initial financial investment required for RPA, universities should regularly measure and monitor the return on investment (ROI) of RPA projects. Identifying key performance indicators (KPIs) for cost savings, efficiency gains, and service improvements can provide data-driven insights, enabling universities to make informed decisions about scaling RPA sustainably.
- To extend RPA's benefits beyond administrative functions, universities should explore its application in academic and student support areas, such as curriculum management, grading, and advising (Munawar, 2021). Such initiatives could improve academic operations and contribute positively to student experiences, aligning with the broader mission of higher education institutions.

By adopting these strategies, universities can strengthen the sustainability and effectiveness of RPA adoption, leveraging automation to enhance operational performance, improve resource efficiency, and support a more sustainable educational environment.

14 CONCLUSION

The adoption of Robotic Process Automation (RPA) presents substantial opportunities for universities to enhance operational efficiency, reduce environmental impacts, and support economic sustainability. This study confirms that RPA can streamline administrative processes, improve data management, and reduce resource consumption, making it a valuable tool for digital transformation in higher education (Nadar et al., 2021). However, achieving sustainable RPA integration requires a comprehensive approach that considers the unique challenges within the university environment, including financial constraints, compatibility with legacy systems, and the need for robust data privacy protections (Gupta et al., 2023). Applying sustainability frameworks like the Triple Bottom Line and Circular Economy enables universities to assess RPA's impact holistically, balancing economic, environmental, and social outcomes. Future adoption strategies should prioritize employee training, regular system updates, and energy-efficient practices to ensure that RPA supports both institutional goals and broader societal objectives (Almgren, 2021). This research provides universities with a practical framework for adopting RPA in a way that aligns with sustainable development, ultimately fostering a digital ecosystem that is efficient, resilient, and socially responsible.

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