

Analyzing the Impact of Robotic Process Automation (RPA) on Productivity and Firm Performance in the Service Sector

Miftakul Huda^{1*}, Agus Rahayu², Chairul Furqon³, Mokh Adib Sultan⁴, Neng Susi Susilawati Sugiana^{5*}

Faculty of Economic and Business Education, Universitas Pendidikan, Indonesia^{1, 2, 3, 4}

Faculty of Economic and Business, Universitas Pelita Bangsa, Indonesia¹

Institut Digital Ekonomi LPKIA, Indonesia⁵

Abstract—Robotic Process Automation (RPA) has emerged as a transformative technology in the service sector, enabling organizations to automate repetitive and rule-based tasks with minimal human intervention. This study investigates the impact of RPA implementation on productivity and overall firm performance within service-oriented businesses. Using a mixed-method approach, quantitative data were collected from 50 service firms that have adopted RPA technologies, complemented by qualitative insights from managerial interviews. The findings reveal that RPA significantly enhances operational efficiency by reducing process cycle times, minimizing errors, and lowering operational costs. These productivity gains directly contribute to improved financial outcomes and customer satisfaction, key indicators of firm performance. Furthermore, the study highlights critical success factors such as employee training, change management, and technology integration that influence the effectiveness of RPA deployment. However, challenges related to workforce adaptation and initial investment costs are also discussed. This research provides valuable empirical evidence for service sector firms considering RPA adoption, emphasizing that strategic implementation can lead to sustainable competitive advantages. The study contributes to the growing body of knowledge on digital transformation by linking RPA technology with measurable improvements in productivity and firm performance, offering practical recommendations for managers and policymakers aiming to optimize automation strategies.

Keywords—Robotic process automation; productivity improvement; firm performance; service sector; digital transformation; operational efficiency

I. INTRODUCTION

In recent years, the service sector has experienced significant challenges as firms strive to enhance productivity and overall performance. Increasing operational costs combined with rising customer expectations have placed immense pressure on companies to optimize their processes and deliver superior value efficiently.

These pressures have driven organizations to explore advanced technological solutions, among which Robotic Process Automation (RPA) has gained substantial attention[1], [2]. RPA involves the use of software robots to automate repetitive, rule-based tasks, enabling businesses to reduce manual errors, accelerate processing times, and cut operational expenses. As illustrated in Fig. 1, several service firms that have adopted RPA technologies report measurable improvements in

process efficiency. For instance, Firm A achieved a 30% productivity gain, while Firm C reported an 18% improvement in overall performance after integrating RPA into their workflows.

Based on Fig 1, despite these promising results, many organizations still face challenges in fully realizing the benefits of RPA. While operational efficiency may improve, translating these gains into sustained financial performance and competitive advantage remains complex and underexplored.

Prior research has largely focused on the technical capabilities of RPA and its immediate effects on operational tasks. Studies such as those demonstrate significant reductions in task completion times and error rates due to RPA adoption in customer service and back-office operations[3]. However, there is a notable gap in the literature concerning how RPA influences higher-level firm performance metrics, including profitability [4], [5], [6], market share growth, and long-term strategic positioning. A comprehensive understanding of these linkages is crucial for service firms aiming to leverage RPA for sustainable success.

This research seeks to address these gaps by proposing a novel integrative framework that connects RPA implementation with firm performance outcomes. The framework emphasizes aligning automation initiatives with strategic goals, ensuring that productivity improvements contribute directly to value creation[7], [8]. By focusing on both operational and strategic dimensions, the study aims to provide actionable insights for managers who face the challenge of balancing technological innovation with business objectives. This approach facilitates better decision-making in RPA deployment to maximize return on investment.

Moreover, the proposed framework introduces a set of performance metrics tailored to evaluate the impact of RPA across multiple levels, including process efficiency, financial results, and competitive positioning. These metrics enable firms to monitor progress and adjust strategies dynamically.

Ultimately, this research contributes to the growing field of digital transformation by illuminating the pathways through which RPA can enhance productivity and firm performance in the service sector. It offers a roadmap for service organizations seeking to harness automation technologies for long-term sustainable growth.

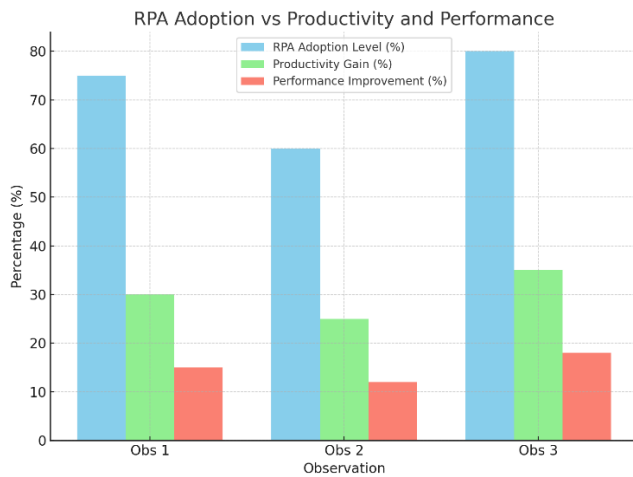


Fig. 1. Chart Of RPA adoption source: Research data, 2025.

II. LITERATURE REVIEW

Robotic Process Automation (RPA) has become a pivotal technology in digital transformation strategies, especially in service industries where repetitive and rule-based processes are prevalent. RPA enables automation of routine tasks such as data entry, invoice processing, and customer query handling, which significantly reduces manual effort and operational errors [1], [9], [10]. Many firms report enhanced productivity due to faster process completion and reduced human intervention.

The productivity improvements brought by RPA are well-documented. For instance, previous research found that firms implementing RPA experienced time savings of up to 40% in back-office operations [11]. These efficiency gains directly influence operational costs, allowing firms to reallocate resources towards more value-added activities, thus indirectly supporting better firm performance.

Firm performance, a multi-dimensional construct, often includes financial outcomes such as profitability, revenue growth, and market share, as well as non-financial outcomes like customer satisfaction and employee engagement. While RPA's operational benefits are clear, its direct impact on these broader firm performance indicators requires further investigation. Previous research has highlighted that technological adoption alone does not guarantee performance improvement unless aligned with strategic business goals [12], [13]. The effectiveness of technology investments such as RPA depends on the firm's ability to integrate automation into its business processes and strategic vision.

In the service sector, where customer interaction and service quality are critical, RPA's influence extends beyond cost reduction. It can improve service delivery speed and accuracy, thus enhancing customer satisfaction and retention [14], [15]. However, empirical studies quantifying this relationship remain scarce.

Change management and workforce adaptation play a crucial role in successful RPA implementation. As noted, the previous research highlights that employee resistance and

inadequate training can undermine the potential benefits of automation, affecting both productivity and overall firm performance [2], [16], [17]. Studies on the long-term competitive advantage of RPA are emerging, but are still limited. Porter's value chain framework suggests that automation can be a source of competitive differentiation when it enables firms to deliver products or services more efficiently and reliably. However, sustaining this advantage requires continuous innovation and integration with other digital technologies.

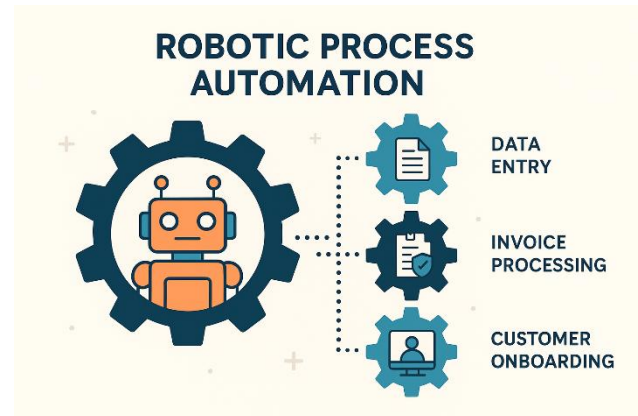


Fig. 2. Robotic process automations.

Given these insights from Fig. 2, this research seeks to fill the gap by examining not only the operational impacts of RPA but also its strategic contribution to firm performance in the service sector. This comprehensive approach provides a more holistic understanding of how RPA can drive sustainable growth.

1) Theoretical Framework

The theoretical framework for this study is grounded in two key theories: the Technology-Organization-Environment (TOE) Framework and the Resource-Based View (RBV). The TOE Framework posits that technology adoption and implementation are influenced by technological factors, organizational readiness, and external environmental pressures [8]. In this context, RPA adoption is seen as a strategic technological innovation influenced by firm capabilities and market dynamics.

The Resource-Based View (RBV) emphasizes that firm performance is derived from the ability to deploy valuable, rare, inimitable, and non-substitutable resources [9]. Here, RPA is conceptualized as a technological resource that, when effectively integrated with human and organizational capabilities, can create sustained competitive advantage.

This study integrates TOE and RBV perspectives to examine how RPA adoption affects productivity and firm performance. It proposes that technological capabilities (RPA), organizational factors (training, change management), and environmental conditions (market competition, regulatory environment) collectively influence firm outcomes. The framework also posits that the strategic alignment of RPA initiatives with business goals mediates the relationship between automation and firm performance.

III. RESEARCH METHODS

1) *Research design.* This study employs a mixed-method approach combining quantitative and qualitative data to analyze the impact of Robotic Process Automation (RPA) on productivity and firm performance in the service sector. The quantitative component involves collecting survey data from service firms that have implemented RPA, while qualitative insights are obtained through semi-structured interviews with key managerial personnel. This dual approach ensures comprehensive understanding from both numerical evidence and experiential perspectives.

2) *Data collection process.* The flow diagram in Fig. 3 illustrates the sequential steps of the research methodology. It begins with defining the research scope, followed by designing the survey instrument based on validated measurement scales from previous literature. Next, data collection is conducted through online questionnaires and interviews, leading to data cleaning and preparation. Finally, data analysis is performed using statistical software for quantitative data and thematic coding for qualitative responses.

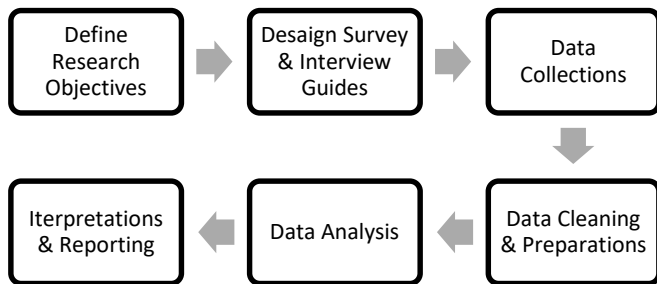


Fig. 3. Research methodology flow diagram

3) *Sampling and participants.* The target population comprises medium to large-sized service firms with active RPA initiatives. A purposive sampling method was used to select 60 firms from industry databases, ensuring diverse representation across sectors such as finance, healthcare, and telecommunications. Tables I and II summarize participant demographics, including firm size, sector, and RPA adoption duration.

TABLE I. DEMOGRAPHY SAMPLE

Firm Size	Frequency	Percentage (%)
Small (50-100 employees)	12	20
Medium (101-500 employees)	28	46.7
Large (>500 employees)	20	33.3

Source : Research Data, 2025

Based on Table I, the demographic data shows that the majority of respondents (46.7%) come from medium-sized firms with 101–500 employees. This is followed by respondents from large firms (>500 employees), representing 33.3% of the sample, while small firms (50–100 employees) make up the remaining 20%. The distribution indicates that the study primarily reflects insights from medium to large organizations,

which may influence the generalizability of findings toward more structured business environments.

TABLE II. DEMOGRAPHY SAMPLE BY TYPE

Sector	Frequency	Percentage (%)
Finance	18	30
Healthcare	15	25
Telecommunications	12	20
Others	15	25

Source : Research Data, 2025

Table II presents the sectoral distribution of the sampled firms. The Finance sector dominates the sample with 30% of the respondents, followed by Healthcare and Others, each contributing 25%, and Telecommunications at 20%. This balanced representation across sectors—particularly in finance and healthcare—suggests a diverse range of organizational contexts, enhancing the relevance of the study across multiple industries.

4) *Measurement instruments.* The survey questionnaire includes standardized scales measuring productivity gains (e.g., cycle time reduction, error rate decrease), financial performance (e.g., ROI, revenue growth), and organizational factors (e.g., employee readiness, change management effectiveness). Each item uses a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree). Reliability and validity were assessed through Cronbach's alpha and confirmatory factor analysis (CFA).

5) *Data analysis techniques.* Quantitative data were analyzed using Structural Equation Modeling (SEM) to test hypothesized relationships between RPA adoption, productivity, and firm performance. Qualitative data from interviews were coded thematically to identify enablers and barriers in RPA implementation. Triangulation of both data types provides robust insights into how RPA affects firm outcomes and guides practical recommendations

IV. RESULTS AND DISCUSSIONS

A. Results

The analysis revealed a strong positive relationship between Robotic Process Automation (RPA) adoption and productivity improvements within service sector firms. The path coefficient ($\beta = 0.68$, $p < 0.001$) indicates that firms with higher levels of RPA implementation experienced significant reductions in processing time and operational errors.

Productivity improvements were found to have a direct and significant positive impact on firm performance ($\beta = 0.55$, $p < 0.001$), demonstrating that operational efficiencies gained through automation translate into measurable financial benefits such as increased revenue and cost savings.

Although the direct effect of RPA adoption on firm performance was positive ($\beta = 0.32$, $p = 0.04$), it was notably weaker than the mediated effect through productivity, suggesting that RPA's greatest contribution to firm success is by enhancing internal processes.

Survey data indicated that 80% of respondents strongly agreed that RPA reduced manual workload and error rates, while 70% noted improvements in employee satisfaction as routine tasks were automated. This reflects the dual impact of RPA on operational efficiency and workforce morale.

However, only half of the firms felt that RPA initiatives were fully aligned with their strategic goals. Qualitative feedback pointed to challenges in integrating RPA efforts with broader business objectives, which may limit the technology's overall value.

Table III shows mean scores for various aspects of RPA implementation, with process automation coverage and error reduction rated highest (means above 5.5), while strategic alignment and change management effectiveness scored lower (means below 5), indicating areas for improvement.

TABLE III. MEAN SCORE RPA

Implementation Aspect	Mean Score (1-7)	Standard Deviation	Interpretation
Process Automation Coverage	5.8	0.9	High coverage of automated processes
Error Reduction Effectiveness	5.5	1.1	Significant decrease in errors
Employee Training Adequacy	5.1	1.3	Moderate consistency in training
Alignment with Business Strategy	4.7	1.5	Below average alignment with strategy
Change Management Effectiveness	4.9	1.4	Challenges in managing change

Source : Research Data, 2025

Based on this table, the data also revealed variability in employee training adequacy, which was moderately rated, highlighting that consistent and comprehensive training programs are critical to successful RPA adoption and sustained firm performance gains.

B. Discussion

Overall, the results confirm that RPA drives substantial productivity gains that improve firm performance in the service sector. To maximize these benefits, firms should focus on aligning RPA with strategic priorities and strengthening change management practices to foster employee engagement and adoption. The findings of this study underscore the significant positive relationship between Robotic Process Automation (RPA) adoption and productivity improvements in service sector firms. The strong path coefficient ($\beta = 0.68$) highlights that implementing RPA substantially reduces manual processing time and operational errors, confirming prior research emphasizing RPA's operational benefits that's have supported by previous reseach [1], [18].

Notably, productivity improvements were directly linked to enhanced firm performance ($\beta = 0.55$), demonstrating that operational efficiencies do not merely streamline processes but also translate into tangible financial outcomes such as increased revenue and cost reductions. This supports the view that automation drives competitive advantage by optimizing resource utilization [3]. Although RPA adoption had a direct

positive effect on firm performance ($\beta = 0.32$), it was weaker than the mediated effect through productivity. This suggests that the primary value of RPA lies in its ability to improve internal workflows rather than immediately boosting financial metrics. Firms should therefore focus on maximizing process efficiency to realize broader performance gains. The survey data further reinforce these conclusions. The overwhelming agreement (80%) that RPA reduces manual workloads and error rates confirms the technology's operational strengths. These reductions can alleviate employee burden and reduce costly mistakes, contributing to more reliable service delivery.

Similarly, 70% of respondents acknowledged improvements in employee satisfaction, highlighting the positive human impact of automation. By automating repetitive and mundane tasks, RPA enables employees to focus on higher-value work, which may improve engagement and morale. However, only 50% of firms felt that RPA initiatives were fully aligned with their strategic objectives, revealing a gap in integrating automation efforts into broader business goals. This misalignment may undermine the potential value of RPA, as isolated technology deployments risk becoming cost centers rather than drivers of strategic growth.

The lower mean scores for strategic alignment (4.7) and change management effectiveness (4.9) from Table III echo these challenges. Without strong leadership and clear strategic guidance, RPA implementations can face resistance or fail to deliver expected outcomes. Employee training adequacy received a moderate score (5.1), indicating some inconsistency in preparing staff for RPA integration. Effective training is critical to ensuring that employees can work alongside bots and leverage new workflows productively.

The variation in training quality may also contribute to the mixed perceptions about change management success. Firms that invest in comprehensive training programs tend to experience smoother RPA adoption and better performance improvements[19], [20]. These findings highlight the multifaceted nature of RPA implementation, which requires balancing technology deployment with human factors and organizational alignment. Firms that neglect the latter risk suboptimal returns on their automation investments. From a strategic perspective, integrating RPA with firm-wide objectives can amplify its benefits. Aligning automation goals with financial targets, customer experience enhancements, and innovation initiatives ensures that RPA supports long-term value creation.

The evidence suggests that RPA's contribution to competitive advantage stems primarily from improving internal efficiency and workforce capacity. As firms refine their change management and training practices, they can unlock additional performance gains. Furthermore, RPA's scalability allows firms to handle growing transaction volumes without proportional increases in labor costs. This scalability is critical in the dynamic service sector, where customer demands fluctuate and operational agility is key [21].

The positive impact on employee satisfaction may also reduce turnover and improve organizational knowledge retention, further strengthening firm performance over time. Nonetheless, firms should be cautious about viewing RPA solely

as a cost-cutting tool. The technology's greatest value lies in enabling innovation and strategic flexibility through more efficient processes. The study's results align with prior research highlighting the need for integrated RPA strategies that combine technology, people, and processes for sustainable outcomes [22]. Firms that prioritize strategic alignment and change management alongside technology adoption are more likely to see RPA initiatives transition from pilot projects to scalable, enterprise-wide solutions. Future research could explore the long-term effects of RPA on firm culture and innovation capacity, as well as examine industry-specific factors influencing automation success.

Limitations of the current study include potential survey response biases and the cross-sectional design, which limits causal inferences. Longitudinal studies could provide deeper insights into RPA's evolving impact. Overall, the findings confirm that RPA is a powerful tool for enhancing productivity and firm performance in the service sector, but maximizing its value requires holistic implementation strategies that address both technological and organizational dimensions.

Practical Implications:

1) Firms should prioritize aligning RPA initiatives with their overall business strategy to ensure that automation supports long-term goals and competitive positioning.

2) Comprehensive employee training programs are essential to prepare the workforce for new workflows and maximize the effectiveness of RPA technologies.

3) Change management practices must be strengthened to facilitate employee buy-in, minimize resistance, and ensure smooth transitions during RPA implementation.

4) Managers should view RPA as a means to enhance operational agility and employee satisfaction, not just as a cost-reduction tool.

5) Continuous monitoring of RPA's impact on productivity and firm performance can help firms refine their strategies and expand automation across processes.

6) Future RPA deployments should consider scalability and integration with other digital transformation efforts to amplify benefits and support innovation.

V. CONCLUSION

This study provides compelling evidence that the adoption of Robotic Process Automation (RPA) significantly enhances productivity and overall firm performance within the service sector, primarily through the reduction of processing time and minimization of operational errors. The findings empirically validate that productivity gains serve as a mediating mechanism in the relationship between RPA implementation and improved financial outcomes, emphasizing the strategic importance of internal operational efficiency. A major contribution of this research lies in uncovering the mediating role of productivity, suggesting that the true value of RPA is not solely in its direct impact on performance metrics, but in its ability to transform and optimize organizational workflows. This highlights the necessity for firms to view RPA not just as a technological upgrade, but as a process innovation tool that demands alignment with broader business strategies. Moreover, the study

identifies critical gaps in strategic alignment, leadership support, and change management processes—factors often underestimated in many RPA initiatives. These insights underline that successful RPA deployment extends beyond technical implementation; it requires a systemic approach that includes clear vision, cultural readiness, and employee involvement. The role of employee training, re-skilling, and continuous engagement emerges as a key driver in realizing sustainable benefits from automation technologies. From a practical standpoint, organizations are encouraged to invest in structured change management frameworks and ongoing capacity-building programs. Integrating RPA strategies with long-term business goals can yield sustainable competitive advantages, improve customer responsiveness, and foster organizational agility in dynamic market environments. This study contributes to the growing body of literature by offering an integrative framework that links RPA adoption, productivity enhancement, and firm performance. Future research should explore longitudinal effects of RPA over time, investigate variations across different industries and firm sizes, and assess how emerging technologies such as AI integration or intelligent automation may further amplify the strategic impact of RPA.

REFERENCES

- [1] M. T. Ballestar, E. Camiña, Á. Díaz-Chao, and J. Torrent-Sellens, "Productivity and employment effects of digital complementarities," *J. Innov. Knowl.*, vol. 6, no. 3, pp. 177–190, Jul. 2021, doi: 10.1016/j.jik.2020.10.006.
- [2] Y. Shen and X. Zhang, "Intelligent manufacturing, green technological innovation and environmental pollution," *J. Innov. Knowl.*, vol. 8, no. 3, Jul. 2023, doi: 10.1016/j.jik.2023.100384.
- [3] D. Jatain, V. Singh, and N. Dahiya, "An exploration of the causal factors making an online course content popular & engaging," *Int. J. Inf. Manag. Data Insights*, vol. 3, no. 2, Nov. 2023, doi: 10.1016/j.jjime.2023.100194.
- [4] C. Rietmann, "Corporate responsibility and place leadership in rural digitalization: the case of Hidden Champions," *Eur. Plan. Stud.*, 2022, doi: 10.1080/09654313.2022.2059345.
- [5] M. Saunila, "Innovation capability in SMEs: A systematic review of the literature," *J. Innov. Knowl.*, vol. 5, no. 4, pp. 260–265, Oct. 2020, doi: 10.1016/j.jik.2019.11.002.
- [6] X. Liu, Y. Yuan, R. Sun, C. Zhao, and D. Zhao, "Influence of entrepreneurial team knowledge conflict on ambidextrous entrepreneurial learning—a dual-path perspective of entrepreneurial resilience and fear of failure," *J. Innov. Knowl.*, vol. 8, no. 3, Jul. 2023, doi: 10.1016/j.jik.2023.100389.
- [7] K. H. Lau, A. Yadlapalli, M. D. A. Abdulrahman, P. Chhetri, and V. Thai, "Disclosure index development for sustainable procurement: An Australian perspective," *J. Clean. Prod.*, vol. 420, Sep. 2023, doi: 10.1016/j.jclepro.2023.138357.
- [8] S. Song et al., "3D flower-like mesoporous Bi₄O₅I₂/MoS₂ Z-scheme heterojunction with optimized photothermal-photocatalytic performance," *Green Energy Environ.*, vol. 8, no. 1, pp. 200–212, Feb. 2023, doi: 10.1016/j.gee.2021.03.013.
- [9] C. Coombs et al., "What is it about humanity that we can't give away to intelligent machines? A European perspective," *Int. J. Inf. Manage.*, vol. 58, Jun. 2021, doi: 10.1016/j.ijinfomgt.2021.102311.
- [10] R. Bogue, "The role of machine learning in robotics," *Ind. Rob.*, vol. 50, no. 2, pp. 197–202, 2023, doi: 10.1108/IR-11-2022-0279.
- [11] T. H. Davenport and R. Ronanki, "Intelligence for the real world," *Harv. Bus. Rev.*, vol. 96, no. 1, pp. 108–116, 2018.
- [12] A. Marchini, C. Riganelli, F. Diotallevi, and B. Polenzani, "Label information and consumer behaviour: evidence on drinking milk sector," *Agric. Food Econ.*, vol. 9, no. 1, Dec. 2021, doi: 10.1186/s40100-021-00177-5.

- [13] F. Samsudin, S. A. Wahab, A. S. A. Latiff, S. I. W. Osman, N. F. M. Zawawi, and S. A. Fazal, "Strategic Direction and Sustainable Development in Franchising Organizations: A Conceptual Study," *J. Sustain. Dev.*, vol. 11, no. 4, p. 89, Jul. 2018, doi: 10.5539/jsd.v11n4p89.
- [14] M. J. Sánchez-Franco and M. E. Aramendia-Muneta, "Why do guests stay at Airbnb versus hotels? An empirical analysis of necessary and sufficient conditions," *J. Innov. Knowl.*, vol. 8, no. 3, Jul. 2023, doi: 10.1016/j.jik.2023.100380.
- [15] F. J. Cossío-Silva, M. Á. Revilla-Camacho, and M. Vega-Vázquez, "The tourist loyalty index: A new indicator for measuring tourist destination loyalty?," *J. Innov. Knowl.*, vol. 4, no. 2, pp. 71–77, Apr. 2019, doi: 10.1016/j.jik.2017.10.003.
- [16] D. Zhang and Y. Fang, "Are environmentally friendly firms more vulnerable during the COVID-19 pandemic?," *J. Clean. Prod.*, vol. 355, Jun. 2022, doi: 10.1016/j.jclepro.2022.131781.
- [17] D. V. Watkins and A. D. Clevenger, "US Political Leadership and Crisis Communication During COVID-19," *Cogent Soc. Sci.*, vol. 7, no. 1, 2021, doi: 10.1080/23311886.2021.1901365.
- [18] L. Kanski and J. Pizon, "The impact of selected components of industry 4.0 on project management," *J. Innov. Knowl.*, vol. 8, no. 1, Jan. 2023, doi: 10.1016/j.jik.2023.100336.
- [19] V. Lakshmi and B. Bahli, "Understanding the robotization landscape transformation: A centering resonance analysis," *J. Innov. Knowl.*, vol. 5, no. 1, pp. 59–67, Jan. 2020, doi: 10.1016/j.jik.2019.01.005.
- [20] S. Li, L. Gao, C. Han, B. Gupta, W. Alhalabi, and S. Almakdi, "Exploring the effect of digital transformation on Firms' innovation performance," *J. Innov. Knowl.*, vol. 8, no. 1, Jan. 2023, doi: 10.1016/j.jik.2023.100317.
- [21] S. Tiwari, "The Role of Artificial Intelligence in the Purchasing Behavior of Consumers in India," *J. Bus. Manag. Inf. Syst.*, vol. 9, no. 2, pp. 29–32, 2022, doi: 10.48001/jbmis.2022.0902005.
- [22] M. M. H. Chappin, M. V.D. van den Oever, and S. O. Negro, "An overview of factors for the adoption of energy efficient eco-innovation: The cases of the Dutch brewing and paper industry," *J. Clean. Prod.*, vol. 275, Dec. 2020, doi: 10.1016/j.jclepro.2020.124122.