

UNIVERSIDADE DE LISBOA
Instituto Superior de Economia e Gestão



The Propensity for Robotic Process Automation Adoption and Its Potential for Value Creation

Daniel Filipe Caiado Durão

Orientador: Doutor António Maria Palma dos Reis, Professor Catedrático, do Instituto Superior de Economia e Gestão da Universidade Lisboa

Tese especialmente elaborada para obtenção do grau de Doutor em Gestão.

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Chapter I: Introduction

The highly dynamic business environment pressures organizations to maintain their competitiveness against market rivals. Organizations tend to create mechanisms and invest in improving the efficiency of their operations and business process management. In this context, the development of digital tools, especially those within the realm of information technology (IT), has been crucial to achieving this goal.

Technological advances in the field of artificial intelligence have paved the way for many organizations to automate their business processes, including operational processes, fostering interest in Robotic Process Automation (RPA), interest that may result in RPA adoption. RPA employs a lightweight automation approach, involving user-oriented solutions that do not alter the foundational structure of systems, and emerging as a solution for organizations to automate business and operational processes, particularly those handling large volumes of data, high rates of human error, and monotonous routine tasks.

By leveraging RPA's potential, organizations can create value propositions, including: (i) operational efficiency, by enabling cost reduction as well as by reducing answer time; (ii) service quality, by the reduction in error rates; (iii) integration, allowing the transfer of information across various systems; and (iv) risk management and reliability, as standardizing procedures makes it easier to identify process deviations.

RPA has been widely studied, particularly in terms of identifying relevant factors for RPA adoption, resources and guidelines for successful implementation, characteristics essential for effective RPA initiatives, transforming business processes with RPA, creating digital value in business through RPA, and case studies in various domains such as accounting, finance, auditing, and human resources. However, the literature review could not find a comprehensive view on how organizations can fully leverage this technology's potential and how it can contribute to organizational performance.

RPA is defined in the literature as a software-based automation technology that mimics human actions in performing structured, repetitive tasks (Lacity & Willcocks, 2018). Unlike traditional automation solutions, RPA operates at the user interface level, allowing organizations to automate processes without modifying underlying IT systems. Prior research has identified several key value propositions of RPA, namely, operational

efficiency - RPA eliminates manual processing inefficiencies, reducing execution times and improving accuracy (Aguirre & Rodriguez, 2017); cost savings - automation of repetitive tasks leads to workforce optimization and reduced labor costs (Willcocks et al., 2017); error reduction and compliance - standardized, rule-based automation minimizes human errors and ensures regulatory compliance (Syed et al., 2020); and scalability and flexibility - RPA allows organizations to scale automation efforts across different functions without requiring extensive IT modifications (van der Aalst et al., 2018).

While these benefits highlight RPA's potential for value creation, its real impact depends on how organizations approach adoption and implementation, which is the focus of the second study. Despite its advantages, RPA adoption is not uniform across organizations. Several theoretical frameworks have been employed to understand the drivers and barriers to RPA adoption, particularly the Technology-Organization-Environment (TOE) framework and the Diffusion of Innovations (DOI) theory.

The technological context in the TOE framework suggests that organizations evaluate RPA based on relative advantage - the perceived benefits of RPA over manual processes (Oliveira & Martins, 2011); compatibility - the extent to which RPA integrates with existing IT infrastructure and business processes (Jöhnk et al., 2021); and complexity - the ease or difficulty of implementing and managing RPA solutions (Madakam et al., 2019). The organizational context focuses on internal capabilities and readiness, such as: top management support - leadership commitment to automation initiatives (Lacity & Willcocks, 2018); financial and human resources - availability of budget and skilled personnel to deploy and manage RPA (Syed et al., 2020); firm size and digital maturity: larger organizations with robust digital infrastructure are more likely to adopt RPA (Jöhnk et al., 2021). The environmental context refers to external pressures influencing adoption, including: regulatory compliance - industries with stringent compliance requirements may adopt RPA to meet regulatory obligations (Aguirre & Rodriguez, 2017); and competitive pressure - the need to maintain a competitive edge may drive firms toward automation (Madakam et al., 2019).

Previous research suggests that RPA enhances performance across multiple dimensions of the value chain, yet its contribution to overall firm performance remains an open question. The third study investigates the performance outcomes of RPA adoption by assessing its impact on key business functions.

According to the Resource-Based Theory (RBT), firms achieve competitive advantage through the effective utilization of valuable, rare, and inimitable resources (Barney, 1991). RPA aligns with this framework by providing cost and operational efficiencies (enabling firms to optimize resources), enhanced decision-making (through automated data analysis and reporting) and agility and scalability (improving responsiveness to market demands).

Despite the growing of literature on RPA, existing studies often focus on either technical implementation or isolated business functions, lacking a holistic organizational perspective.

This research addresses the gap mentioned above by focusing on RPA adoption, usage, and the value generated by RPAs in organizations. This research proceeds along three chapters with a logical flow and coherent connection. The first chapter, presented as an article, explores how RPA creates value for organizations and identifies the RPA features critical for value creation. The second article identifies the main factors driving organizations to adopt and use RPA. Finally, the third chapter, corresponding to the third article, examines RPA characteristics that create value and impact organizational performance.

The first chapter reviews existing literature on RPA and its value, analyzing the phenomenon from an organizational perspective to identify factors that determine the value of RPA for businesses. The research question for this chapter is, "How does RPA create value for organizations, and what characteristics of RPA are critical for value creation?" The literature review employed specific terms in article searches, including RPA, RPA and Artificial Intelligence, RPA deployment or implementation, Value Creation with RPA, Business Value of RPA, RPA Capabilities, Process Automation, Organizational Performance, and IT. After analyzing several articles, the information on the topics under investigation was synthesized, particularly regarding RPA's value for organizations. Semi-structured interviews conducted with specialists in the field validated and supplemented the construct's contours. Seven interviews, with recordings transcribed for analysis, were conducted until saturation was achieved. The interview data was coded using specific rules for segmentation, grouping, and enumeration to represent the content. Subsequently, the interviews were analyzed using a category grid based on the frequency of expressions corresponding to codes or equivalent terms in the transcriptions, representing a set of segmented and comparable discourses.

The potential of RPA to improve organizational performance warrants an analysis of the conditions under which organizations are most likely to adopt RPA. This analysis, addressed in the second chapter, contributes to researchers and practitioners working with RPA by providing a validated model to estimate organizational propensity for RPA adoption and usage, confirming the usefulness of the TOE (Technology-Organization-Environment) framework for organizational-level studies. It exemplifies the combination of qualitative and quantitative approaches in research. The research question for this chapter is, "What are the main factors influencing organizations' decisions to adopt and use RPA?".

For quantitative data analysis, structural regression was used, as this statistical technique allows the examination of relationships between latent variables and the testing of dependency relationships among them. The structural model was validated based on the construct's nature. For reflective constructs, internal consistency was assessed using Cronbach's Alpha and Composite Reliability, while convergent validity was evaluated through the Average Variance Extracted (AVE) while discriminant validity was evaluated using the Fornell-Larcker criterion. For formative constructs, multicollinearity was estimated using the Variance Inflation Factor (VIF), along with the significance and the direction of the weights.

Previous studies have overlooked the impact of RPA on performance from an organizational perspective, leaving a research gap. The third chapter explores RPA and its value from an organizational perspective to identify the factors determining its impact on performance. The research question for this chapter is, "What RPA characteristics create value and ultimately impact overall organizational performance?" The research was conducted using a combination of qualitative and quantitative approaches. The structural model validation was performed as outlined for the second chapter.

This research provides a comprehensive and theoretically grounded understanding of RPA adoption and its implications for organizational success, bridging the gap between adoption frameworks and performance outcomes. Through this approach, it contributes to the broader discourse on digital transformation and automation, equipping organizations with insights to navigate the evolving landscape of business process automation.

This research is structured into three interconnected studies that collectively provide a comprehensive understanding of RPA adoption and its organizational impact.

The first study, *"How does Robotic Process Automation create value for firms?"*, investigates the mechanisms through which RPA contributes to value creation, examining both tangible and intangible benefits. The first study is published in the journal *Information Systems and e-Business Management*. The second study, *"An organizational perspective on RPA adoption and usage factors"*, explores the factors influencing RPA adoption and implementation from an organizational standpoint, leveraging theoretical models such as the Technology-Organization-Environment (TOE) framework and Diffusion of Innovations (DOI) theory, and is accepted for publication in the journal *Electronics*. Finally, the third study, *"An organizational perspective on RPA's impact on firm performance"*, empirically assesses how RPA adoption influences key business dimensions and contributes to overall firm performance. By integrating these three perspectives, this research offers a holistic understanding of RPA within organizational contexts, addressing a crucial research gap in how firms adopt, use, and derive value from RPA.

Chapter II

How does Robotic Process Automation create value for firms?

Abstract

RPA's potential for efficiency improvement highly recommends the analysis of its applicability to the organizations' processes. This paper analyses the value of RPA as its impact on the main activity groups in the value chain: Procurement, Internal Operations and Marketing and Sales. The analysis of RPA's contribution for each of the activity groups addresses a research question through an exploratory approach: "How does RPA create value for organizations and which RPA features are critical for such value creation?". The data was collected through interviews, analyzed using content analysis, and shows that RPA has impacts on both downstream and internal dimensions. Regarding upstream dimension further research is required to ascertain RPA's potential.

Keywords: Value Creation; RPA; RPA Value

1. Introduction

The highly dynamic business environment puts pressure on organizations to reformulate the management of business processes in order to ensure competitiveness. In this context, the emerging development of digital tools, especially IT, has been crucial to achieving the goal (Osman, 2019). Constant technological advances in the field of artificial intelligence have opened the way for many organizations to automate their business and operational processes, especially those involving large amounts of data, high human error rates and routine situations, boosting interest and adoption of RPA (Van der Aalst et al. 2018).

Some of the characteristics likely to support the adoption of RPA are the possibility of freeing humans from monotonous and repetitive tasks, guaranteeing results with better quality and faster (Davenport and Kirby, 2016). Potentials on which organizations can create their value propositions of (i) operational efficiency, enabling cost reduction; (ii) quality of service, due to the reduction in the human error rate; (iii) integration, allowing the transfer of information between various systems and (iv) risk and reliability management, given that inherent to the standardization of procedures, it is

possible to identify deviations in the processes more easily (Syed et al 2020).

According to the German company Statista, global revenue for the AI area is expected to reach USD 97.9 billion by 2023 (Rao and Pathak, 2022). The use of RPA in a business context has increased in recent years, therefore, it is expected that the investment of organizations in this type of technology will follow the trend (Lacity and Willcocks, 2018). In this sense, Rätty (2022) states that in recent years RPA has ceased to be just a topic of conversation to become a well-established tool, whose possibilities extend to more and more processes. According to Chugh et al (2022), the RPA market was recently considered the corporate software segment with the highest growth, and it is therefore expected that this development will continue in the future with the consolidation of the sector through improvements in the RPA offer.

However, the advantages of its use can only contribute to business value if it leads to improvements in business processes. That is, only organizations that have the ability to leverage technologies to achieve process improvements will be able to fully benefit from improvements in productivity and decision making, operational cost reduction and customer satisfaction (Melville et al, 2004). In other words, the gains resulting from the adoption of RPA without the rationalization of existing business processes will not reach the same extent generated by the adoption of RPA associated with the rationalization of business processes.

Although RPA has gained preponderance in recent years, becoming a priority for some organizations, its development and application has not yet reached mass adoption. Le Clair et al (2017), considers that, for this to happen, the RPA needs to become more “intelligent” so that it can support more complex and less well-defined tasks. Wewerka and Reichert (2021), note that companies still have difficulties in perceiving the fundamental concepts of RPA and in the way they estimate the effects of its application.

In the last decade research on RPA has also increased (Chugh et al, 2022) and, although there are multiple studies on RPA, we have not found any research studying the relationship between RPA’s usage and value creation in organizations along the main activity groups of the value chain.

The RPA has been extensively studied, namely in terms of describing the relevant factors to consider when analysing the adoption of the RPA, the resources and guidelines to ensure successful implementation (Suri et al, 2017; Sobczak, 2021; Herm et al 2022), the identification of a wide range of characteristics as important factors for the effective

conduct of RPA initiatives (William & William, 2019; Carmo, 2020), transformation of business processes with RPA (Dey and Das, 2019), digital business value creation with RPA (Kedziora and Kivirant, 2018) and several case studies in different areas as accounting (Fernandez and Aman, 2018), finance (Asatiani and Penttinen, 2016), auditing (Huang and Vasarhelyi, 2019), human resources (Papageorgiou, 2018), banking industry (Romao et al 2019), between others. Despite the studies carried out, there is still no unified view on how organizations can leverage the full potential of this technology, since its successful implementation depends, among other factors, on the organization's organizational culture and the way it works involve the different collaborators (Hallikainen et al, 2018).

Research on this topic has been conducted mainly in the form of case studies in different areas of knowledge, namely information systems, telecommunications, the accounting sector, particularly in the auditing and banking sector (Huang & Vasarhelyi, 2019). This research addresses the literature on RPA and its value, considering the RPA phenomenon from an organizational perspective in search of the factors that determine its value to the business. The results obtained will be a basis for supporting decision-making by managers on initiatives in this area.

This study addresses the following research question: “How does RPA create value for organizations and which RPA features are critical for such value creation?”.

As a guideline for this investigation, keywords were used as search strings on the literature review, namely: RPA, RPA and Artificial Intelligence, RPA deployment or implementation, Value Creation with RPA, Business Value of RPA, RPA Capabilities, Process Automation, Organizational Performance and IT. After analysing the articles, information was sought on the topics under analysis in the investigation, namely the value of RPA for organizations. Thus, the review of the existing literature allowed a first approximation to the value of RPA for organizations. Interviews with experts validated and completed the contours of the construct regarding the value of RPA for organizations. Data were collected from interviews with experts in the field.

This paper is organized as follows: Section 2 presents the literature review for RPA concepts; Section 3 presents the conceptual model; Section 4 explains the research design; Section 5 provides the analysis of the data collected; Section 6 presents the discussion and, finally, Section 7 presents the conclusions, limitations and further research.

2. Literature Review

Following Brocke et al. (2009), the literature review involves the identification and evaluation of academic literature. In the present research, the literature review aimed at synthesizing previously conducted investigations on the concept of RPAs, as well as on their adoption, usage and value.

The development of the literature review, according to Brocke et al. (2009), can be divided into five stages, namely (i) Definition of review scope, (ii) Conceptualization of topic, (iii) Literature search, (iv) Literature analysis and synthesis, and (v) Research agenda. Following the above stages, we defined two possible research areas, namely artificial intelligence and information systems. After some research, we delimited our investigation to RPA.

Subsequently, searches were conducted for the keywords Value Creation, RPA, and RPA Value in scholarly databases (e.g., B-ON). Additionally, the references of articles read on the topic were also analyzed, and those selected for reading were chosen based on their titles, which could contribute to the ongoing research. We also considered the publication date of the articles; that is, although we deliberately included relevant articles with older publication dates, we made an effort to include articles with recent publication dates as well.

After collecting sufficient literature on a topic, it has to be analyzed and synthesized, and after this phase, according to Webster and Watson (2002), the emergence of a research agenda is expected, which should be composed of concise and objective questions for future investigations. In this case, the research question as well as questionnaire questions emerged.

This section is divided into two subsections. The first one describes the characteristics and purposes of RPA, and the second subsection discusses the business value of RPA and how it can impact an organization's key activities.

2.1.RPA

Technological development opened the way for many organizations to automate their business processes, especially the most complex ones, which involve a large volume

of data, high error rates and repetitive routine situations (Willcocks et al, 2020). Thus, after identifying the task that can be progressed, IT offers a range of possibilities, highlighting two approaches: Lightweight and Heavyweight (Penttinen et al, 2018).

Lightweight IT are characterized by a more commercial orientation, easy experimentation and user-oriented solutions, becoming more independent from the IT sections of organizations (Willcocks et al, 2015). They are, as a rule, solutions that do not change the bases of systems structures, as they use resources and user interfaces in existing systems (Bygstad, 2015). On the other hand, IT Heavyweight is usually associated with the development and maintenance of large systems. Robotic Process Automation (RPA) integrates the first approach - lightweight IT.

According to Syed et al (2020), the concept of RPA can be defined as the use of software associated with AI, namely the Machine Learning¹ (ML) capabilities to deal with a large volume of data, repetitiveness of tasks and with rules well structured. According to Tornbohm (2017), RPA is a productivity tool (sold as a software) that allows the user to configure scripts (or bots) so that they perform human work in an automated way. Aguirre and Rodriguez (2017) describe RPA as an application of specific technologies and methodologies to use a computer instead of a person, to manipulate existing software (e.g.: ERP) and process a transaction or complete a process. Willcocks et al. (2015a), define RPA as a socio-technical knowledge regime driven by the need for IT services, competent users, enabled by the consumption of digital technologies and compatible with the governance, security, architecture and IT infrastructure model.

Despite the panoply of existing definitions, they all point to the same purpose. In this sense, for an implementation with greater probability of success and with a view to optimizing the potential and effects of the RPA, there are criteria at the level of business processes that must be met, namely: processes must have rules as a basis, so that they are limited exceptions during its course, they must be repetitive and involve a high volume of transactions (Anagnoste, 2018).

RPA emerges as a solution to automate complex commercial and operational processes at the structure level that involve extensive labour and a high error rate. There

¹ According to L'heureux et al (2017), Machine Learning is a branch of artificial intelligence based on the foundation that systems can learn from data, identify patterns and make decisions with minimal human intervention.

is the possibility of being implemented at the various levels of business processes, namely, finance, accounting, supply chain or human resources (Cooper et al, 2019).

This technology has several purposes, including the possibility of freeing humans from monotonous tasks, guaranteeing results with more quality and in shorter periods. Thus, leaving this typology of tasks with low added value to the RPA responsibility, it is possible to allocate people more easily to tasks where creativity, ingenuity and decision-making capacity are needed (Romão et al, 2019).

RPA provides the ability to increase operational efficiency by reducing costs, improving the definition of work processes and reducing human negligence that will lead to increased competitiveness of the organization (Hallikainen et al, 2018). The reduction of manual tasks, as well as the reduction of workload, allow for an increase in time efficiency, visible in the reduction of process cycle time, task handling and waiting time (Cappiello, 2018). RPA offers flexibility, that is, the robot can have its intervention scheduled and, in addition, it is capable of carrying out various types of processes, and can be quickly transferred from sector to sector (Lowes et al, 2017).

2.2. *RPA Business Value*

The contribution of IT to organizational performance has been widely studied in works such as Brynjolfsson & Hitt (1996), Kohli & Devaraj (2003) or Mukhopadhyay et al. (1995). Several conceptual, theoretical and analytical approaches were adopted and various empirical methodologies were employed at various levels of analysis (eg, Brynjolfsson, 1993; Brynjolfsson & Yang, 1996; Dedrick et al. 2003; Wilson, 1995).

The measurement of the value generated by IT can be of a financial nature, or based on the perception that managers have about the impact of IT on the value chain (Tallon & Kraemer, 2003). The business value of IT is dependent on a variety of factors, including the type of IT, management practices, organizational structure, business partners as well as the competitive and macro environment (Brynjolfsson et al. 2002; Cooper et al. 2000; Dewan & Kraemer, 2000).

In the present study, we are interested in a process-oriented approach to the RPA definition. This approach requires that the main business processes² are identified, as well as the IT potential to improve the organization's performance in achieving its goals. A key factor in achieving business value from IT is its relationship to process innovations (Davenport, 1993). These innovations can be perceived as the mechanism to align the IT resource with the organization's business strategy (Hammer & Champy, 2009).

According to Tallon et al (2000), the use of IT in the organization's value chain activities increases the potential for value creation. However, IT investments have not always resulted in productivity gains (Kemerer & Sosa, 1991), substantiating the “productivity paradox” (Baily et al, 1988). The lack of good quantitative measures for evaluating production and value created made it particularly difficult to justify investments (Brynjolfsson, 1993). According to Melville et al (2004), explanations for this phenomenon can be grouped into 4 groups: Mismeasurement (inputs and outputs are not being properly measured); Lags (between current cost analysis and benefits); Redistribution (IT are used in redistributive activities between organizations and are not added to the output) and Mismanagement (of the generated information and technology allocation).

To measure the impact of IT on organizations Mahmood et al (1991) propose a theoretical model according to which IT contributes to the value chain in the following dimensions: (i) downstream dimension (development of products more suited to market requirements or improvement of services provided to the customer); (ii) internal dimension (improving the efficiency of internal processes); and (iii) the upstream dimension (promoting organizational efficiency and coordination with business partners).

Towards identifying the effects of IT on business processes, Mooney et al (1996) identify: (i) effects of automation (perspective of efficiency of the value that derives from the use of IT as a substitute for work); (ii) informational effects (derived from IT's ability to collect, store, process and disseminate information) and (iii) transformational effects (value creation from IT's ability to facilitate and support innovation and process transformation).

The growing importance of automation solutions as a way to drive sales processes through the development and value creation of innovative tools, enables progress in the

² According to Melville et al (2004), business processes are activities underlying value creation processes (transforming inputs to outputs) such as inbound logistics, manufacturing, sales, distribution, etc.

efficiency and effectiveness of sales and marketing, as well as the improvement of long-term relationships with customers (Cardinali et al, 2014). It is already a trend nowadays the automation of repetitive tasks with the goals of reducing human error and costs. By comparing automation rates, users can explore which can be improved and where further automation can create benefits such as improving other process-related performance measures (Geyer-Klingeberg et al, 2018).

To define the value of RPA and how it can impact an organization's key activities, it is essential to assess what unique characteristics distinguish it from other innovations. The RPA stands out in terms of (i) operational efficiency, (ii) service quality, (iii) integration and (iv) risk and reliability management (Syed et al 2020).

The increase in operational efficiency comes from reducing time, costs and human resources, as well as reducing manual work and workload. Based on quantitative measures, such as the number of full-time employees replaced by robots, RPA has proven to reduce the cost of human resources (20% to 50%) (Cappiello, 2018).

Traditional errors caused by incorrect data entry, failed steps, among other human errors, are greatly mitigated, with almost 100% reliability being expected (Lacity and Wilcocks, 2016). Studies reveal that organizations consider RPA as a tool to help them provide better services and customer experiences (e.g., Lacity & Willcocks, 2018; Lamberton et al, 2017).

Compared to the traditional back-end integration process, RPA is relatively simpler and cheaper to implement, configure, maintain and is more intuitive for users (Asatiani and Penttinen, 2016). RPA uses existing user interfaces to replicate human work, providing tools that allow for infrastructure integration and interaction between different computer systems (Hallikainen et al, 2018).

The reduction of risk and increased reliability are obtained by using the RPA to monitor the activities of human beings and by automation with high security in execution, generating alerts whenever actions are carried out that do not comply with the previously established rules (Vitharanage et al, 2020). Robots are configured according to rules and regulations, and easily detect process failures (Lacity & Wilcocks, 2016).

RPA capabilities can be grouped into two levels. The first, associated with the individual work of employees and the way in which the value of the tasks performed changes. Second, related to the overall optimization of the organization, namely the standardization of processes and support for decision making (Davenport & Kirby, 2016).

Inherent in standardization, the activities performed by robots are recorded, which leads to greater transparency and allows for the identification of deviations in the processes, achieving better auditability rates (Syed et al 2020).

RPA should be considered as an integral part of the organization's long-term business and automation strategy. When combined with human labour, better performances are obtained (Lacity and Willcocks, 2018).

In summary, RPA is part of lightweight IT, characterized by a more pronounced commercial orientation, easy experimentation (user friendly) and allowing greater independence from the IT department. RPA is a productivity facilitator that automatically performs human-computer interaction tasks through one or more scripts (bots). Bots are used to mimic one or a set of ordered tasks hitherto performed by people. It provides organizations with a virtual workforce that is fast, reliable, affordable and available 24 hours a day for the most varied processes, resulting in gains in operational efficiency, in cost reductions and guarantee in the execution of repetitive tasks.

3. Conceptual Model for Analysing RPA Value

The automation of business processes is a significant aspect of the digital transformation that will lead to the growth of digital innovations in organizations (Sobczak, 2021). According to forecasts, automation tools, in particular RPA, are currently the fastest growing group of digital transformation technologies in the IT market, with an estimated investment evolution of 1.3 billion USD in 2019 to 6.8 billion USD in 2026 (Fortune Business Insight, 2020). These solutions have a set of common goals, including increasing efficiency and minimizing the costs of executing business processes and ensuring the highest quality of outputs produced by such processes.

After reviewing the literature on the value of RPA, this article proposes a definition of the value of RPA for organizations, dimensions and factors identified in the literature as relevant to the value of RPA. The most important impacts include reducing the costs of executing business processes, improving the ability to carry out processes without increasing staff, improving the employee experience by assigning less repetitive and routine tasks, improving the quality of products/ services provided as a consequence of minimizing the number of errors committed by humans or increasing the number of

innovations introduced by organizations (Anagnoste, 2018), (Asatiani & Penttinen, 2016) and (Lacity & Willcocks, 2016).

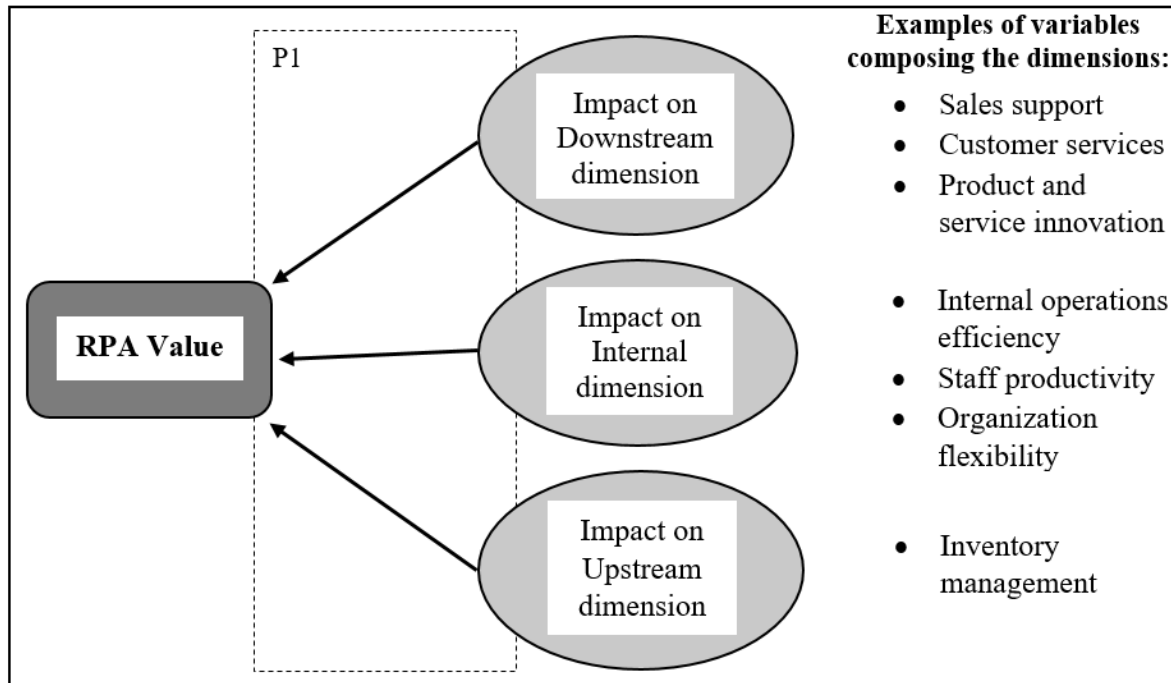


Figure 1. Conceptual model for analysing RPA's value

Porter's (1985) value chain analysis has been widely used in the IS literature to study the business value of IT, and organizations can use IT as a way to improve the performance of different business activities along the value chain (Kraemer et al, 2005). In this article, we consider that the value of RPA corresponds to the impact of its use on the organization's performance, which is measured by the three main activities of the organizational value chain (Mahmood et al, 1991). They are graphed in Figure 1: (i) downstream dimension, relevant to creating a greater impact on the market, primarily related to how the organization interacts with customers. (e.g.: sales, customer service, product and service innovation); (ii) upstream dimension, related to the coordination between suppliers and business partners (example: inventory management); and (iii) internal operations, associated with greater internal efficiency of the organization (example: operations efficiency, employee productivity, organization flexibility) (Tallon et al., 2000). In addition to the variables listed from the literature review carried out, other variables, which were mentioned by the interviewees, were also considered. Respondents were free to add variables.

Thus, we would expect that a firm's RPA usage leads to specific types of performance improvements along these three dimensions so, the RPA value is analysed as composed of the following dimensions: RPA impact on the downstream dimension, RPA impact on the internal dimension and RPA impact on the upstream dimension.

4. Methodology

In order to understand the potential of a technology that is not yet being widely used (Pramod, 2021) and assuming that the RPA context has been evolving recently, this investigation takes an exploratory approach, that, according to Saunders et al (2009) is a valuable way to ask open-ended questions to find out what's going on and gain insights into a topic of interest. Keaveney (1995), concludes that there are several ways to conduct exploratory research, namely, literature search, interview 'experts' on the subject, conducting in-depth individual interviews or conducting interviews in focus groups.

So, we conducted interviews with a panel of experts in the field to explore and validate the definition of the RPA value construct and its components, as well as to envision the potential of technology. The interviews with the experts also aim to validate the composition of the construct by the sub-constructs of the impact of RPA on the downstream dimension, impact of RPA on the internal dimension and impact of RPA on the upstream dimension. The interviews also assumed the objective of exploring the composition of the construct that will establish the value of the RPA as a value creation factor for organizations. The collection of these data aims to provide preliminary evidence regarding the validity and applicability of the conceptual model proposed in section 3. In previous investigations, executives' perceptions of the business value of IT were used to assess the real impact of IT on value chain activities (Soh & Markus, 1995; Tallon et al, 2000; Melville et al, 2004).

The experts who participated in this study are experts from organizations in the field of creating, implementing and developing RPA and academics with research on RPA. After extensive research, the subjects selected for interview are key informants who are currently part or participated in RPA projects of large organizations in the most diverse areas (energy sector, postal, banking, telecommunications). 7 interviews were

carried out until the saturation point was reached, that is, there were no new impacts of the RPA to be mentioned (Sekaran & Bougie, 2016). When the saturation point was reached, relevant information was gathered to understand and describe the important factors about the business value of RPA.

To increase the reliability of data collection, the interviews were carried out based on the suggestions of Yin (2018), namely taking into account that the nature of the interviews is essentially open, which can lead to the respondent not fully cooperating and not following the planned sequence of questions so there is a need to establish explicit and well-planned procedures to avoid it. To interview key informants, their hours and availability must be respected. The questions are in essence reminders of the information that needs to be collected and the questions are intended to keep the researcher on track as data collection proceeds. The constructs on which the interview protocol was developed are presented in Table 1.

Based on the literature review and on the expected dimensions, an interview protocol was created, consisting of a set of questions for a semi-structured interview (see Questionnaire's foundation table). In this type of interview, the researcher has a list of topics and some key questions to address, however, he can omit or add some questions depending on the specific organizational context (Carson et al 2001). Normally, according to Bell et al (2022), this type of interviews is used to collect data that will be analysed qualitatively. In addition to the questions present in the questionnaire's rationale table, we consider it pertinent to ask additional questions not supported by other authors, namely, "*How did you see the RPA before adoption and how do you see the RPA today?*" or "*What feedback have you been getting?*". The protocol was previously tested and validated with research colleagues. The interviews were recorded and later transcribed. The transcribed data were analysed based on the content analysis techniques proposed by Bardin (2009). Initially, the interview data were coded, transforming the text according to specific rules of clipping, grouping and enumeration, in order to achieve a representation of the content. Then, the interviews were analysed according to a grid of categories taking into account the frequency of themes taken from a set of speeches considered segmented and comparable (see annex A).

For each component of the downstream, internal and upstream dimensions, respondents were asked about to what extent RPA impacts in terms of each component on their organizations. For example, questions include "*What are the impacts felt on*

sales/marketing?” or “What are the impacts felt in purchases/procurement?”, systematically asking respondents to share examples.

5. Data Analysis and Results

Of the seven experts, four are responsible for RPA initiatives in their organizations, two are academics and one is a developer. The demography of the interviewed experts is described in table 2.

Demography		Academic Education		Professional Profile	Identification
Gender	Age	Scientific Area	Degree		
Male	32	Electrical and Computer Engineering	Master	Manager	Interviewee 1
Male	55	Management	PhD	Teacher	Interviewee 2
Male	25	Data Science and Advanced Analytics	Master	Intelligence Technical Specialist	Interviewee 3
Male	45	Biotechnology	Graduation	Head of Transformation & Processes - B2C, Retail & Corporate Services	Interviewee 4
			MBA		
Male	41	Information Systems Information Systems for Enterprises	Graduation	Business Transformation Leader Professor & Executive Program Director	Interviewee 5
			Post-Graduation		
Male	40	Science (MSc), Economics, Financial and Monetary	Master	Head Of Digitalization and Transformation	Interviewee 6
Male	37	Economy	Master	Automation Center Leader	Interviewee 7

Table 2. Respondent Demographics

5.1. *Impact on Downstream Dimensions*

Regarding the impact of RPA on the downstream dimension, all respondents agreed that its use can have a positive impact on this organizational dimension.

Expert comments indicate that better customer service, improved communication, greater customer satisfaction and convenience are positive impacts that the use of RPA can offer to the organization: *“We did proofs of concept, in the area of customer support it went very well, so we decided to move forward with the project. The reality is that RPA brings greater speed, greater quality and allows you to mobilize people for tasks that motivate them more. The most motivated teams impact the entire organization and the services we are able to provide to our customers”* (interviewee 4); *“Customer satisfaction levels have clearly increased, we have several situations where the customer experience has been radically transformed (example: in the past we negotiated a payment plan in 5 days, today we are doing it on the same day)”* (interviewee 5); *“if one of our potential customers asks us a question on our website, there is a robot that actually reads that information and creates leads (opportunities) in our CRM so that the commercial teams can then work on these opportunities and result in the contract”* (interviewee 4); *“it works as a process cycle time accelerator, this is where we see a great advantage, it is accelerating our time to market, that is, between the customer's order and what we deliver. The faster we can respond to the customer, the better the customer experience/satisfaction”* (interviewee 6).

The use of RPA can also have a significant effect on increasing sales. That is, taking into account the testimony of the interviewees, it was possible to conclude that with the help of this technology, sellers gain a kind of personal virtual assistant who simply communicates that package X has been sold to customer Y. Thus, sellers get more availability to understand the needs and problems of the customer: *“We are talking about someone who previously could not give the same degree of attention to the customer because, in the meantime, he had to interact with a series of systems that were difficult to operate and now had a much simpler experience at that level, starting to be able to give more pay attention to the person on the other side of the counter”* (interviewee 5).

Evidence gathered from the interviews clearly supports that RPA has an impact on the downstream dimension.

5.2. *Impact on Internal Dimensions*

As for the impact of the RPA on the internal dimension, experts agreed with most components. On the other hand, all mentioned that the use of RPA in organizations is not a driver for reducing the number of workers, and that these, or part of them, can be allocated to other tasks with greater intellectual value. In these cases, there may also be workers who leave organizations and the staff is not restored to 100%.

All respondents voluntarily expressed the relevance of the effect of using and usefulness of RPA in internal operations and the positive impact it entails, namely in the reduction of errors and costs and in the reduction of routine work, which, in turn, increases the quality of work and employee motivation: *“better quality (of the process itself) with correction of any errors and a success rate of around 98%. What used to take 4 hours can be reduced to 1 hour”* (interviewee 1); *“this type of technology greatly increases the human capacity to stimulate the intellectual capital that each one of us has and that was often wasted in the consumption of time in repetitive tasks”* (interviewee 5); *“employee motivation increases, as they no longer spend a large part of their day copying and pasting and instead have time to prepare reports and analyse them with a more critical view, develop process improvements (value added tasks) and analyse management information for better decision making”* (interviewee 1).

RPA is described as a quick solution (short payback): *“the ROI of our automation solutions is high. In fact, I can say that most of them pay for themselves in the first year”* (interviewee 5); capable of increasing operational speed, used to speed up time to market and sometimes overcome IT's inability to rapidly develop structuring solutions.

The vast majority of respondents emphasize that the use of RPA provides increased organizational flexibility and operational elasticity, allowing organizations to always have a flexible and capable task force at their disposal, to be allocated to the various departments in case of occasional work peaks (seasonality). The increase in efficiency and optimization of processes and, consequently, the increase in organizational productivity are also highlighted: *“A robot works 24/7, 365 days a year, for this reason alone already works about 3 times more than a person”* (interviewee 2); *“It allows for greater flexibility, that is, taking into account, for example, the end of the month in the financial area, which involves a peak of work, we managed with the robots to allocate all*

available robots in certain periods of the month, which does not happen with people” (interviewee 1).

Thus, evidence gathered from interviews with experts clearly supports that RPA has an impact on the internal dimension.

5.3. *Impact on Upstream Dimensions*

Expert comments reveal that it is still unclear how RPA can impact the upstream dimension. However, there are suggestions that the RPA made it possible to reduce outsourcing and consequently reduce external dependence on consulting organizations: *“Today, that part that at the beginning was external, from our partners, already represents a tiny part compared to what we build internally”* (interviewee 5). According to interviewee 7, it is necessary to *“train people who develop, those who master the process or those who manage”*, otherwise, *“it leads to a great dependence on external consultants, which means that the process is more expensive and when they leave, it is necessary to manage and maintain the robots”*. One of the specialists also referred to the improvement in auditability levels, *“as the robot records everything it does”* (interviewee 1).

Therefore, the evidence collected in the interviews with experts, although including encouraging evidence, fails to prove the relevance of the value of the RPA for the upstream dimension.

5.4. *Other Impacts*

After the questions related to the impacts caused by the RPA in the downstream, internal and upstream dimensions, the participants were asked if there were any other impacts that should be included.

For the downstream dimension, more than half of respondents report that RPA had a positive impact on product quality. With regard to the internal dimension, specialists identified the ease of communication between systems or platforms as another impact

produced by the use of RPA, as well as the increase in the organization's profits and changes in the organizational culture.

Our findings do not fully support Proposition 1, as respondents' comments indicate that RPA has relevant effects on the performance of organizations in downstream and internal organizational activities, but its effect on upstream activities is not confirmed.

Table 3 summarizes the results presented in this section.

	Components^a	Evidence from interviews (n. ° of respondents)
Impact on downstream dimensions	Increased customer satisfaction.	3
	Increased convenience for customers.	4
	Improved customer communication.	2
	Best customer service.	4
	Quality increase.	4
Impact on internal dimensions	Quick fix, short term, short payback.	5
	Bridging IT inability.	3
	Ease of communication between systems/platforms.	3
	Ease of implementation / configuration / use (intuitive).	4
	Reduced time/speed/operational speed.	5
	Cost reduction.	5
	Error reduction.	6
	Intellectual appreciation of employees.	7
	Routine work reduction.	7
	Changes in organizational culture.	3
	Process safety.	1
	Efficiency increase/Process optimization.	6
	Increased productivity.	5
	Organizational flexibility.	3
	Operational elasticity.	4
Organization profit.	2	
Reduction in the number of workers.	7	
Increased motivation / Quality of work of employees.	5	
Impact on upstream dimensions	Outsourcing reduction.	2
	Reduction of external dependence (consultants).	2
	Auditability.	1

Table 3. Constructs and Components

- a. Those components were identified based on the IT business value, RPA value and RPA researches.

6. Discussion

The interviews carried out with experts highlighted several impacts that, directly or indirectly, contribute to the production of value for organizations in the Downstream, Internal and Upstream dimensions.

Regarding the downstream dimension, 4 out of 7 interviewees listed impacts felt mainly on consumer relationships and consumer satisfaction. Some interviewees also reported RPA's positive impact on convenience for the customer, better communication with the customer, better customer service and quality increase. These results suggest that RPA's may provide an enhanced customer experience that will improve the firm's performance on the downstream dimension. Since the RPA contributions for superior performance on the downstream dimension are not mentioned by all the interviewees, the present research results ground the perspective that RPAs are likely to foster superior performance in this dimension, but such superior performance should be further tested either with sector-specific research or through an analysis of a specific firm business model.

In the internal operations dimension, the interviewees expressed unanimously the contribution of RPA to the reduction of employees' routine work, as well as the increased intellectual appreciation of employees and the reduction in the number of workers. These impacts highlighted benefits not only to the organization but also to the employees, that is, in addition to the improvements in process performance, an increased appreciation of employees was felt since they are assigned tasks that involve more intellectual and decision-making capacity and less routine. So, in the internal dimension, the RPA's impact on the workforce is bidirectional, some RPA's related employees will perform tasks with superior intellectual involvement, and achieve superior satisfaction, while others may end up retired or searching for another job. Therefore, the impact of RPAs on the internal dimension of the firm is widely positive in terms of firm performance, as well as to some of the workforce, while raising issues for the remaining workforce that may end up facing reskilling needs.

Finally, some of the interviewees pointed to some impacts felt in the Upstream dimension, even though none of the impacts on this dimension was widely recognized by the interviewees. The impacts on the upstream dimension that were mentioned by the interviewees were outsourcing reduction, reduction of external dependency, and

auditability. Since the recognition of these impacts by the interviewees was the exception, rather than the rule, we consider that, even though some impacts on this dimension were identified by some interviewees, this research is inconclusive in what regards to the relevance of RPA's contribution to the performance of the firm's upstream dimension.

7. Conclusion

The purpose of this article is to assess the value of RPA from an organizational perspective. Supported by the concept of IT value developed by Mooney et al (1996), a definition was proposed and potential components identified for the RPA value. Preliminary evidence for the validity of the conceptual model was obtained from interviews carried out with experts. Thus, the result of this study may contribute to the adoption of IS by identifying examples of value creation through the adoption of RPA. It will encourage organizations to adopt RPA to achieve a performance boost.

The research results allow validating the definition of the RPA value. Respondents suggest that the value of RPA is made up of impacts on the downstream dimensions and internal operations. The impact on the upstream dimension is still unclear.

In the downstream dimension, RPA's contributions on value creation were particularly recognized in terms of improved customer services, improved communication, greater customer satisfaction and convenience.

In the internal dimension, the contributions of RPA in terms of reducing errors and costs and reducing routine work were widely recognized, which in turn increases the quality of work, the motivation of employees and create value to the company.

The composition of the RPA value by the value components for the downstream, internal and upstream dimensions, as well as the composition of the relevant aspects for each of these dimensions, should be empirically validated in future work.

The results of this study provide theoretical and practical contributions. It is possible to access a list of potential impacts that the use of RPA may have on the organization. The results obtained will be useful to managers in decision-making about RPA initiatives. Academically, a definition and components of the RPA value are proposed.

Despite the theoretical and practical contributions, this study has some limitations. It must be taken into account that this is an exploratory study, and further investigations are recommended to validate the results obtained. It is also limited in terms of generalizability of results due to the small sample of respondents.

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Appendix 1

Question	Author's Question	Author
What is RPA?	<i>What is Robotic Process Automation (RPA)?</i>	Syed et al (2020)
	<i>What is RPA and how is it different from other automation tools?</i>	Lacity & Willcocks (2016)
	<i>What is RPA?</i>	Rutaganda et al (2017)
What is the company's purpose with regard to RPA?	<i>What are the main reasons for you to adopt m-business?</i>	Picoto et al (2014)
	<i>How can RPA in municipal administration contribute to good bureaucracy?</i>	Johansson et al (2022)
When did the company adopt RPA?	<i>When were Software Bots adopted within your company?</i>	Suri et al (2017)
	<i>How long do RPA implementations take?</i>	Lacity et al (2016)
Why has RPA started to appear now, or why is RPA used when in practice what it does is a connection between systems, repetitive tasks? Shouldn't it be a development in the software itself?	<i>How does a company choose between the implementation of lightweight IT and heavyweight IT?</i>	Penttinen et al (2018)
	<i>How will RPA interact with its ERP systems?</i>	Lacity et al (2016)
Are there proper tasks to be automated?	<i>What characteristics make processes suitable to be supported by RPA?</i>	Van der Aalst et al (2018)
	<i>How can we guide companies in selecting processes that are beneficial for their RPA projects?</i>	Wanner et al (2019)
	<i>Might some of these activities be automated as well?</i>	Lacity et al (2016)
What are the main features of RPA?	<i>What is the potential of RPA?</i>	Syed et al (2020)
	<i>How does it work, what is it about?</i>	Herm et al (2022)
What are the success factors to consider when adopting RPA?	<i>What is an effective RPA methodology?</i>	Syed et al (2020)
Is there a specific type of company that uses RPA?	<i>What business model to choose for the technology?</i>	Asatiani & Penttinen (2016)
	<i>Are some models a better fit for this market than others?</i>	
	<i>Which are the industries with more propensity to adopt EPSs?</i>	Soares-Aguiar & Palma-dos-Reis (2008)

When adopting the RPA, did the company achieve the objectives that supported the decision to adopt?	<i>Is m-business part of your company's overall strategy?</i>	Picoto et al (2014)
	<i>What were the initial goals for your m-business initiatives?</i>	
	<i>Will the technology provide quality services?</i> <i>Will the technology provide enough of a return on investment?</i>	Lacity et al (2016)
What are the main advantages/disadvantages?	<i>What are the main benefits and risks associated with new solutions that deepen BP automation with greater "intelligence" in BPM?</i>	Cooper et al (2019)
	<i>Would automation produce business benefits?</i>	Lacity et al (2016)
What were the impacts felt in the adoption of the RPA?	<i>What are the benefits that companies have realized because of RPA?</i>	Syed et al (2020)
	<i>How does RPA perform integrative and productive tasks?</i>	Money & Mew (2022)
	<i>And, what are the new performance measures?</i>	Alberth & Mattern (2017)
Did the RPA bring beneficial changes to the organization's dynamics?	<i>How does RPA implementation impact organizational behavior in global accounting services from a professional logic lens?</i>	Fernandez& Aman (2018)
	<i>How will AI and robotics lead to the allocation of labor and capital, so will whole society improve?</i>	Beerbaum (2022)
	<i>Who will be responsible for RPA governance: business or IT?</i>	Alberth & Mattern (2017)
	<i>Who will control them during daily production: back office, data center production, or a new group wide central RPA control group?</i>	
What was the motivation for investing in RPA?	<i>Why are clients adopting service automation and what outcomes are they achieving?</i>	Lacity& Willcocks (2016)
	<i>What are the factors that foster the adoption of EPSs?</i>	Soares-Aguiar& Palma-dos-Reis (2008)
When they moved towards the RPA, had they already decided in which areas they would implement it?	<i>In which areas of enterprise business operations is robotic process automation applied?</i>	Sobczak, A. (2021)
	<i>Which processes have been automated using Software Bots and in what functional areas of Shared Services organizations?</i>	Suri et al (2017)
Given the project's success, will the idea be to expand the scope of the RPA to other sectors?	<i>What else can we automate?</i>	Lacity& Willcocks (2016)
	<i>Are there bottlenecks?</i>	Gadre et al (2017)
	<i>What business lines will be involved?</i>	

	<i>Where is service automation launched – in business operations, IT or in outsourcing provider firms?</i>	Lacity et al (2016)
What are the impacts felt on sales/marketing (downstream dimension)?	<i>What are the Impacts on the Downstream Dimension (sales)?</i>	Picoto et al (2014)
	<i>To what extent do m-business initiatives facilitate communication with your clients?</i>	Picoto et al (2010)
	<i>How can the external investor receive standardized information with regard to the application of RPA?</i>	Beerbaum (2022)
What are the impacts felt on internal operations?	<i>What impact does m-business have on staff productivity?</i>	Picoto et al (2010)
	<i>What is the Impact on Internal Dimensions (internal operations)?</i>	Picoto et al (2014)
	<i>Is RPA secure?</i>	Lacity et al (2016)
What are the impacts felt on purchases/procurement (upstream dimension)?	<i>What are the impacts on Upstream Dimensions (procurement)?</i>	Picoto et al (2014)
	<i>Are there vendor dependencies that create risk for clients?</i>	Gadre et al (2017)
	<i>What access will audit and compliance get?</i>	Alberth & Mattern (2017)
In addition to those mentioned here, are there any impacts you would like to mention?	<i>Are there other impacts that m-business have in your company that were not mentioned yet?</i>	Picoto et al (2014)

Table 1: Questionnaire reasoning table

Annex A

According to Bardin (2009), content analysis is a set of communication analysis techniques. The distribution procedure must be carried out from the general to the particular, that is, the classification headings are determined first and then dispose of the whole.

There are several ways to conduct interviews. Semi-structured interviews, with a normal duration of one to two hours, must be registered and fully transcribed. In this type of interview, we deal with a relatively spontaneous speech, with references to something the interviewee experienced. As a general rule, the researcher is faced with a set of interviews, with the ultimate goal of inferring something about a reality.

Carrying out a classic content analysis, with a categorical framework, the researcher favors the repetition of the frequency of themes in all interviews. It consists of a structural deciphering process centered on each interview, in a non-systematic and flexible way. Each interview is built according to a specific logic, taking into account that it is more a spontaneous speech than a prepared one. Each interview must be seen as the first in order to avoid the formation of preconceived ideas from other interviews already carried out. It is essential to assign a number to each interview.

Coding corresponds to a transformation of the raw data of the text, into a representation of the content or its expression based on clipping, aggregation and enumeration. The information obtained allows the investigator an accurate description of the pertinent characteristics of the content. The coding organization comprises three choices:

- The clipping (choice of recording units). It must respond in a pertinent way to the characteristics of the material and given the objectives of the analysis.

- Enumeration (choice of counting rules, counting mode). Frequency is usually the most used. The importance of the recording unit increases with the frequency of appearance, that is, it is based on the implicit assumption that its significance, in relation to what one seeks to achieve in the description or interpretation of the targeted reality, will be greater the more often the frequency is repeated.

- Classification and aggregation (category choices). Categorization consists of classifying the constituent elements of a set by differentiation, and then regrouping according to gender (analogy), with previously defined criteria. Categories are rubrics or classes that bring together a group of elements (registration units) according to the common characteristics of these elements.

Chapter II

An organizational perspective on RPA adoption and usage factors

Abstract

The adoption of Information Technologies in organizations is a crucial decision for growth, productivity, competitiveness and even survival in an increasingly competitive market. It highlights the growing importance of automation solutions such as RPA to achieve or maintain competitiveness.

Although there is research on RPA, most of it focuses on technology, and what it can provide, rather than on the effective contribution to the better performance of organizations, which depends on adoption and use. This work studies the propensity to the adoption and usage of RPA.

As a basis for the conceptual model of this research, the DOI and TOE theoretical models were used in order to evaluate the propensity for adoption and use of RPA from an organizational perspective.

This research uses mixed methods. Initially, interviews were carried out to complement the information collected in the literature with a view to developing a model for assessing the propensity to use RPA and, subsequently, data from surveys collected from 123 organizations were used to test the proposed model.

The results indicate that it is in the technological context that the antecedents prove to be significant in the propensity for the adoption and use of RPA, namely Compatibility and Relative Advantage. The implications of these findings are discussed from a practical and research perspective.

Keywords: Information Technologies; DOI; TOE; Adoption/Use of RPA.

1. Introduction

In order to achieve competitiveness, organizations tend to strive to improve the efficiency of their operations, with the need to reformulate their management, and, in this field, the emerging development of digital tools, especially Information Technologies (IT) is the key to achieving the efficiency improvement (Syed et al, 2020).

Robotic Process Automation (RPA) integrates a Lightweight³ automation approach and emerges as a solution to automate commercial and operational processes, which involve extensive labor and the risk of human error (Bygstad, 2015). Its implementation is feasible in various areas of business processes and aims to increase company productivity, reduce costs and create value, increasing customer satisfaction and improving the company's competitiveness (Lacity & Willcocks, 2018).

The use of RPA in the business context has increased in recent years, therefore, it is expected that organizations' investment in this type of technology will follow the trend (Lacity and Willcocks, 2018).

Despite all the potential of RPA, there is a need to justify its viability, its strengths and its value to the various stakeholders (Hallikainen et al, 2018). Based on quantifiable measures, according to Willcocks et al (2016), with RPA the cost of full-time employees can be reduced between 20% and 50% and the cost of processing per transaction can be reduced between 30% and 60%.

The potential of RPA to improve the performance of organizations recommends analyzing what assumptions or under what conditions organizations are most likely to adopt RPA. The article offers contributions for researchers and people who deal in practice with RPA. In the first case, it provides a validated model for estimating the organization's propensity for the adoption and usage of RPA, confirming the usefulness of TOE (Technology Organization Environment) for organizational-level studies.

³ Lightweight IT is characterized by business orientation, easy experimentation, user-oriented solutions. They are, as a rule, solutions that do not change the basis of the systems' structures, as they use resources and user interfaces from existing systems. It is a term generally used to describe commercially available front-end software associated with applications for mobile devices, sensors and devices also known as the Internet-of-Things (Penttinen et al, 2018).

The article is also an additional example of the combination of qualitative and quantitative approaches when conducting an investigation.

The research question guiding this paper is: What are the main factors influencing organizations' decision to adopt and use RPA?

This article is organized as follows: section II presents the literature review focusing on the characteristics of RPA and theoretical foundations, followed by the methodology and qualitative data analysis in section III. The subsequent sections, namely, the section IV describes the research model and hypothesis, followed by the confirmatory study (section V). Next, the discussion of the results is presented (section VI) and, finally, the conclusions, including limitations and implications of this research (section VII).

2. Literature Review

This section is divided into two subsections. The first one describes the characteristics of RPA and its potential contributions, and the second one addresses the two most prominent theoretical models of IT innovation adoption at the organizational level.

2.1 RPA features and potential contribution

Currently, there is a greater propensity to automate repetitive tasks with the aim of reducing human error and costs and improve response time (Madakam et al, 2019). This trend, in turn, implies new strategies in business processes (Osman, 2019).

There are several differences between RPA and other forms of automation, emphasizing the need to develop an integrated model to analyze the use of RPA. According to Seasongood (2016), RPA becomes a viable option to consider when the objective is driven by cost reduction, quality improvement and efficiency. RPA can provide contributions in terms of *(i)* operational efficiency through cost reduction (Menon and Aslekar, 2022); *(ii)* service quality, possible due to the reduction in the rate of human error (Potturu, 2023); *(iii)* ease of implementation and integration, allowing the transfer of information between various systems (Gupta et al, 2023); and, *(iv)* risk and reliability management, inherent to the standardization of procedures, it is possible to identify deviations in processes with greater transparency (Syed at al, 2020) as illustrated in figure 1.

The increase in operational efficiency is due to the reduction of time, costs and human resources, as well as the reduction of manual work and workload, being noticeable in the reduction of process cycle time, task handling and waiting time (Cappiello, 2018).

Traditional errors caused by incorrect data entry, failed steps, among other human errors, are practically mitigated, with an effectiveness of practically 100% expected, given the reliability and continuity of the work performed by robots (Lacity and Wilcocks, 2016).

Compared to the traditional back-end integration process, RPA is relatively simpler and more economical to implement, configure, maintain and is more intuitive for users (Asatiani and Penttinen, 2016). RPA replicates work processed by humans, uses

user interfaces and is integrated into the infrastructure of existing systems (Chakraborty et al, 2023).

Reducing risk and increasing reliability is related to the use of RPA to monitor the activities of human beings, generating alerts whenever actions are carried out that do not comply with previously established rules (Vitharanage et al, 2020). Robots are configured according to rules and regulations, and easily detect failures in processes.

According to Jha et al (2023), emerging technologies offer numerous benefits when integrated into the service industry, potentially driving business growth and revenue, providing opportunities for differentiation and competitive advantage, helping to reduce operational costs, and increasing efficiency through automation and optimization.

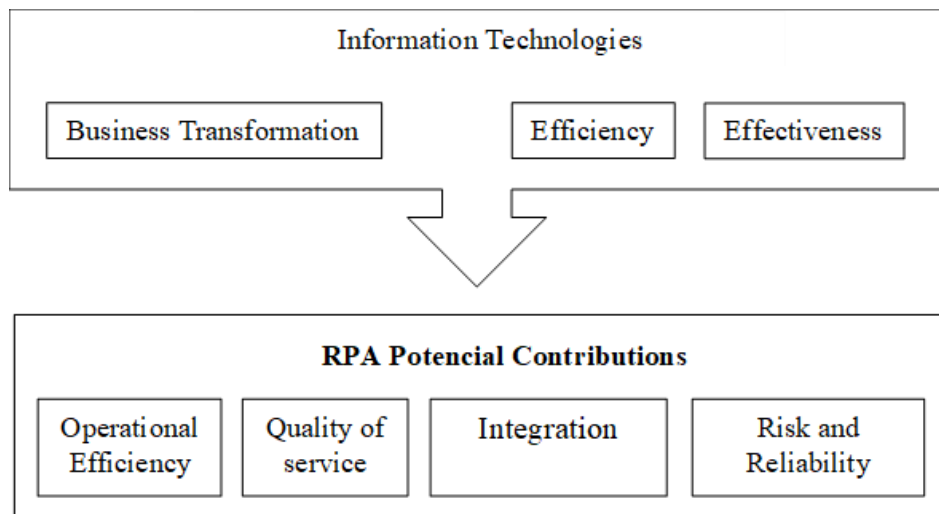


Figure 1: RPA Potential Contributions

2.2 DOI vs TOE

The purpose of the investigation is to analyze the propensity to adopt and use RPA from an organizational perspective, with the unit of analysis being the organization. To study the use of RPA in organizations, theoretical support is needed to explain how innovations are adopted and used by organizations (Hsu et al, 2006). The two most prominent theoretical models of IT innovation adoption at the organizational level are the DOI (Diffusion of Innovation) theory proposed by Rogers (2010, first edition published in 1962) and the TOE proposed by Tornatzky & Fleisher (1990). The first emphasizes the

characteristics of innovation, the second focuses on the context of innovation. Both were found to be significant in previous adoption studies (Gangwar et al, 2014).

Based on this theoretical basis and previous research with an organizational RPA perspective (Willcocks et al, 2016; Hallikainen et al, 2018) we intend to determine the antecedents of the use of RPA.

The DOI theory attributes the organizational use of an innovation to its organizational attributes and characteristics. Rogers (2010), proposes 5 main characteristics: relative advantage (innovation produces benefits for the organization); compatibility (the innovation is compatible with existing business processes, practices and value systems); complexity (the degree of difficulty in using the innovation); observability (the results of using the innovation are visible); and trialability (possibility for the innovation to be tried). According to Tornatzky and Klein (1982), the most significant and relevant characteristics are the first three, that is, relative advantage, compatibility and complexity.

The TOE framework emerges as an important theoretical perspective for the study of contextual factors. This theory identifies 3 aspects that can influence the use of a technological innovation at the organizational level: technological context (describes the existing technologies and relevant technical capacities available in the organization); organizational context (refers to internal characteristics of the organization such as size or quantity of available resources); and environmental context (area where the organization operates its business, its industry, its competitors and commercial partners), the latter being an innovation in relation to the DOI theory (Tornatzky & Fleischer, 1990).

Integrating this framework into theoretical development allows strengthening some aspects neglected by DOI theory, such as the specific technological and organizational circumstances of the potential user and respective industry (Chau & Tam, 1997). This framework has been used for example in the context of manufacturing industries (Mishra et al. 2007; Zhu et al. 2006b), healthcare (Lee and Shim 2006), retail and financial services (Zhu et al. 2006b).

In short, both the DOI and the TOE address the issue of technological innovation and organizational characteristics when related to adoption and use, however, the TOE provides additional contributions as it includes factors of the organizational environment. Their combination was used with the purpose of better explaining the adoption and use of RPA, instead of using only one of them (Zhu et al., 2006a).

3. Methodology and Qualitative Data Analysis

In order to fill the existing gap in the literature, this study applied the Mix Methods approach to add knowledge on the adoption and use of RPA.

A sequential research design (qualitative followed by quantitative) was adopted, following both Mingers (2001), according to whom a qualitative exploratory study allows the performance of a subsequent confirmatory study and Venkatesh et al (2013, p. 21) that suggests that if the objective of a research inquiry is to identify and test theoretical constructs and mechanisms in a new context, a qualitative study followed by a quantitative study is appropriate. The combination of methods provides better opportunities to respond to the formulated hypotheses (Tashakkori and Teddlie, 2010).

Subsequently, based on the results of this exploratory study, a quantitative study was started, that is, the development and validation of the nomological network based on data collected from 123 organizations. Figure 2 presents the outline of the investigation with the various stages developed to achieve the objectives of the study.

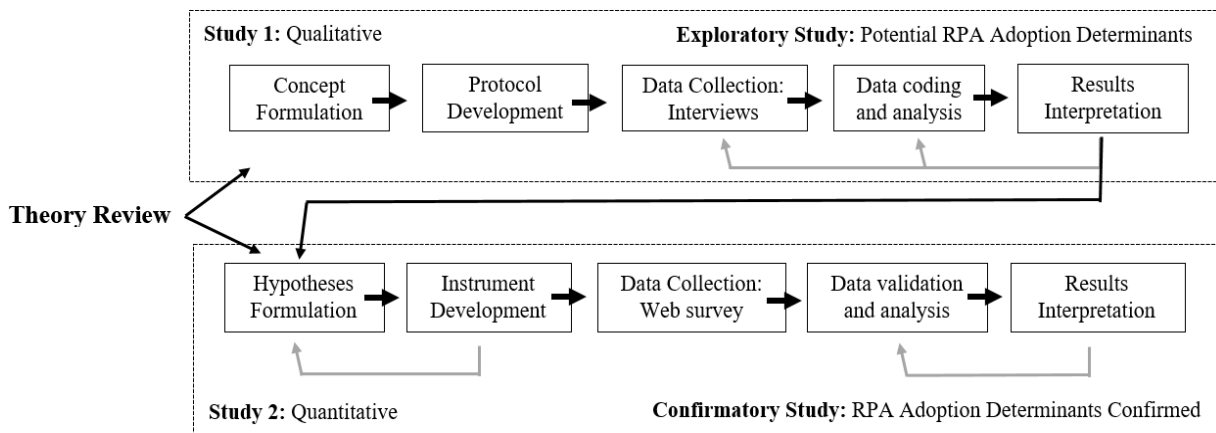


Figure 2: Research outline (Adapted from Picoto et al (2010))

3.1 Exploratory Study

Given the novelty of the concept and the absence of theoretical models aimed at the determinants of RPA adoption, we conducted a study to validate the potential RPA adoption determinants and explore additional insights that could support future investigations. The empirical content was obtained from in-depth semi-structured

interviews (Myers and Aviton, 2002), with key informants (Yin, 2003), and published articles (eg.: Melville et al (2004), Lacity et al (2016), Hallikainen et al (2018), Money & Mew (2022), etc).

Based on the value hierarchy presented in Figure 1 and previous investigations, it appears that RPA is likely to improve operational efficiency and the quality of service, integrates and leverages the potential of existing information technology resources, reduces risk, and increases reliability.

The Qualitative Study aims to validate the definitions and measures of the factors that are likely to influence the propensity for RPA adoption and use. The sample of interviewees was selected based on a purposeful sampling strategy, that is, only people with RPA knowledge or experience were selected. The diversity of sectors of operation of the individuals surveyed, increases the usability of the results (Lyytinen and Rose, 2003). In Portugal, there is already a large number of organizations with investments in information technologies, and it is expected that, in 2023, according to IDC, 45% of Portuguese companies will increase their investment in digital initiatives and sustainable technologies by 10% (Coimbra, 2023)⁴.

The exploratory study selected 6 organizations (energy sector, postal, banking, telecommunications) with significant use of RPA and interviewed one person familiar with RPA projects from each of these organizations. Additionally, an academic with RPA research was also interviewed. Appendix A presents the demographics of the respondents.

The number of interviews was determined by saturation, the standard approach for data collection in qualitative studies (Saunders, 2012). Saturation was achieved at the 6th interview, with a previously scheduled interview also being carried out, with a total of 7 interviews being carried out. The interviews were carried out in 2021, each of which lasted for about 1 hour and was conducted in Portuguese. They were recorded and later transcribed. To clarify some reasonings in the transcription of the interviews, telephone conversations were carried out and emails were exchanged.

⁴ Coimbra, G. (2023, [data de publicação]). Investimento em tecnologia cresce 4,7% em 2023. 45% das empresas portuguesas admitem aumentar orçamentos acima de 10%. *TekSapo*. Consulted on February 22, 2023, at 6:33: <https://tek.sapo.pt/noticias/negocios/artigos/investimento-em-tecnologia-cresce-47-em-2023-45-das-empresas-portuguesas-admitem-aumentar-orcamentos-acima-de-10>

3.1.1 Exploratory Study Data Analysis and Results

The analysis of the responses to the interviews was carried out by counting the number of times each interviewee referenced the factors driving RPA adoption in organizations. The results are presented in Table I.

RPA is presented as a solution to automate commercial and operational processes, carried out manually, which involve extensive labor and the risk of human error, aiming to increase the productivity of organizations, reduce costs, create value, increase customer satisfaction and improve the competitiveness of the organization.

The results obtained provided information about the determinants that lead organizations to adopt RPA. The construct presented in Table I (construct and its components) on adoption determinants resulted from the literature review and were mostly validated in the interviews. Some of the drivers for adoption are the improvements expected in terms of quality and efficiency of processes, the possibility of interaction with other systems and the capacity to allocate workforce at any time, the expected reduction of routine work which is supposed to increase the quality of work and employee motivation.

	Components	Evidence from interviews (n. ° of respondents)
Adoption determinants	Adoption of RPA (low-code tool) to free up work from the IT department.	4
	RPA as a short-term tool, with a payback period of less than 6 months.	3
	Possibility of interaction with other systems/platforms already existing in the organization.	6
	Reduction of routine work in the organization.	7
	Flexibility in robot allocation (workforce).	5
	A robot works 24/7, 365 days a year.	6
	Increase in quality/efficiency (of processes).	7
	Improve process auditability.	3
	Boost employee motivation.	5

Table 1. Results of data analysis

4. Research Model and Hypotheses

The determinants of the adoption and use of RPA in the research model (Figure 2) derive from the TOE and DOI, previous research on RPA (Ivančić et al (2019), Syed et al (2020), Martínez-Rojas et al (2023), etc) as well as the exploratory study. The TOE allowed the identification of relevant categories, on the other hand, the DOI helped to identify the most relevant determinants related to technological and organizational factors. According to DOI theory, the contribution of an innovation is dependent on the level of use for conducting business activities (Zhu et al, 2006a).

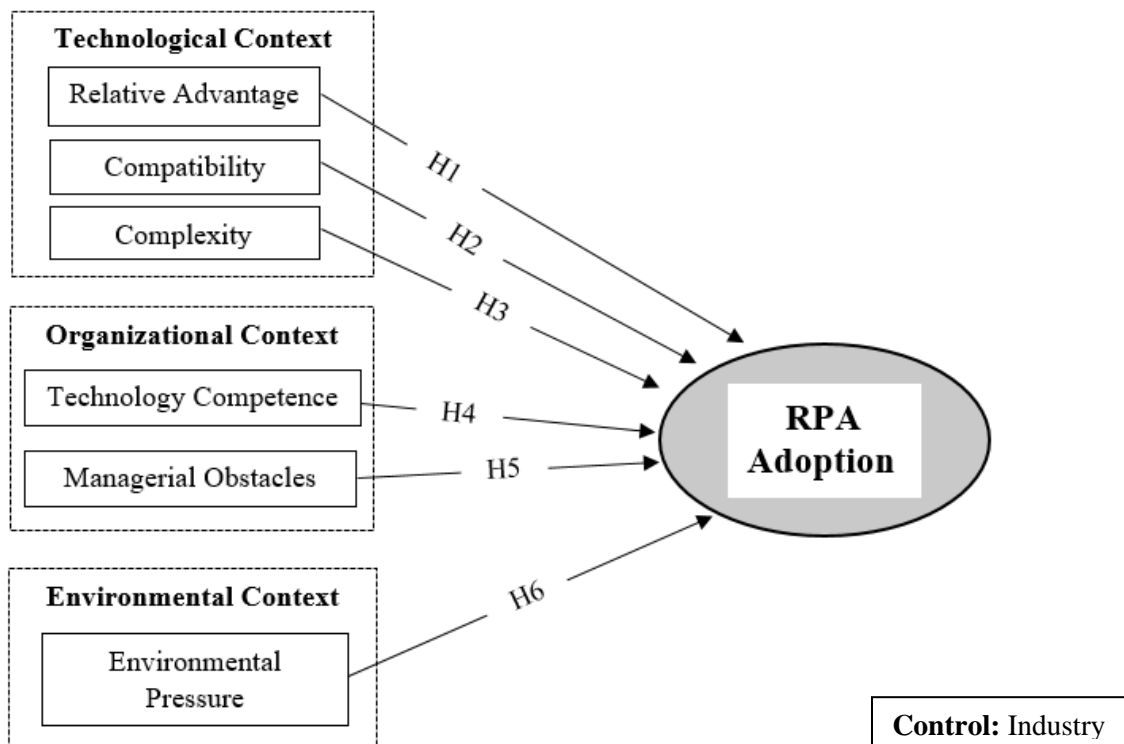


Figure 2: A research model for RPA Adoption

However, due to the specificity of each organization arising from the sector in which it operates and the resources it has, the control variable Industry was included in order to control possible variations. The control variable made it possible to divide organizations into two large sectors, namely, the production of goods and the provision of services.

Underlying the model proposed above, we consider the hypotheses below:

Hypotheses	References
H1: The relative advantage over competitors increases with the adoption/use of RPA.	Results from the Exploratory Study.
H2: Compatibility with other technologies increases the propensity to adopt/use RPA.	Adapted from Rawashdeh et al (2022) and results from the Exploratory Study.
H3: The low complexity of RPA increases the propensity to adopt/use RPA.	Results from the Exploratory Study.
H4: The organization's technological competence increases the propensity to adopt/use RPA.	Adapted from Soares-Aguiar & Palma-dos-Reis (2008) and Rawashdeh et al (2022).
H5: Management obstacles in an organizational context reduce the propensity for adopting/using RPA.	Adapted from Rawashdeh et al (2022).
H6: The environmental pressure that arises from the environmental context increases the propensity to adopt/use RPA.	Adapted from Soares-Aguiar & Palma-dos-Reis (2008).
H7: In services, there is a greater propensity for the adoption and use of RPA.	Sharma et al (2023).

Table 2. Hypotheses

5. Confirmatory Study

The Quantitative study tests the research model through a questionnaire-based research approach. The questionnaire structure was built on the theoretical concepts of Robotic Process Automation (RPA), the results of the exploratory study, and scales tested and published adapted to fit the RPA context. For the antecedents of RPA use, items from existing literature were adapted (see Appendix B). The nature of each construct (reflective or formative) must be taken into consideration (Petter et al., 2007). When measures are used to analyze an underlying latent variable, and it is the latent variable that causes the measures, these can be referred to as reflective indicators. When the indicators shape an underlying construct, they are causal or formative indicators (Petter et al., 2007). Based on the aforementioned definitions and the set of decision rules proposed by Jarvis et al. (2003), we classified the nature of each construct as presented in Appendix B. RPA Adoption was measured as an aggregation of two binary variables, the effective adoption of RPAs, and the intention to use RPAs in the near future. This way, we can combine the actual adoption with the high likelihood to adopt in the near future (Aguilar & Palma-dos-Reis (2008)).

Since the survey was conducted in Portuguese, we relied on the suggestions of Sekaran and Bougie (2003) to apply the "back-translate" technique to ensure correct translation into Portuguese. A pre-test was also conducted with two researchers for initial conceptual validation of the scales, and no changes were made at this stage. Subsequently, a pilot test was conducted with 30 senior executives from the Information Systems, Operations, and Marketing areas. Items that did not demonstrate reliability in the scales were then excluded.

We followed Henseler et al (2009) suggestions to assess the measurement model in terms of its internal consistency, convergent validity, and discriminant validity. According to Fornell-Larcker (1981), we eliminated three items with low outer loadings (less than 0,5), two from the latent variable Relative Advantage (RA1 e RA5) and one from the latent variable Environmental Pressure (EP5). Since these were for reflective constructs, there is no impact on the study results and the questionnaire maintained its conceptual integrity.

The items removed are marked as deleted in Table B1 (Appendix B).

5.1.1 Confirmatory Study Data Collection

The sample was drawn from the Informa D&B company database, which contained organizations (small, medium, and large) operating in Portugal with Information Systems directors. The questionnaire was sent to 2.158 organizations via email (to the Director/Head of Information Systems, Operations, and Marketing departments). Considering the organization as the unit of analysis, it is relevant to obtain responses from the heads of these areas to get the most relevant perspectives (Grover & Goslar, 1993). Data collection took place between January and October 2023. We received a total of 141 responses, corresponding to 123 organizations, with response rates of approximately 7%.

5.1.2 Confirmatory Study Data Analysis and Results

Smart PLS 2.0 evaluates the measurement and structural models using PLS (Partial Least Squares) as the technique to analyze the data since the model has both formative and reflective constructs, and is complex with some constructs presenting mixed scales (Sarstedt et al, 2019). Given the predictive nature of the research model, PLS is a suitable technique (Gefen et al, 2011).

5.1.2.1 Measurement model

This paper evaluates the measurement model with different analyses according to the nature of the construct (reflective or formative). Following the guidelines of Henseler et al. (2009) and Gefen et al. (2011), we evaluated the reflective measurement model through internal consistency, indicator reliability, convergent validity, and discriminant validity (Tables C1 and C2 of Appendix C). We assessed internal consistency using Cronbach's alpha and composite reliability.

All latent variables demonstrated good performance in terms of internal consistency with Cronbach's alphas ranging from 0.75 to 0.96 and composite reliabilities

between 0.75 and 0.96 (Table C1). Overall, the instrument exhibits good indicator reliability.

The convergent validity criterion states that the values of AVE (Average Variance Extracted) should be greater than 0.5. As seen in Table C1, all constructs exhibit AVE values above 0.5 (ranging from 0.57 to 0.96), indicating that the constructs represent a dimension and the same underlying construct. It also suggests that the latent variable can explain more than half of the variance of its indicators (Henseler et al., 2009). Discriminant validity was tested using two criteria: Fornell-Larcker (1981), which asserts that AVEs should be greater than the squared correlations, and each indicator should have a higher correlation with its designated latent variable than with any other latent variable. Additionally, cross-loadings analysis was performed. As observed in Tables C2 and C3 (Appendix C), both criteria are satisfied for all constructs and indicators, indicating that the instrument has good discriminant validity.

For the assessment of the formative measurement model, multicollinearity and the significance and sign of the weights were evaluated, as presented in Table C4 (Appendix C). Multicollinearity was assessed using the Variance Inflation Factor (VIF). In this case, the VIF values were similar for both indicators, slightly above 7. In the literature, there is no strict and universal limit for what is considered acceptable or unacceptable, but VIFs between 5 and 10 may indicate moderate multicollinearity. Regarding the significance and sign of the weights, one indicator “Technology Competence 1” (TC1) was found to be significant, while the other “Technology Competence 2” (TC2) was not. However, after analyzing the outer loadings and following Sarstedt et al. (2019), it was observed that both TC1 and TC2 had outer loadings above 0.5, and therefore, both were retained in the model.

5.1.2.2 Structural model

After assessing that the measurement model holds good psychometric properties, we assessed the structural model. The results, reported in Figure 4 and Table 2, show that, the R^2 , which expresses the proportion of variability in the dependent variable explained by the regression model, has a reasonable value (0.657).

The significance of paths was calculated by means of bootstrapping procedure generating 10000 random samples (as suggested by Henseler et al 2009 and Hair et al, 2011). The path coefficients provide information about the direct relationships between variables in the model. Compatibility showed the most relevant significant path coefficient, similar to Relative Advantage, which, despite lower values, showed signs of statistical significance. On the other hand, Complexity, Technology Competence, Managerial Obstacles, and Environmental Pressure presented non-significant path coefficients. Nevertheless, we consider that there is a moderate fit of the model.

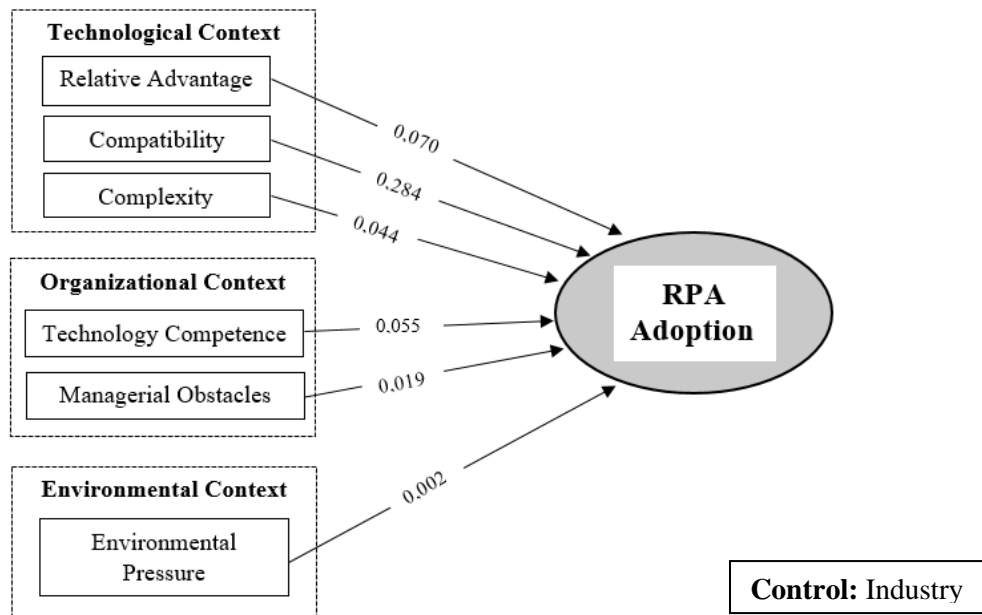


Figure 4. PLS results.

Dependent variable	Independent variable	Path coefficient (Pilot model)	R ² (Pilot test)	Path coefficient (Full model)	R ² (Full model)
RPA Adoption	Relative Advantage	0,122	0,608	0,070	0,657
	Compatibility	0,233		0,284*	
	Complexity	-0,036		0,044	
	Technology Competence	-0,032		0,055	
	Managerial Obstacles	0,055		0,019	
	Environmental Pressure	0,029		0,002	
	Control Variable	0,12		0,133	

Table 3. PLS results.

*Significant at $P < 0,05$

5.1.2.3 Control variable: industry

In a linear regression model, a control variable is an independent variable whose inclusion allows for controlling or adjusting the effects of other independent variables. Therefore, to obtain more reliable and generalizable results regarding the adoption and use of RPA, we chose to include the industry control variable. The questionnaire respondents' organizations were distributed into two major categories: the production of goods and the production of services.

The results show a positive coefficient (0,133) for the control variable (CV), suggesting that an increase in the control variable is associated with an increase in the dependent variable (RPA Adoption). In this specific case, dealing with a binary control variable (goods production = 0, services production = 1).

Given the information presented earlier, hypothesis 7 is confirmed. In other words, there is a greater propensity for the adoption and use of RPA in the service industry.

6. Discussion

Due to the existing gap in theoretical foundation regarding RPA from an organizational perspective, one of the research proposals was to explore the propensity for the adoption and use of RPA from an organizational point of view. The research is based on the combination of the TOE and DOI theories to explain the adoption and use of RPA.

The obtained results confirm that Compatibility is a significant antecedent of the adoption and use of RPA, and Relative Advantage, based on the results obtained in both the pilot test and the full model, also appears to be statistically significant. Both antecedents belong to the category of technological factors. Despite the fact that the remaining antecedents did not prove to be statistically significant in this study, the combined use of DOI and TOE as theoretical foundations for the model has proven to be useful, as these antecedents together explain a substantial variation in the adoption and use of RPA ($R^2 = 0.657$). In fact, a significant contribution of this research is the combination of DOI and TOE to explain the propensity for RPA adoption.

6.1 Technological, Organizational and Environmental contexts

In the Technological context, Compatibility emerges as the most influential factor affecting the adoption and use of RPA. The higher the degree of compatibility with existing technologies in the organization, the greater the inclination for the adoption and use of RPA. Relative Advantage, although showing lower significance in both the pilot test and the complete model, does exhibit signs of statistical significance in the model.

Low Complexity does not prove to be a significant antecedent of the propensity for the adoption and use of RPA in this study. However, organizations have resources to deal with complexity and align processes if they conclude that the innovation will bring sufficient advantages.

Based on the obtained results, it is suggested that there is a need to further evaluate the DOI theory in an organizational context, where some factors may be less relevant.

In the organizational context, the obtained results suggest that neither Technology Competence nor low Managerial Obstacles emerge as significant antecedents for the adoption, or lack of adoption, of RPA.

The TOE framework allows for the expansion of factors commonly used in traditional technology adoption models as it includes environmental factors. In this particular study, Environmental Pressure did not show as statistically significant.

In summary, the information gathered from the literature review on RPA and its features and potential contributions was largely confirmed by the exploratory study through the testimonies collected from experts. Regarding the confirmatory study, contrary to what was expected based on the theoretical framework used (DOI and TOE), only factors from the technological context, particularly Compatibility, showed signs of statistical significance. The fact that only the technological context impacts RPA adoption can be explained by its dependence on existing digital infrastructure, its ease of implementation, and the fact that the adoption decision is more related to operational efficiency rather than external pressures (environmental context) or structural changes within the company (organizational context).

7. Conclusions, contributions, limitations and further research

As the number of companies using RPA continues to grow worldwide, this can be an opportunity to change the business model and create new tools for business partners, customers, and employees. RPA technology can help organizations become more efficient and effective, improving their overall organizational performance. However, few studies have explored the adoption of RPA at the organizational level. To address this gap, this study tested a model for the adoption and use of RPA (Figure 2). Based on TOE, DOI, and existing literature on RPA, the model provides an integrated view of the propensity for adoption and use by organizations.

The results indicate that antecedents related to the technological context are relevant for enhancing the adoption and use of RPA. In this context, Compatibility stood out with greater statistical significance, suggesting that the fact that RPA is compatible with existing information infrastructure, applications, and systems, as well as established procedures, fosters the adoption and use of RPA. Relative Advantage, although with more moderate significance, suggests that when organizations are confronted with the possibilities (relative advantage) of RPA, such as increased sales, cost reduction, or decreased paper-based work, the propensity for the adoption and use of the technology increases.

Thus, it partially confirms what Tornatzky and Klein (1982) stated, that is, the most significant and relevant characteristics are the relative advantage, compatibility, and complexity. Regarding the remaining antecedents, in this study, we cannot evaluate their influence on the propensity for adoption and use since they were not statistically significant.

7.1 Contributions

The results of the present study provide theoretical and practical contributions. For researchers, it offers a validated model of the propensity for the adoption and use of RPA, identifying significant antecedents such as compatibility or relative advantage. Thus, the research confirms the utility of the TOE and DOI frameworks for organizational-level studies. The combination of these frameworks can be valuable for other researchers intending to analyze the use of other technologies within organizations.

Future research may consider extending studies beyond the assessment of adoption and usage to explore the impact it has on value creation and company performance.

For researchers, this article serves as an example of conducting research with a mixed methods approach, considering the combination of a qualitative study based on interviews with experts and a quantitative study that collected data through questionnaires. The integration of approaches provides a more comprehensive and reliable development of theoretical knowledge.

For professionals in the field, the article highlights the importance of various impacts that RPA can have on company performance, including sales levels, cost reduction, reduction of routine work, among others.

7.2 Limitations

There are limitations in this research that should be highlighted. The impact measures are subjective as they rely on executives' perception of the impact of RPA on their organization.

The reflective measurement model raises some issues regarding negative and insignificant weights. While this does not pose a threat to the structural model, it complicates the interpretation of the meaning of weights for these reflective variables.

Additionally, the study collected data from organizations in only one country and no demographic questions were asked to characterize the questionnaire respondents.

7.3 Further Research

The research highlights several avenues for future studies. Initially, the antecedents of RPA use were chosen based on the DOI and TOE theories, with only the most significant antecedents from previous research selected for parsimony. However, it is possible that other antecedents of RPA use may be relevant. Therefore, future research should explore additional potential antecedents based on the theories used (DOI and TOE) or other frameworks.

The impact of RPA use by industry type can also be studied to analyze different usage patterns within each industry. In a multi-level approach, considering the perspective of both employees and organizations would allow for a combination of their viewpoints on the implications of RPA use at both levels of analysis.

Lastly, it may be interesting to investigate the effect of organizational culture on the adoption and use of RPA. Using the questionnaire from this study in countries with different perspectives on automation technologies could provide relevant insights into the influence of culture and the automation environment on the adoption and use of RPA.

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Appendix A

Study 1 Details

Study 1 involved a series of interviews with RPA implementers or experts.

Respondent Demographics

Demography		Academic Education		Professional Profile
Gender	Age	Scientific Area	Degree	
Male	32	Electrical and Computer Engineering	Master	Manager
Male	55	Management	PhD	Teacher
Male	25	Data Science and Advanced Analytics	Master	Intelligence Technical Specialist
Male	45	Biotechnology	Graduation	Head of Transformation & Processes - B2C, Retail & Corporate Services
			MBA	
Male	41	Information Systems Information Systems for Enterprises	Graduation	Business Transformation Leader
			Post-Graduation	Professor & Executive Program Director
Male	40	Science (MSc), Economics, Financial and Monetary	Master	Head Of Digitalization and Transformation
Male	37	Economy	Master	Automation Center Leader

High-level protocol questions (further probing was done when appropriate)

1. What is RPA?
2. What is the company's purpose with regard to RPA?
3. When did the company adopt RPA?
4. Why has RPA started to appear now, or why is RPA used when in practice what it does is a connection between systems, repetitive tasks? Shouldn't it be a development in the software itself?
5. Are there proper tasks to be automated?
6. What are the main features of RPA?
7. What are the success factors to consider when adopting RPA?
8. Is there a specific type of company that uses RPA?
9. When adopting the RPA, did the company achieve the objectives that supported the decision to adopt?
10. What are the main advantages/ disadvantages?
11. What were the impacts felt in the adoption of the RPA?
12. Did the RPA bring beneficial changes to the organization's dynamics?
13. What was the motivation for investing in RPA?
14. When they moved towards the RPA, had they already decided in which areas they would implement it?
15. Given the project's success, will the idea be to expand the scope of the RPA to other sectors?
16. What are the impacts felt on sales/marketing (downstream dimension)?
17. What are the impacts felt on internal operations?
18. What are the impacts felt on purchases/procurement (upstream dimension)?

Additional questions pertaining to demographics and characteristics of firms are not included.

Appendix B

Measurement Items

Table B1: Operationalization of constructs

Construct	Indicator code	Indicators	Scale	Source
Relative Advantage/R		Please rate the degree to which you agree with the following statements (from 1 totally disagree to 5 totally agree):	(1~5)	
	RA1*	My company expects RPA to help increase sales.		Adapted from Zhu et al (2006a), Wang et al (2010) and Picoto et al (2014)
	RA2	My company expects RPA to help reduce costs.		
	RA3	My company expects RPA to reduce paperwork.		
	RA4	My company expects RPA to help quick data capture and analysis.		
	RA5*	Does the adoption of RPA affect the value of the brand?		
	H	The relative advantage over competitors increases with the adoption/use of RPA.		Results from the Exploratory Study.
Compatibility/R		Please rate the degree to which you agree with the following statements (from 1 totally disagree to 5 totally agree):	(1~5)	
	CT1	Using RPA is compatible with your organization corporate culture.		Adapted from Zhu et al (2006a), Wang et al (2010) and Picoto et al (2014)
	CT2	RPA is compatible with existing information infrastructure.		
	CT3	RPA is compatible with existing applications.		
	CT4	RPA is compatible with existing procedures.		
	CT5	RPA is compatible with the users' experience with similar systems.		
	H	Compatibility with other technologies increases the propensity to adopt/use RPA.		Adapted from Rawashdeh et al (2022)
Complexity/R		Please rate the degree to which you agree with the following statements (from 1 totally disagree to 5 totally agree):	(1~5)	
	CX1	My company believes that RPA is complex to use.		Adapted from Grover (1993) and Picoto et al (2014)
	CX2	My company believes that RPA development is a complex process.		

	H	The low complexity of RPA increases the propensity to adopt/use RPA.		Results from the Exploratory Study.
Technology Competence/F		Please rate the level of the following statements (from 1 very low to 5 very high):	(1~5)	
	TC1	Experience of the firm in supporting RPA software.		Adapted from Kuan & Chau (2001)
	TC2	Expertise of the firm in supporting RPA software.		
	TC3	Approximately how many IT professionals are work in or for your organization?	#	Adapted from Zhu & Kraemer (2005) and Picoto et al (2014)
	H	The organization's technological competence increases the propensity to adopt/use RPA.		Adapted from Soares-Aguiar & Palma-dos-Reis (2008) and Rawashdeh et al (2022)
Managerial Obstacles/R		Please rate how significant the following obstacles are to your organization's ability to conduct RPA (from 1 totally irrelevant to 5 totally relevant):	(1~5)	
	MO1	Integrating the RPA into your overall strategy and business process.		Adapted from Zhu et al (2006b), Pan & Jang (2008) and Picoto et al (2014)
	MO2	Lacking staff with RPA expertise.		
	MO3	Insufficient top-management support.		
	MO4	The RPA'S operating platform or interface feels unfriendly.		
	H	Management obstacles in an organizational context reduce the propensity for adopting/using RPA.		Adapted from Rawashdeh et al (2022)
Environmental Pressure/ R		Please indicate (from 1 totally disagree to 5 totally agree):	(1~5)	
	EP1	My company experienced competitive pressure to implement RPA.		Adapted from Zhu et al (2006b), Wang et al (2010) and Picoto et al (2014)
	EP2	ICT strongly influences the competition in your industry.		
	EP3	Customers demand it.		Adapted from Hsu et al (2006) and Picoto et al (2014)
	EP4	To improve coordination between suppliers and customers.		
	EP5*	Suppliers require it.		

	H	The environmental pressure that arises from the environmental context increases the propensity to adopt/use RPA.		Adapted from Soares-Aguiar & Palma-dos-Reis (2008)
Control Variable (Industry)/R	CV			
	H	In services, there is a greater propensity for the adoption and use of RPA.		Sharma et al (2023)

* are the items marked for deletion (in the pilot test, the outer loading values were below 0.5).

Constructs modeled as reflective are marked with (R) and constructs modeled as formative are marked with (F).

Appendix C

In this appendix, we report the results for the reflective and the formative measurement models in Tables C1-C4.

Table C1: Reflective constructs reliability criteria, loadings and t-statistics

Reflective multi-items (Cronbach's alpha/ Composite reliability/ AVE)	Construct composite	Indicator Code	Mean	SD	Outer Loadings	Conv. Validity (t-stat)
RA	Relative Advantage (0,90/0,96/0,83)	RA1				
		RA2	0,487	0,070	0,919	6,758
		RA3	0,296	0,041	0,886	7,359
		RA4	0,317	0,034	0,923	9,342
		RA5				
CT	Compatibility (0,95/0,95/0,82)	CT1	0,207	0,013	0,889	16,087
		CT2	0,247	0,016	0,922	15,649
		CT3	0,237	0,013	0,946	18,497
		CT4	0,233	0,014	0,921	16,261
		CT5	0,177	0,017	0,854	10,335
CX	Complexity (0,79/0,91/0,82)	CX1	0,667	0,262	0,948	2,567
		CX2	0,383	0,302	0,861	1,395
MO	Managerial Obstacles (0,85/0,89/0,68)	MO1	0,324	0,313	0,834	1,166
		MO2	0,206	0,280	0,768	0,801
		MO3	0,339	0,271	0,897	1,426
		MO4	0,212	0,280	0,788	0,800
EP		EP1	0,297	0,135	0,708	2,226

	Environmental Pressure (0,76/0,75/0,58)	EP2	0,435	0,174	0,68	2,408
		EP3	0,252	0,118	0,855	2,331
		EP4	0,324	0,108	0,785	3,143
		EP5				

Table C2: AVE and latent variables correlations

	Compatibility	Complexity	Environmental Pressure	Managerial Obstacles	Relative Advantage
Compatibility	0,907				
Complexity	-0,404	0,905			
Environmental Pressure	0,421	-0,067	0,76		
Managerial Obstacles	0,161	0,102	0,203	0,824	
Relative Advantage	0,739	-0,236	0,372	0,199	0,909

Note: The diagonal are the values of AVE squared root and the off-diagonal represents the correlations.

Table C3: Cross loadings

	Compatibility	Complexity	Environmental Pressure	Managerial Obstacles	Relative Advantage	Technology Competence
CT1	0,889	-0,351	0,34	0,091	0,68	0,685
CT2	0,922	-0,456	0,357	0,16	0,697	0,674
CT3	0,946	-0,394	0,409	0,189	0,699	0,727
CT4	0,921	-0,283	0,396	0,13	0,652	0,68
CT5	0,854	-0,339	0,414	0,161	0,621	0,764
CX1	-0,423	0,948	-0,064	0,133	-0,309	-0,436
CX2	-0,283	0,861	-0,057	0,029	-0,066	-0,341
EP1	0,362	0,04	0,708	0,185	0,32	0,348
EP2	0,289	-0,047	0,68	0,216	0,181	0,305
EP3	0,283	-0,054	0,855	0,087	0,245	0,43
EP4	0,332	-0,131	0,785	0,096	0,388	0,454
MO1	0,18	-0,051	0,112	0,834	0,233	0,177
MO2	-0,006	0,219	0,168	0,768	0,091	0,02
MO3	0,167	0,039	0,17	0,897	0,144	0,111
MO4	0,143	0,25	0,261	0,788	0,169	0,148
RA2	0,78	-0,319	0,374	0,208	0,919	0,584
RA3	0,562	-0,061	0,346	0,145	0,886	0,373
RA4	0,618	-0,204	0,279	0,176	0,923	0,443
TC1	0,755	-0,412	0,5	0,162	0,506	0,983
TC2	0,762	-0,447	0,492	0,122	0,54	0,981

Note: Bold numbers indicate item loadings on the assigned constructs.

Table C4: Formative measurement model evaluation criteria

Formative construct		Indicator Code	Mean	SD	VIF	Outer Weights (Outer Loadings)	<i>t</i> Value	<i>p</i> Value	95% Confidence Interval
TC	Technology Competence	TC1	0,719	0,348	7,211	0,771 (0,996)	2,218	0,027*	[-0,05;1,305]
		TC2	0,286	0,355	7,211	0,243 (0,958)	0,683	0,495	[-0,342;1,047]

***Note:** Significance level 0,05

Chapter III

An organizational perspective on RPA's impact on firm performance

Abstract

Several automation techniques have been developed in the last decade with the purpose of reducing costs, improving customer satisfaction, and reducing errors. RPA is a technology that aims to create software robots (bots) that mimic human behavior. It is a system focused on automating business processes that provides users with tools to develop bots that mimic their interactions with applications and enable communication with other digital systems.

The aim of the study is to analyze from an organizational perspective the impact of RPA on firm performance. As a basis for the conceptual model of this research, the Resource-Based Theory (RBT) was used to evaluate the impact of the adoption and use of RPA on firm performance.

This research utilizes mixed methods. Initially, interviews were conducted to complement the information gathered from the literature in order to develop a model for assessing the propensity to adopt and use RPA. Subsequently, data from surveys collected from 123 organizations were used to test the proposed model.

The results indicate that the adoption and use of RPA enable a reduction in errors and achieve improvements in organizational efficiency, impacting process optimization, as well as reducing routine work and thus increasing employee motivation. Regarding the impact on firm performance, RPA proved to be significant at the level of Marketing and Sales and Internal Operations. The implications of these findings are discussed from both practical and research perspectives.

Keywords: RPA; RBT; Firm Performance.

1. Introduction

The digitization of procurement and supply chain⁵ management has accommodated the most significant investments by organizations, which are forced to adapt to a constantly changing reality and face increased competitiveness and price constraints (Khan et al., 2022).

Robotic Process Automation (RPA) focuses on automating routine, repetitive, and rule-based tasks to streamline supply chain processes (Ivančić et al., 2019). According to Lacity and Willcocks (2016), RPA means tasks previously performed by human workers are now carried out by robots (bots). It is, according to Hallikainen et al., 2018, the digital automation of tasks performed in information systems, such as clicking, cutting and pasting, sending emails, filling out forms, data searching, among others.

In this context, given its potential, RPA has been gaining prominence (Hofmann et al., 2020) and is at the forefront of technologies generating high expectations (Gartner, 2021). There is a growing trend towards the adoption of RPA in various sectors and business processes as organizations seek supply chain management capabilities that reduce complexity and enable the achievement of value creation, customer satisfaction, competitive advantage, performance improvement, and a favorable return on investments, aligning with strategic, financial, and operational goals (E-Fatima et al., 2022).

The need for process standardization is a challenge imposed on organizations in RPA implementation, especially when dealing with complex processes (Khan et al., 2022). Thus, according to Nagtegaal (2021), guidelines for introducing RPA should include considerations based on a well-founded analysis of areas susceptible to automation, with many repetitive tasks in sourcing, operations, and logistics that can be automated by RPA in supply chains.

RPA is often the initial step in the digital transformation of an organization and can be used to overhaul an entire process (end-to-end) or solely implemented at a problematic point in the process (bottleneck). However, before automating a process, organizations must ensure that it functions well and that automating one aspect of the process may affect its overall performance (E-Fatima et al., 2022).

⁵ Supply Chain" is a widely used term in the business world and is described, according to Min et al. (2019), as a network of goods and services in response to supply and demand dynamics.

Tasks performed by RPA are typically structured, direct, recurring, rule-based, with standardized data, and do not involve human judgment (Aguirre & Rodriguez, 2017). The implementation of RPA in supply chains results in significant cost reductions in terms of full-time equivalents (FTE) and productivity benefits since its continuous availability (24/7) reduces the production cycle and improves operational efficiency (Hofmann et al., 2020). This translates into more effective materials management, better operational control, and active coordination among internal activities (Chiadamrong & Sophonsaritsook, 2015).

Although RPA implementation does not require extensive coding skills and may be beyond the scope of the IT team, they, along with a consulting team, should be included in the project to ensure that existing systems are interoperable and all capabilities can be efficiently explored (Khan et al., 2022). Nevertheless, it is expected that by 2024, nearly half of all organizations that have adopted RPA will have non-IT users due to their familiarity with business processes (Kokina & Blanchette, 2019).

RPA has brought significant changes to the job market, replacing human labor with software bots to perform repetitive and tedious tasks (Kosonen & Lappi, 2020). Tasks, not jobs, are automated, allowing people to be allocated to higher-value actions that require more qualifications, management skills, decision-making, brainstorming activities, and thus, leaving the execution of valueless tasks in various sectors (Flechsigt et al., 2022).

According to the results obtained in conducted studies, RPA is capable of processing data 7 times faster compared to the methodology used previously for the same task, without making errors (Sandy et al., 2022). By automating repetitive and time-consuming processes, such as data entry into a system, RPA can fine-tune supply chain management, transportation, and logistics, resulting in improved processes, enhanced productivity, competitiveness, and flexibility, as well as a significant reduction in costs and time savings (Viale & Zouari, 2020). Regarding the supply chain, RPA can serve another purpose beyond automation; it can be useful in collecting and organizing data for future predictions, process optimization, and decision-making support (Khan et al., 2022).

Previous studies have lacked knowledge regarding the impact of RPA on performance from an organizational perspective, leaving a research gap. This research addresses the literature on RPA and its value, considering RPA from an organizational perspective to identify the factors determining its impact on performance. The results

obtained will serve as a basis for supporting managers' decision-making regarding initiatives in this area.

This study aims to answer the following research question: Which RPA features create value and ultimately impact organizations' overall performance?

The paper is organized as follows: Section II presents the literature review for RPA concepts and Resource-Based Theory (RBT); Section III explains the research methodology and qualitative data analysis; Section IV presents the conceptual model and hypotheses; Section V explains the confirmatory study methodology; Section VI provides the analysis of the collected data and results, and finally, Section VII presents the conclusions, limitations, and suggestions for further research.

2. Literature Review

This section is divided into three subsections. The first one describes the characteristics of RPA, the second subsection discusses the value of RPA and its potential contributions for organizations, and, finally, the third subsection explores the Resource-Based Theory and how we connect it with the value of RPA.

2.1 RPA

Task automation is generally considered economical as robotics increases production and enhances quality control (Purnell & Further, 2021). According to Gartner (2021), RPA is a productivity enabler that automatically performs human-computer interaction tasks through one or more scripts (bots). The bots are used to automate business operations (a single or a set of ordered tasks) previously performed by people, providing organizations with a virtual workforce that is fast, reliable, cost-effective, available 24 hours a day for various processes and can be initiated or terminated at any time (Khan et al, 2022).

Technological advancements like RPA have led to significant improvements and developments (Annosi et al, 2021). Due to its flexibility, previous studies conclude that RPA shows potential in various industries (Osman, 2019).

According to Ribeiro et al (2021), RPA is a technique or tool to perform administrative or scientific tasks to benefit organizational processes. Plattfaut et al (2022) states that RPA can be described as a non-invasive automation method that does not require major changes to existing business systems. According to Wewerka & Reichert (2021), RPA is a tool to improve supply chain processes and reduce the financial burdens of organizations, that is, it is used to increase process efficiency and reduce business process costs by automating tedious and routine tasks (Sullivan & Simpson, 2021).

Currently, there is the possibility of combining this technology with other digital tools such as IoT, Chatbots, among others, to reinterpret processes and address inefficiencies or other business challenges (Flechsig et al, 2022) and to enable making more complex decisions (Sandy et al, 2022).

Intelligent RPA (iRPA) involves using RPA with Artificial Intelligence and Machine Learning technologies. This combination can be developed to automate tasks

between platforms (ERP system), transfer relevant information between platforms and systems, or estimate and help organizations in preparing for demand peaks. Two types of bots can be distinguished in iRPA: assisted bots are used for business processes that involve partially automated tasks, meaning user interaction is required to complete the tasks, while autonomous bots are used to automate large sets of tasks that do not require human interaction (Stoykova et al., 2022).

Although RPA adoption is generally considered beneficial, some aspects need to be taken into consideration, including its scope, impact on the organization, and defined objectives (Sandy et al, 2022). RPA promotes task execution agility, but, on the other hand, it can pose challenges regarding governance structure (Hofmann et al., 2020). The implementation of RPA thus implies the development of organizational learning paradigms, for example, in digital leadership (Johansson et al, 2022). Generally, companies use their centers of excellence as the governing body, which, in turn, assumes responsibility for monitoring and evaluating the automation initiative (Sandy et al, 2022).

2.2 RPA Value

The contribution of IT to organizational performance has been widely studied in works such as Mukhopadhyay et al (1995), Brynjolfsson & Hitt (1996), Melville et al (2004), or Wu et al (2015). The use of IT in the organization's value chain activities increases the potential for value creation according to Tallon et al (2000), Aboiron and Aboiron (2022) or Zelenkov (2022). A key factor in achieving business value from IT is its relationship to process innovations (Davenport, 1993). These innovations can be perceived as the mechanism to align the IT resources with the organization's business strategy (Hammer & Champy, 2009).

The introduction of automation in business processes results in improved operational efficiency, significant cost reductions, greater speed, and consistency in the execution of repetitive tasks (Bavaresco et al, 2023). RPA allows people to focus on meaningful tasks instead of repetitive and valueless ones, such as identifying and extracting data, transferring data between platforms and users, creating logs of operations performed in a particular process or predefined workflow, creating business documents, among others (Stoykova et al, 2022).

According to Flechsig et al (2022), tools like RPA are generally associated with numerous advantages such as promoting the agility and productivity of organizations, as well as ways to minimize some of their constraints, including report automation, fleet management, improvement in decision-making, and enhancement of inventory management, billing, and procurement accuracy. The use of RPA has various impacts on the supply chain, including the reduction of manual and administrative work, reduction of human errors and duplication, cost reduction in operations, flexible integration with chain systems and tools, and the definition of new goals (Farinha et al, 2023).

Supply chain operations include reception operations, development, and customer relationship maintenance. Thus, even though this technology can be seen as a substitute for some professions, human participation is necessary (Khan et al, 2022). RPA should be considered as an integral part of the organization's long-term business and automation strategy.

According to Mărușter & Van Beest (2009), RPA is seen as a mean to achieve a high return on investment (ROI) quickly. Therefore, due to the expected results, organizations are likely to invest more in this type of technology (Ansari et al, 2019).

2.3 Resource-Based Theory (RBT)

Since its inception to the present day, the RBT has continually been recognized as one of the most prominent and powerful theories in understanding organizations (Barney et al, 2011). Its objective is to explain an organization's internal resources that confer competitive advantage (Kraaijenbrink et al, 2010). It is based on two main assumptions about organizational resources to understand how some organizations achieve better performance than others (Zhang & Yuan, 2023). First, organizations operating in the same sector may possess a diverse mix of resources, meaning heterogeneity (Forcadell et al, 2018). Second, these unique resources are difficult to trade between organizations, meaning they are practically immovable (Barney & Hesterly, 2010). Resources include all assets, capabilities, organizational attributes, knowledge, among others (Barney, 1991).

Based on the two aforementioned assumptions, the logic of RBT encompasses the VRIO framework, which clearly points out that organizational performance depends on

the extent to which the organization can possess resources that are simultaneously valuable (V), rare (R), inimitable and non-substitutable (I), and properly organized (O) (Brink, 2019). By controlling and applying these resources, the organization can conceive and implement strategies that improve efficiency and effectiveness, contribute to enhancing new value propositions and strategic patterns, and consequently enable the attainment of sustainable competitive advantage (Herhausen et al, 2021).

Despite its origin being associated with strategic management, RBT has been used in various themes, including Information Systems (Wade & Hulland, 2004; Gupta et al (2018); Osakwe et al, 2022). According to RBT, technology is also considered a strategic resource that can influence organizational performance. Consequently, organizations that adopt RPA more prominently in their value chain activities can create superior value from its use (Oh & Pinsonneault, 2007).

We grounded RBT to assert that there is a connection between the RPA use and value creation. Thus, the deeper and broader the use of RPA, the higher the probability that the organization creates IT resources that, according to RBT, will be valuable, rare, and difficult to copy and replace. Based on this assumption, we claim a theoretical link between the RPA use and value creation. Greater depth and breadth of RPA usage increase its impact on (i) Procurement, (ii) Internal Operations, and (iii) Marketing and Sales.

3. Research Methodology and Qualitative Data Analysis

This study applied a Mix Methods approach to add knowledge on the RPA impact on firm performance. A sequential research design (qualitative followed by quantitative) was adopted, following both Mingers (2001), according to whom a qualitative exploratory study enhances the performance of a subsequent confirmatory study and Venkatesh et al (2013, p. 21) that suggests that if the objective of a research inquiry is to identify and test theoretical constructs and mechanisms in a new context, a qualitative study followed by a quantitative study is appropriate. The combination of methods provides better opportunities to respond to the formulated hypotheses (Tashakkori and Teddlie, 2010).

Subsequently, based on the results of the exploratory study, a quantitative study develops and evaluates a set of hypotheses based on data collected from 141 organizations. Figure 1 presents the outline of the investigation with the various stages developed to achieve the objectives of the study.

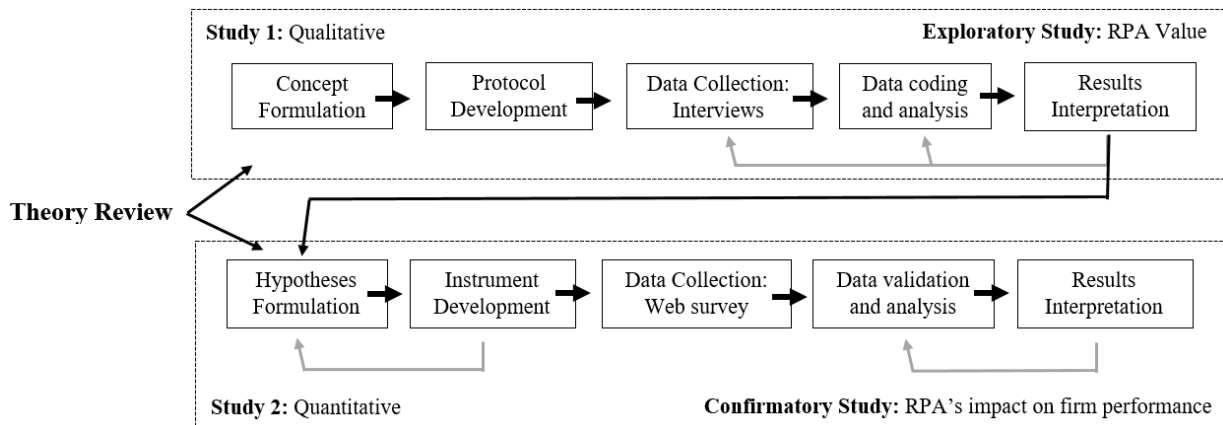


Figure 1: Research outline (Adapted from Picoto et al (2010))

3.1 Exploratory Study

Given the novelty of the concept and the absence of theoretical models aimed at the value of RPA, we conducted a study to validate the definition of RPA value and explore additional insights that could support future investigations. The empirical content was obtained from in-depth semi-structured interviews (Myers and Aviton, 2002), with key informants (Yin, 2003), and published articles (eg.: Melville et al (2004), Lacity et al (2016), Hallikainen et al (2018), Money & Mew (2022), etc).

The Qualitative Study aims to explore and validate the definition of the RPA value construct and its components, as well as to envision the potential of this technology. The sample of interviewees was selected based on a purposeful sampling strategy, that is, only people with RPA knowledge or experience were selected. The interviews with the experts aim to validate the composition of the construct by assessing the sub-constructs: the impact of RPA on the Downstream dimension corresponding to Marketing and Sales, the impact of RPA on the Internal dimension corresponding to Internal Operations, and the impact of RPA on the Upstream dimension corresponding to the Procurement. The diversity of sectors of operation of the individuals surveyed increases the generalizability of the results (Lyytinen and Rose, 2003).

In Portugal, most organizations have investments in information technologies, and it is expected that, in 2023, according to IDC, 45% of Portuguese companies will increase their investment in digital initiatives and sustainable technologies by 10% (Coimbra, 2023)⁶. The exploratory study selected 6 organizations from a diversity of sectors (energy sector, postal, banking, telecommunications) with significant use of RPA and interviewed one person familiar with RPA projects from each of these organizations. Additionally, an academic with RPA research was also interviewed. Appendix A presents the demographics of the respondents.

The number of interviews was determined by saturation, the standard approach for data collection in qualitative studies (Saunders, 2012). Saturation was achieved at the 6th interview, with a previously scheduled interview also being carried out, with a total of 7 interviews being carried out. The interviews were carried out in 2021, each of which was conducted in Portuguese and lasted for about 1 hour. The interviews were recorded and later transcribed. To clarify some reasonings in the transcription of the interviews, telephone conversations were carried out and emails were exchanged.

⁶ Coimbra, G. (2023, [data de publicação]). Investimento em tecnologia cresce 4,7% em 2023. 45% das empresas portuguesas admitem aumentar orçamentos acima de 10%. *TekSapo*. Consulted on February 22, 2023, at 6:33: <https://tek.sapo.pt/noticias/negocios/artigos/investimento-em-tecnologia-cresce-47-em-2023-45-das-empresas-portuguesas-admitem-aumentar-orcamentos-acima-de-10>

3.1.1 Exploratory Study Data Analysis and Results

The analysis of the interviews' responses was carried out by counting the number of times each interviewee referenced each of the impacts produced by the use of RPA in organizations. The results are presented in Table I.

	Components ^a	Evidence from interviews (n. ° of respondents)	References
Impact on Downstream dimensions	Increased customer satisfaction.	3	Beerbaum (2022); Hallikainen et al (2018) and Willcocks et al (2019).
	Increased convenience for customers.	4	
	Improved customer communication.	2	
	Best customer service.	4	
	Quality increase.	4	
Impact on Internal dimensions	Quick fix, short term, short payback.	5	Chugh et al (2022); Herm et al (2023); Huang & Vasarhelyi (2019); Johansson et al (2022); Rao & Pathak (2022); Sobczak (2021) and Wewerka & Reichert (2021).
	Bridging IT inability.	3	
	Ease of communication between systems/platforms.	3	
	Ease of implementation / configuration / use (intuitive).	4	
	Reduced time/speed/operational speed.	5	
	Cost reduction.	5	
	Error reduction.	6	
	Intellectual appreciation of employees.	7	
	Routine work reduction.	7	
	Changes in organizational culture.	3	
	Process safety.	1	
	Efficiency increase/Process optimization.	6	
	Increased productivity.	5	
	Organizational flexibility.	3	
	Operational elasticity.	4	
	Organization profit.	2	
Impact on Upstream dimensions	Outsourcing reduction.	2	Money & Mew (2022) and Syed et al (2020).
	Reduction of external dependence (consultants).	2	
	Auditability.	1	

Table 1. RPA Impact dimensions and their components

b. These components were identified based on the IT business value, RPA value and RPA researches.

The results obtained provided information about the RPA as a value creation factor for organizations. The constructs presented in Table I, namely the Impact on Downstream dimensions, Impact on internal dimensions, and Impact on upstream dimensions, along with their components, resulted from the literature review and were mostly validated during the interviews. The most commonly reported impacts of RPA adoption are the improvements reported in terms of customer services through improved communication, greater customer satisfaction and greater convenience. The reduction of errors and costs and the reduction of routine work which in turn increases the quality of work and employee motivation.

4. Confirmatory Research Model and Hypotheses

The determinants of RPA value in the research model are derived from the RBT as well as from previous research on RPA (Van der Aalst et al (2018), Hofmann et al (2020), Syed et al (2020), etc.). From RBT, we assert that there is a connection between the use and value of RPA. Thus, the deeper and broader the use of RPA, the higher the probability that the organization creates IT capabilities that, according to RBT, are difficult for competitors to imitate, create value, and provide sustainable advantage over time. In this line of reasoning, we argue that there is a theoretical link between the use and value of RPA.

Therefore, greater depth and breadth of RPA usage increase the impact on the three major groups of value chain activities: (i) Procurement, (ii) Internal Operations, and (iii) Marketing and Sales. Since the primary goal of organizations in using RPA is performance improvement (Lacity & Willcocks (2018); Geyer-Klingeberg et al (2018)), we consider organizational performance as the endogenous variable. Figure 2 presents the research model for analyzing the impact of RPA on organizational performance.

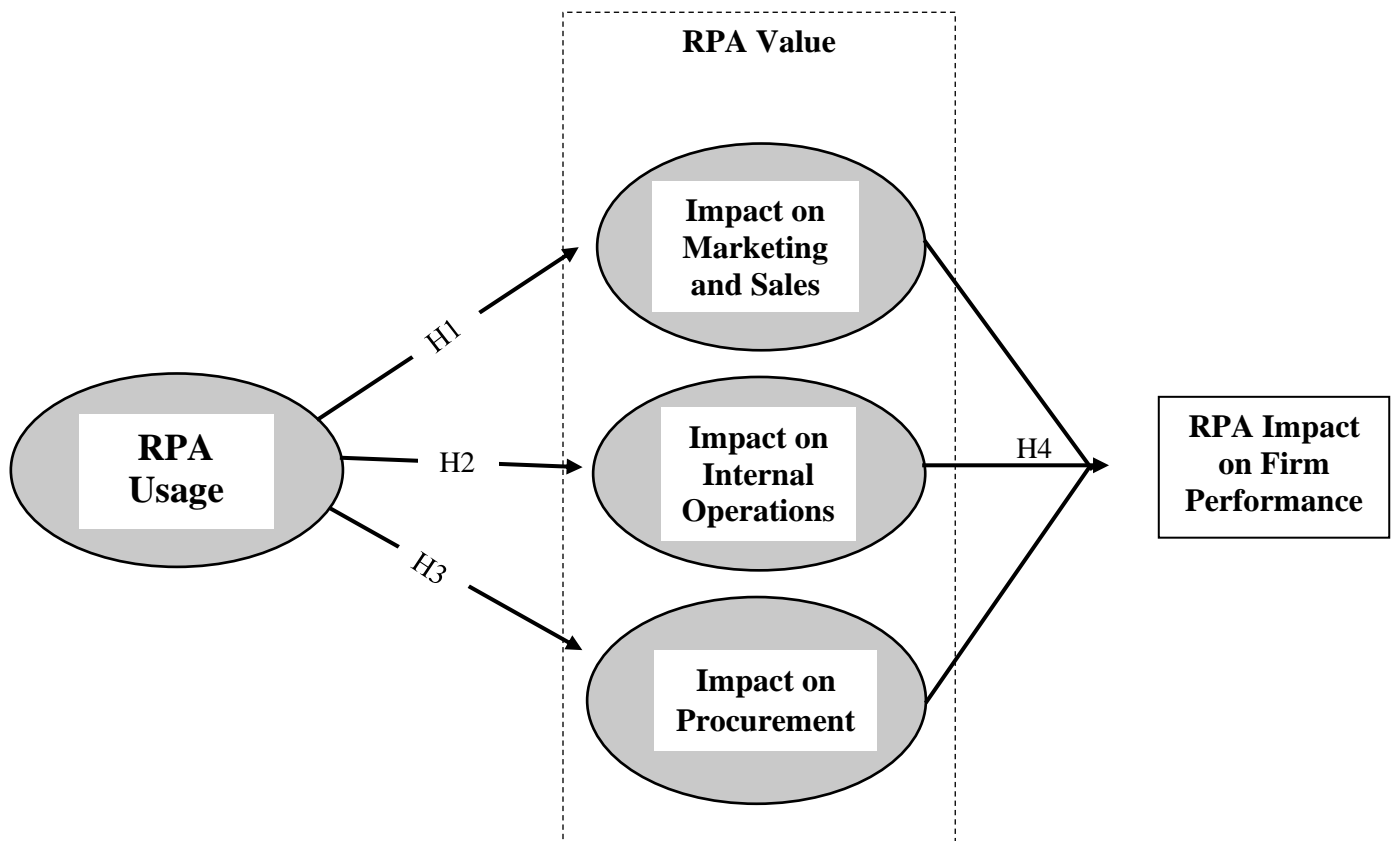


Figure 2: The research model for RPA's impact on firm performance

The use of RPA in the Marketing and Sales area can significantly improve efficiency in repetitive and high-volume data tasks, such as order processing and customer service personalization. By reducing time to market, enhancing the customer experience, and optimizing human resource allocation, organizational performance will be positively impacted.

RBT emphasizes that efficient internal processes drive sustainable value creation. The use of RPA in internal operations can optimize administrative workflows, eliminating repetitive tasks and reducing human errors. By improving organizational efficiency and ensuring greater responsiveness to market demand, organizational performance will be positively impacted.

According to RBT, efficiency in supply chain management and procurement can represent a sustainable competitive advantage. The use of RPA in Procurement can automate processes such as supplier evaluation, order processing, compliance auditing, and contract monitoring, leading to greater accuracy, transparency, and reduced operational costs. By improving the company's ability to strategically manage resources,

RPA contributes to greater efficiency and competitive advantage, which, in turn, positively impacts organizational performance.

RBT states that competitive advantage translates into superior performance. The adoption of RPA across various organizational areas (Marketing and Sales, Internal Operations, and Procurement) can generate financial and operational gains, such as cost reduction, increased productivity, and improved quality. These benefits enable the company to become more agile and competitive, positively reflecting on its overall performance.

Based on the rationale above, the hypotheses presented in Table 2 were formulated.

Underlying the model proposed above, we consider the hypotheses below:

Hypotheses	References
H1: RPA usage has a positive influence on Marketing and Sales.	Adapted from Zhu & Kraemer (2005), Picoto et al (2014) and Rawashdeh et al (2022).
H2: RPA usage has a positive influence on Internal Operations.	Adapted from Zhu & Kraemer (2005), Picoto et al (2014) and Rawashdeh et al (2022).
H3: RPA usage has a positive influence on Procurement.	Adapted from Zhu & Kraemer (2005), Picoto et al (2014) and Rawashdeh et al (2022).
H4: RPA usage has a positive influence on Firm Performance.	Adapted from Gattiker & Goodhue (2005) and Rawashdeh et al (2022).

Table 2. Research Hypotheses

5. Confirmatory Study Methodology

The Quantitative study tests the research model through a questionnaire-based research approach. The questionnaire structure was built on the theoretical concepts of Robotic Process Automation (RPA), the results of the exploratory study, and scales tested and published adapted to fit the RPA context. For the impacts of RPA use, items from existing literature were adapted (see Appendix A).

The nature of each construct (reflective or formative) must be taken into account. According to Petter et al (2007), when measures are used to analyze an underlying latent variable, and the latent variable causes the measures, they can be called reflective indicators. When indicators determine an underlying construct, they are called causal or formative indicators. Thus, based on the definitions above and the guidelines provided by Diamantopoulos and Sigauw (2006), each of the latent variables of the construct was classified as presented in Appendix A.

Since the survey was conducted in Portuguese, we relied on the suggestions of Sekaran and Bougie (2003) to apply the "back-translate" technique to ensure the correct translation into Portuguese. A pre-test was also conducted with two researchers for initial conceptual validation of the scales, and no changes were made at this stage. Subsequently, a pilot test was conducted with 30 senior executives from the Information Systems, Operations, and Marketing areas. Items that did not demonstrate reliability in the scales were then excluded.

We follow Henseler et al (2009) suggestions to assess the measurement model in terms of its internal consistency, convergent validity, and discriminant validity.

5.1 Data collection

The sample was drawn from the Informa D&B company database, which contained organizations (small, medium, and large) operating in Portugal. The questionnaire was sent to 2158 organizations via email to the Director or the Responsible for the Information Systems, Operations, or Marketing departments. Considering the organization as the unit of analysis, it is relevant to have responses from the heads of these areas to obtain more accurate perspectives (Grover & Goslar, 1993). Data collection

took place between January and October 2023. We received a total of 141 responses, corresponding to 123 organizations, providing a response rate of approximately 7%.

5.2 Data analysis and results

Smart PLS 2.0 evaluates the measurement and structural models using PLS (Partial Least Squares) as the technique to analyze the data since the model has both formative and reflective constructs, and is complex with some constructs presenting mixed scales (Sarstedt et al, 2019). Given the predictive nature of the research model, PLS is a suitable technique (Gefen et al, 2011).

5.2.1 Measurement model

For the evaluation of the measurement model, the analysis was conducted according to the nature of the construct (reflective or formative). According to Fornell-Larcker (1981), we eliminate the items with low outer loadings (less than 0,5). So, we had to eliminate one item from the latent variable Impact on Marketing and Sales (Improved customer communication - MS3) and three items from the latent variable Impact on Internal Operations (Quick fix, short term, short payback - IO1, Ease of implementation / configuration / use (intuitive) - IO4 and Intellectual appreciation of employees - IO8). After this assessment, the scales are further refined. Those items are marked as deleted in Table A1 (Appendix A).

Following the guidelines of Henseler et al. (2009) and Gefen et al. (2011), the assessment of the reflective measurement model was performed through internal consistency, indicator reliability, convergent validity, and discriminant validity (Tables B1 and B2 of Appendix B). Internal consistency was evaluated using Cronbach's alpha and composite reliability (both above 0,8). The reflective variable Firm Performance shows good performance in terms of internal consistency with a Cronbach's alpha of 0.91 and composite reliability of 0.91 (Table B1). Overall, the instrument demonstrates good indicator reliability.

The criterion of convergent validity states that the AVE values should be greater than 0,5. As can be seen in Table B1, the construct has an AVE value above 0,5 (0,85),

indicating that the items (or indicators) that compose the construct have a significant amount of shared variance among them, and most of the variance of the items is explained by the latent variable they measure (Henseler et al., 2009). Discriminant validity was tested using two criteria: first Fornell-Larcker (1981), which states that the square root of the AVE of a construct (on the diagonal of the matrix) should be greater than the correlations of that construct with other constructs, and each indicator should have a higher correlation with the designated construct than with any other construct, and, secondly, the cross-loadings analysis, which refers to the weights or coefficients that arise when an item from a measurement model is correlated with more than one latent variable. As observed in Tables B2 and B3 (Appendix B), both criteria are met for all constructs and indicators, indicating that the instrument has good discriminant validity.

For the assessment of the formative measurement model, multicollinearity and the significance and sign of the weights were evaluated, as presented in Table B4 (Appendix B). Multicollinearity was assessed through the calculation of the Variance Inflation Factor (VIF). In the literature, there is no strict and universal threshold for what is considered acceptable or unacceptable; however, VIFs between 1 and 5 indicate that collinearity does not reach critical levels in any of the formative constructs (Akinwande et al., 2015). The VIF values obtained resulted from a prior conceptual validation and subsequent correlation analysis for items considered to capture the same domain. As a result of these analyses, the indicators with VIF values above 5 such as Quick fix, short term, short payback (MS1) and Best customer service (MS4) were removed from the latent variable Impact on Sales and Marketing, and Cost reduction (IO6), Process safety (IO11), Efficiency increase/process optimization (IO12), Increased productivity (IO13) and Organizational flexibility (IO14) were removed from the latent variable Impact on Internal Operations. The VIF values for the indicators remaining in the model ranged from 1,68 to 4,97.

Despite the removals listed previously, the meaning and theoretical validity of the formative constructs Impact on Marketing and Sales and Impact on Internal Operations were not compromised, as the results presented in table B4 (formative measurement model evaluation criteria).

Looking at the significance levels, we find that formative indicators Reduced time/speed/operational speed (IO5), Increased convenience for customers (MS2), Improved customer communication (MS5), RPA has seriously improved my

organization's overall business performance (FP2), From the perspective of my organization, the benefits of RPA outweigh the costs (FP3) and RPA has had a significant positive effect on my organization (FP4) are significant at a 1% level, while the remaining indicators are not. The results report from the SmartPLS software also provides their outer loadings, t-values, and p-values in the results table for the outer loadings. Using this information, we note that the lowest outer loading of non-significant indicators occurs for IO17 (0,151). We removed the indicator IO17 and since all the remaining indicators have outer loading values above 0,5 the indicators were kept in the model as recommended by Sarstedt et al. (2019).

5.3 Structural model

After confirming that the measurement model exhibits good psychometric properties, we proceeded to assess the structural model. The significance of paths was determined using a bootstrapping procedure that generated 10000 random samples (as recommended by Henseler et al., 2009, and Hair et al., 2011). Path coefficients provide information about the direct relationships between variables in the model. The results, depicted in Figure 3 and Table 2, indicate that except for the path Impact on Procurement to RPA Impact on Firm Performance and Impact on Internal Operations to RPA Impact on Firm Performance that does not reach statistical significance, all other paths that is, the path from RPA Usage to Impact on Marketing and Sales; the path RPA Usage to Impact on Internal Operations; the path RPA Usage to Impact on Procurement and the path Impact on Marketing and Sales to RPA Impact on Firm Performance exhibit significant path coefficients. The R^2 , which expresses the proportion of variability in the dependent variable explained by the regression model, shows a reasonable value (0,675), leading us to conclude that there is moderate model fit.

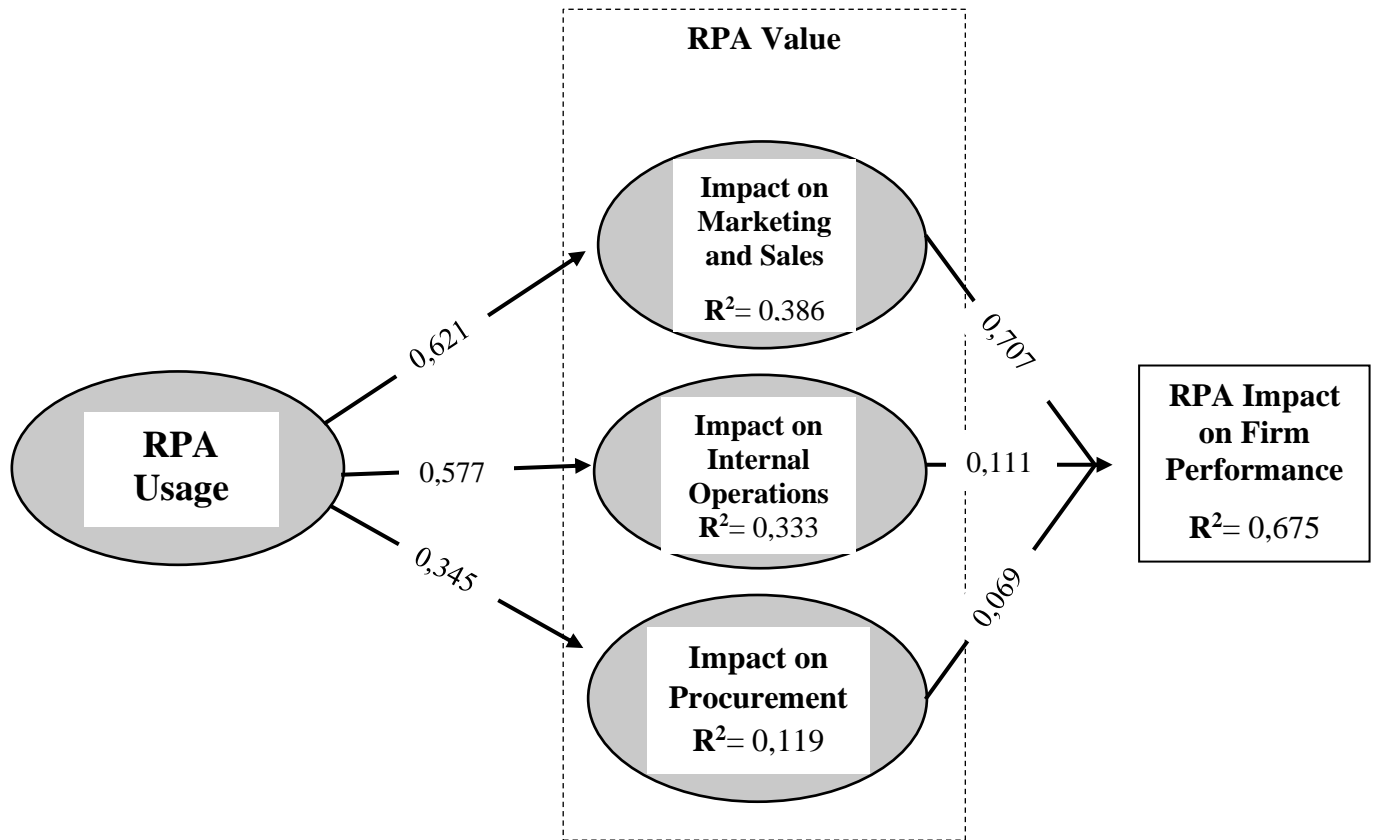


Figure 3. PLS results.

Dependent Variable	Independent Variable	Path coefficient (Pilot model)	R ² (Pilot test)	Path coefficient (Full model)	R ² (Full model)
Impact on Marketing and Sales	RPA Usage	0,509	0,687	0,621*	0,675
Impact on Internal Operations	RPA Usage	0,598		0,577*	
Impact on Procurement	RPA Usage	0,146		0,345*	
RPA Impact on Firm Performance	Impact on Marketing and Sales	0,838		0,707*	
	Impact on Internal Operations	-0,066		0,111	
	Impact on Procurement	0,100		0,069	

*Significant at $P < 0,01$

Table 2: PLS results

6. Data Analysis and Results

The hypothesized impact of RPA adoption and usage on Marketing and Sales (Downstream dimension), on internal Operations (Internal dimension) as well as on Procurement (Upstream dimension) is confirmed as positive and significant (see Table 2 and Figure 3). Consistent with the RBT, the results suggest that the extensive use of RPA is associated with enhanced performance in each of the value chain dimensions. However, even though RPA adoption and usage results in increased performance in all the three corporate dimensions, the contribution of RPA to global firm performance is confirmed only through the Marketing and Sales dimension, since the RPA driven improvements on Internal Operations and on Procurement were not able to reach statistical significance in what regards to their impact on firm performance. It is pertinent to highlight that both the preliminary evidence obtained through interviews with RPA experts (exploratory study) and the data obtained from the questionnaire suggest that RPA adoption and usage have a greater impact on the Downstream dimension and Internal dimension than on the Upstream dimension. Thus, empirical results suggest that when considering different automation projects, executives should prioritize those more focused on customers and employees as they are more likely to create value.

The model shows that the value of RPA explains a considerable amount of the variation in the impact of RPA on company performance ($R^2 = 0,675$). This finding confirms that RPA adoption and usage can indeed improve the overall performance of the organization.

As depicted in Figure 3, the path from Impact on Marketing and Sales to Firm Performance is significant and of high magnitude, unlike the path from Impact on Internal Operations to Firm Performance and the Impact on Procurement to Firm Performance, which were not found to be significant. We found positive but not significant betas, so we must recognize that the present research is inconclusive in what regards to these two relationships. This is partially aligned with our findings from the Exploratory study since it was in the downstream dimension, which corresponds to marketing and sales, and in the internal dimension, which corresponds to the internal operations, that the impacts produced by RPA in organizations were most frequently mentioned.

In summary, the information gathered from the literature review on RPA and RPA Value was largely confirmed by the exploratory study through the testimonies collected

from experts. Regarding the confirmatory study, the influence of RPA usage on the main dimensions of the value chain was also validated. However, contrary to what was expected based on the theoretical foundation (RBT), statistical significance was confirmed only in the Marketing and Sales dimension. Considering that the Marketing and Sales dimension involves a high volume of repetitive tasks (e.g., order processing, campaign automation), the use of RPA in these activities can enhance efficiency and time to market, directly impacting the organization's overall performance.

7. Conclusions, contributions, limitations and further research

The exploratory study suggested and the confirmatory study verified that RPA improves operational efficiency and employee productivity, adding value to supply chains and making them more efficient.

The analysis of the interviews provided some evidence of the impact of RPA as a reduction in human error, increased efficiency, process optimization, a reduction in work routines, and intellectual empowerment of employees have been observed. Furthermore, improvements have also been noted in quality, customer service, and supply chain processes.

The confirmatory study confirmed most of the exploratory study results. Grounded on the RBT this research analyses the connection between capabilities as antecedent variables and firm performance as the dependent variable (Zhang & Yuan, 2023). Building on this connection, in the specific case of RPA, its usage has a particularly relevant impact on Marketing and Sales, as well as Internal Operations and Procurement. The marketing and sales variable is the most relevant for Firm Performance improvement and ultimately contributing to overall organizational performance and competitiveness, highlighting the consistency between the exploratory and the confirmatory study.

7.1 Contributions

The present research provides both theoretical and practical contributions, as it adds value and scientific knowledge to the literature by focusing on the process of determining the value of RPA. Previous studies offer limited information and literature that generally focus on factors influencing the overall adoption process of RPA technology and lack scientific knowledge regarding the impact of RPA on organizational performance.

The study has practical implications for stakeholders, decision-makers, and managers interested in adopting RPA. The paper offers a model that can be standardized for use in real-life scenarios and modified according to organizational needs, requirements, and circumstances, thereby assisting managers in achieving goals and objectives of enhancing the potential of RPA. This article provides a contribution to the scientific community, both theoretically and practically, as it adds scientific knowledge through the identification of value generated by the adoption and use of RPA and enables decision-makers to adopt RPA focusing on the tasks where it creates more value.

This research validates three key dimensions of RPA value for organizations, namely: impact on Internal Operations, impact on Marketing and Sales and impact on Procurement, with Marketing and Sales showing the most significant impact. Metrics or indicators are also provided for each value dimension that can be used by professionals in the field to evaluate their RPA initiatives.

7.2 Limitations

There are limitations in this research that should be highlighted. The impact measures are subjective as they rely on executives' perception of the impact of RPA on their organization. The study collected data from organizations in only one country and a limited number of interviewees and respondents were obtained. Additionally, no demographic questions were asked to characterize the questionnaire respondents. No common method bias tests were conducted.

7.3 Further Research

The research highlights several avenues for future studies. Future investigations could assess other scenarios based on different parameters that influence the adoption and use of RPA and the impact generated by RPA. For example, they could focus on the acceptance of RPA adoption by employees or on human-robot interaction. Organizational culture and its dynamics play a fundamental role in RPA adoption and can transform businesses. In this sense, future research could also focus on the impact of organizational culture or its role in RPA success. Using the questionnaire from this study in countries with different perspectives on automation technologies could provide relevant insights into the influence of culture and the automation environment on the adoption and use of RPA.

Since the impact of Internal Operations and Procurement on Firm Performance in the present research is inconclusive, it may be clarified in further studies.

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Appendix A

Measurement Items

Table A1: Operationalization of constructs

Construct	Indicator code	Indicators	Scale	Source
RPA Usage/R	RPAU	Please indicate whether your organization uses RPA (0- No and have no intention of using it; 1- No, but intend to use; 2- Yes).	(0~2)	
Impact on Marketing and Sales/F		Please indicate the extent to which your RPA have impact in (from 1 very low to 5 very high):	(1~5)	
	MS1*	Increased customer satisfaction.		Results from the Exploratory Study
	MS2	Increased convenience for customers.		
	MS3*	Improved customer communication.		
	MS4*	Best customer service.		
	MS5	Quality increase.		
	H	RPA adoption has a positive influence on Marketing and Sales.		Adapted from Rawashdeh et al (2022)
Impact on Internal Operations/F		Please indicate the extent to which your RPA have impact in (from 1 very low to 5 very high):	(1~5)	
	IO1*	Quick fix, short term, short payback.		Results from the Exploratory Study
	IO2	Bridging IT inability.		
	IO3	Ease of communication between systems/platforms.		
	IO4*	Ease of implementation / configuration / use (intuitive).		
	IO5	Reduced time/speed/operational speed.		
	IO6*	Cost reduction.		
	IO7	Error reduction.		
	IO8*	Intellectual appreciation of employees.		

	IO9	Routine work reduction.		
	IO10*	Changes in organizational culture.		
	IO11*	Process safety.		
	IO12*	Efficiency increase/Process optimization.		
	IO13*	Increased productivity.		
	IO14*	Organizational flexibility.		
	IO15	Operational elasticity.		
	IO16	Organization profit.		
	IO17*	Reduction in the number of workers.		
	IO18	Increased motivation / Quality of work of employees.		
	H	RPA adoption has a positive influence on Internal Operations.		Adapted from Rawashdeh et al (2022)
Impact on Procurement/F		Please indicate the extent to which your RPA have impact in (from 1 very low to 5 very high):	(1~5)	
	IP1	Outsourcing reduction.		
	IP2	Reduction of external dependence (consultants).		Results from the Exploratory Study
	IP3	Auditability.		
	H	RPA adoption has a positive influence on Procurement.		Adapted from Rawashdeh et al (2022)
RPA Impact on Firm Performance/R		Please rate the degree to which you agree with the following statements (from 1 totally disagree to 5 totally agree):	(1~5)	
	FP1*	In terms of its business impacts on the organization, the RPA has been a success.		
	FP2	RPA has seriously improved my organization's overall business performance.		Adapted from Gattiker & Goodhue (2005) and Picoto et al (2014)
	FP3	From the perspective of my organization, the benefits of RPA outweigh the costs.		
	FP4	RPA has had a significant positive effect on my organization.		
	H	RPA adoption has a positive influence on Firm Performance.		Adapted from Picoto et al (2014)

* are the items marked for deletion (in the pilot test, the outer loading values were below 0,5).

Constructs modeled as reflective are marked with (R) and constructs modeled as formative are marked with (F).

Appendix B

In this appendix, we report the results for the reflective and the formative measurement models in Tables B1-B4.

Table B1: Reflective constructs reliability criteria, loadings and t-statistics

Reflective multi-items (Cronbach's alpha/ Composite reliability/ AVE)	Construct composite	Indicator Code	Mean	SD	Outer Loadings	Conv. Validity (t-stat)
FP	Firm Performance (0,91/0,91/0,85)	FP2	0,361	0,020	0,928	18,066
		FP3	0,366	0,020	0,905	18,457
		FP4	0,363	0,018	0,935	20,349

Table B2: AVE and latent variables correlations

	Firm Performance	RPA Usage
Firm Performance	0,923	
RPA Usage	0,546	1

Note: The diagonal are the values of AVE squared root and the off-diagonal represents the correlations.

Table B3: Cross loadings

	Firm Performance	Internal Operations	Procurement	Marketing and Sales	RPA Usage
FP2	0,928	0,518	0,486	0,753	0,436
FP3	0,905	0,660	0,279	0,754	0,558
FP4	0,935	0,564	0,399	0,747	0,516
IO2	0,297	0,536	0,471	0,407	0,354
IO3	0,466	0,715	0,452	0,51	0,395
IO5	0,585	0,946	0,452	0,647	0,557
IO7	0,551	0,785	0,446	0,608	0,391
IO9	0,391	0,670	0,249	0,519	0,42
IO10	0,371	0,47	0,579	0,373	0,189
IO15	0,382	0,476	0,541	0,421	0,185
IO16	0,378	0,526	0,485	0,47	0,252
IO18	0,516	0,72	0,527	0,601	0,347
IP1	0,406	0,306	0,97	0,418	0,337
IP2	0,406	0,319	0,905	0,423	0,281
IP3	0,356	0,497	0,868	0,370	0,311
MS2	0,553	0,382	0,583	0,585	0,264
MS5	0,814	0,669	0,517	0,972	0,576
RPAu	0,547	0,566	0,345	0,431	1

Note: Bold numbers indicate item loadings on the assigned constructs.

Table B4: Formative measurement model evaluation criteria

Formative construct		Indicator Code	Mean	SD	VIF	Outer Weights (Outer Loadings)	t Value	p Value	99% Confidence Interval
MS	Marketing and Sales	MS2	-0,359	0,132	2,35	-0,357 (0,585)	2,702	0,007*	[-0,708; -0,008]
		MS5	1,24	0,088	2,35	1,243 (0,972)	14,074	0,000*	[1,006; 1,487]
IO	Internal Operations	IO2	-0,083	0,211	2,321	-0,071 (0,536)	0,338	0,736	[-0,732; 0,530]
		IO3	-0,034	0,296	3,348	-0,006 (0,715)	0,02	0,984	[-0,929; 0,699]
		IO5	0,778	0,26	3,084	0,847 (0,946)	3,261	0,001*	[0,036; 1,506]
		IO7	0,446	0,363	4,427	0,387 (0,785)	1,065	0,287	[-0,388; 1,612]
		IO9	-0,001	0,257	2,974	-0,028 (0,670)	0,109	0,913	[-0,619; 0,859]
		IO10	-0,166	0,289	3,521	-0,188 (0,57)	0,651	0,515	[-1,108; 0,519]
		IO15	-0,122	0,225	2,914	-0,148 (0,576)	0,659	0,51	[-0,845; 0,489]
		IO16	-0,16	0,223	2,105	-0,154 (0,526)	0,69	0,49	[-0,866; 0,366]
		IO18	0,194	0,293	2,832	0,272 (0,72)	0,928	0,353	[-0,869; 0,818]
IP	Procurement	IP1	0,497	0,701	4,97	0,595 (0,97)	0,848	0,397	[-1,237; 2,246]
		IP2	0,081	0,603	4,459	0,160 (0,905)	0,265	0,791	[-1,544; 1,594]
		IP3	0,354	0,598	2,224	0,321 (0,868)	0,536	0,592	[-1,034; 1,499]

*Note: Significance level 0,01

Conclusion

RPA's potential for corporate performance improvement, together with the lack of research published exploring the adoption of RPA at the organizational level, encouraged the development of the present research.

Regarding RPA's potential for corporate performance improvement, the experts interviewed in the first chapter suggest that the value of RPA results from its impact on the Downstream dimension and Internal Operations, while its impact on the Upstream dimension remains unclear. In the Downstream dimension, the main benefits include improved customer service, enhanced communication, increased customer satisfaction, and greater convenience for clients. Regarding the internal dimension, RPA contributes primarily by reducing errors and costs and minimizing routine work. This, in turn, improves work quality, boosts employee motivation, and creates value for the organization.

The results regarding the main factors influencing organizations' decisions to adopt and use RPA indicate that antecedents related to the technological context are crucial for enhancing RPA adoption and use. Within this context, Compatibility stood out with the highest statistical significance, suggesting that RPA's compatibility with existing IT infrastructure, applications, systems, and established procedures promotes its adoption and use. Relative Advantage, although with more moderate significance, suggests that when organizations recognize RPA's potential benefits, such as increased sales, cost reduction, or decreased reliance on paper-based processes, their propensity to adopt and use RPA increases. Thus, according to Tornatzky and Klein (1982), it is partially confirmed that the most significant and relevant factors are Compatibility (Hypotheses 2), Relative Advantage (Hypotheses 1) and Complexity (Hypotheses 3). However, for other factors, such as Technological Competence (Hypotheses 4), Management Obstacles (Hypotheses 5), and Environmental Pressure (Hypotheses 6), this study cannot confirm their influence on adoption and use propensity, as they were not statistically significant.

Regarding RPA characteristics that create value and ultimately impact performance (Hypotheses 4), the exploratory study suggests and the confirmatory study verifies that RPA enhances operational efficiency and employee productivity, adding value to supply chains and making them more efficient. Interviews provided evidence of

RPA's impact, including reduced human error, increased efficiency, optimized processes, minimized routine tasks, and intellectual empowerment of employees. Additionally, improvements were mentioned in quality, customer service, and supply chain processes. The confirmatory study validated most findings of the exploratory study.

Grounding on the Resource-Based Theory (RBT), this research analyzes the connection between RPA's potential as an antecedent and organizational performance as a dependent variable. RPA's usage shows a significant impact on Marketing and Sales (Hypotheses 1), Internal Operations (Hypotheses 2), and Procurement (Hypotheses 3). The marketing and sales variable is the most relevant for Firm Performance improvement and ultimately contributes to overall organizational performance and competitiveness, highlighting the consistency between the exploratory and the confirmatory study.

The meta-inferences resulting from this articulation provide a deeper understanding of the determinants of RPA adoption and the value it creates. The vast majority of findings confirmed the benefits and drivers of adoption, namely the reduction of routine work, increased quality and operational efficiency, process standardization, and cost reduction, reinforcing that adoption is aligned with tangible benefits perceived by organizations. Different contexts could influence RPA adoption, including the environmental context (regulations, competition) and the organizational context (resources and management support). However, only the technological context had a statistically significant impact, particularly the Compatibility variable. This suggests that digital infrastructure and ease of implementation are decisive factors in RPA adoption, and the adoption decision is not strongly influenced by external (environmental) pressures or internal structural changes (organizational). The literature review suggested that RPA would positively impact all dimensions of the value chain. This perspective was reinforced by experts, who highlighted gains in operational efficiency, customer service improvements, and administrative support. However, statistical significance was confirmed only in the Marketing and Sales dimension. This area involves a large volume of repetitive tasks, such as order processing and campaign automation, and the use of RPA in these activities improves efficiency and reduces time to market, directly impacting the company's overall performance.

The study has practical implications for stakeholders, decision-makers, and managers interested in adopting RPA. This research provides a model that can be standardized for use in real-life scenarios and modified according to organizational needs,

requirements, and circumstances, thereby assisting managers in achieving goals and objectives of enhancing the potential of RPA. This study provides a contribution to the scientific community, both theoretically and practically, as it adds scientific knowledge through the identification of value generated by the adoption and use of RPA and enables decision-makers to adopt RPA focusing on the tasks where it creates more value.