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Risks and Challenges of Robotic Process Automation

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"In the pursuit of knowledge, horizons expand, and learning is the key that unlocks all doors."

-Albert Einstein

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I also like to thank ISCTE University for its assistance and resources. The ability to access its research resources, and academic community has made it much easier to carry out this research.

I'll end by quoting Winston Churchill, who once said, "Perseverance is not a long race; it is many short races one after the other." this emotion perfectly captures the course of this research, which was characterized by both overwhelming obstacles and stunning successes.

Resumo

Este resumo aborda o tema da transformação digital e automação de processos utilizando a Automação Robótica de Processos (RPA) nas empresas. Enquanto a automação tem trazido benefícios notáveis, como a minimização de tarefas repetitivas e a melhoria da eficiência operacional, também apresenta riscos, uma vez que é baseada em robôs sem capacidade de pensamento crítico.

Para esta pesquisa, foram coletados e analisados um total de setenta e quatro artigos académicos. Durante o estudo, identificaram-se cinco pilares fundamentais de risco relacionados à Automação Robótica de Processos (RPA). Esses pilares foram minuciosamente explorados ao longo da pesquisa, proporcionando uma compreensão mais profunda dos desafios associados a esta tecnologia. Neste estudo foram ainda relatadas medidas de mitigação para os riscos identificados.

Palavras-chave: RPA, Gestão de Risco, SLR, Entrevistas, Continuidade de Negócio

Abstract

The topic of digital transformation and process automation in businesses utilizing robotic process automation (RPA) is covered in this abstract. Automation has several advantages, including reducing monotonous work and increasing operational effectiveness, but it also has drawbacks because it depends on robots that are incapable of critical thought. A total of seventy-four articles were gathered and examined for this study. Five key risk pillars associated with robotic process automation (RPA) were found during the investigation. These pillars were thoroughly investigated during the study, which led to a greater comprehension of the difficulties posed by this technology. The study also provided risk mitigation strategies for the hazards that were found.

Keywords: RPA, Risk Management, SLR, Interviews, Business Continuity

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Glossary of Abbreviations and Acronymns

AA	-	Activity Areas
AI	-	Artificial Intelligence
BC	-	Business Continuity
BCM	-	Business Continuity Management
BPA	-	Business Process Automation
CoEs	-	Centers of Excellence
ERM	-	Enterprise Risk Management
IT	-	Information Technology
IPA	-	Intelligent Process Automation
ML	-	Machine Learning
OCR	-	Optical Character Recognition
RPA	-	Robotic Process Automation
RQ	-	Research Question
SLR	-	Systematic Literature Review

CHAPTER 1. Introduction

In recent years, Robotic Process Automation (RPA) technology has emerged as a transformative tool in organizations worldwide and has the capacity to revolutionize company procedures and boost productivity [1][2].

There are numerous factors that influence the extent to which enterprises can effectively adopt RPA, and these factors can significantly impact the overall success of automation initiatives. By understanding these conditions, organizations can better navigate the path to RPA implementation and reap its numerous benefits and avoid risks [3].

With the increasing usage of RPA by enterprises, a concept called as "strategic implications for global business services" arises. This idea highlights the fact that RPA is a strategic tool that may be used to redefine the global business services environment, rather than just streamlining operational operations. RPA adoption signifies a change in an organization's approach to providing services that goes beyond merely increasing efficiency. There are dangers and problems associated with this strategic shift that need to be carefully considered. Moreover, the notion of "cross-industry applicability" is intimately associated with RPA, hence broadening its sphere of influence beyond conventional business domains [4].

As organizations aim to align their operations with global sustainability goals, RPA's role in this context becomes a subject of paramount importance [5].

The idea that the adoption of RPA is heavily dependent on the shift from manual to automated processes is emphasized using software robots. This change signifies a basic departure from the way work is done in organizations. It is suggested that during the RPA deployment phase, crucial problems related to this shift that need to be successfully addressed are personnel adaptability and change management. These difficulties cover the organizational and human dimensions of RPA in addition to its technological features. The workforce's ability to adjust to and work well with software robots is essential for the successful implementation of RPA. To fully utilize RPA while minimizing any interruptions and obstacles, companies must implement change management techniques and mitigation measures [6].

The growing interest and adoption of RPA by both businesses and researchers are indicative of an ongoing revolution in business practices.

The increasing interest in RPA as a subject of study is corroborated by Google Trends data, revealing a striking trend. In 2017, RPA was a relatively new topic, but its popularity surged significantly during the second half of 2018, as evidenced by the rise in searches related to RPA on Google (see Figure 1). This signals that RPA is an emerging technology rapidly attracting attention from both organizations and researchers.

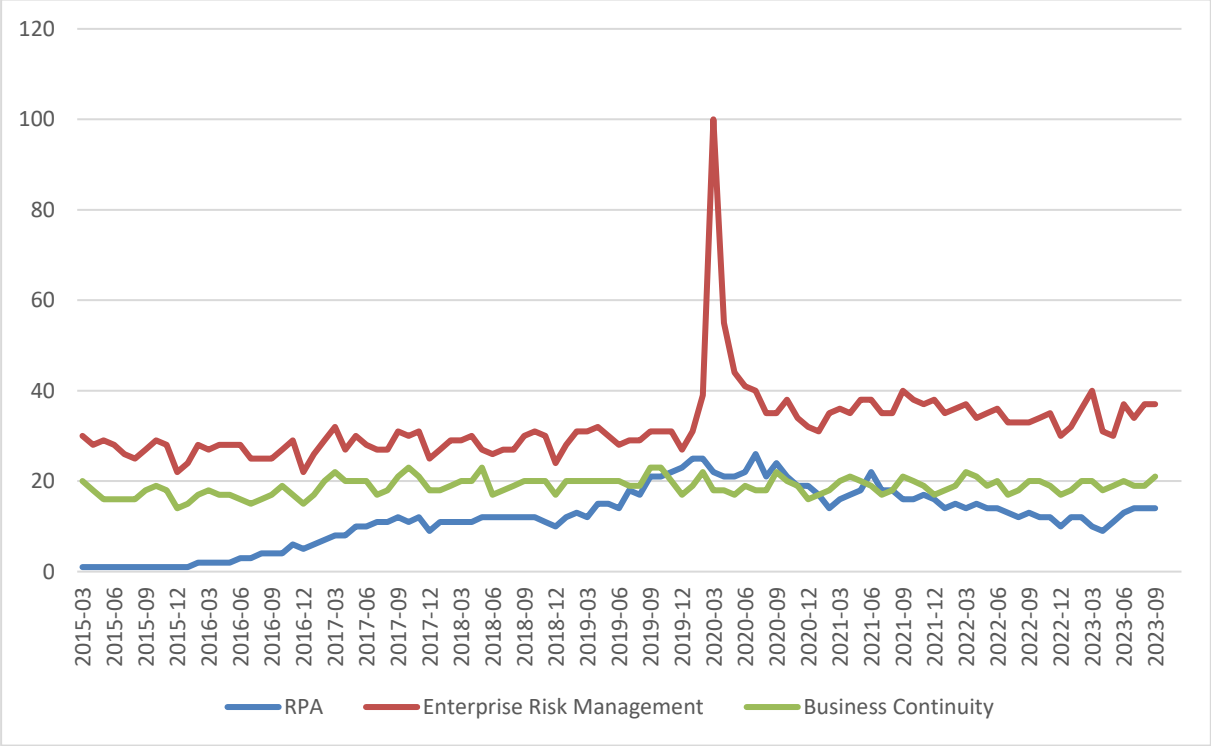

Figure 1 - Searches related to RPA,ERM and BC on Google

Furthermore, it is crucial to consider how the adoption of RPA may impact Business Continuity (BC) and Enterprise Risk Management (ERM). These two aspects are fundamental to an organization's operation and survival in an increasingly complex and dynamic world [7]. How organizations integrate RPA into their daily operations and how this affects their ability to maintain BC and manage risks have become matters of significant interest.

The goal of this study is to critically analyze the dangers and difficulties related to RPA and to suggest ways to minimize those risks. The study is based on a systematic review of specific paper selection that were all published between 2015 and 2023. The articles were selected based on their relevance to the research question, and their contributions to the existing knowledge on RPA.

RPA's success can be greatly impacted by how closely it complies with the overall goals of the organization. Furthermore, for RPA to provide the advantages for which it is meant, there may be obstacles that need to be overcome.

CHAPTER 2. Background

In addition to providing historical context, the Background chapter serves as a roadmap that directs readers toward the next chapters, which address the benefits, dangers, and difficulties related to RPA in a variety of industries. The goal is to enable a deeper investigation into how RPA is influencing businesses, industries, and the global business landscape in the present and the future through this fundamental understanding.

2.1 Risks Concepts

In the context of business, risk is the likelihood that an occurrence of an event or scenario could have a detrimental effect on the aims, goals, or operations of an organization [1].

These occurrences or circumstances may involve monetary losses, operational disruptions, reputational harm, or compliance concerns [1]. They may be internal or external, predicted, or unforeseen. These possible risks must be identified, evaluated, and mitigated to reduce their negative effects [8][9][10][7][11][12][13].

Risk is a complex idea that has attracted a lot of attention in both academic study and real-world commercial applications. It includes a range of variables, such as compliance risk, operational risk, and financial risk [14]. Financial risk refers to the possible monetary losses that an organization can suffer because of credit defaults, market volatility, or economic downturns. Operational risk includes dangers related to internal procedures, controls, and human error that could cause operations to fail or be disrupted [15][16]. Threats to an organization's strategic goals, such as shifting market dynamics or competitive environments, are referred to as strategic risks [17]. Compliance risk is concerned with the potential repercussions of failing to adhere to legal and regulatory regulations, which may lead to fines and reputational damage [18].

It's crucial for a company to manage these various risk factors well if it wants to be resilient and sustainable. It necessitates a thorough comprehension of the intricate interactions between internal and external elements that could affect an organization's capacity to meet its objectives and provide value to stakeholders [19]. Additionally, because corporate environments are changing, it is necessary to continually analyze risks and modify risk management techniques to take advantage of new possibilities and difficulties [20].

2.1.1. Risk and Business Continuity

Business continuity (BC) is the ability of a company to continue performing its core responsibilities during and after disruptive occurrences [21]. These occurrences might include everything from natural disasters and cyberattacks to operational errors and supply chain disruptions [[15]. Business continuity planning is essential to risk management because it tries to lessen the effects of unplanned occurrences on an organization's capacity to provide goods or services, safeguard its reputation, and uphold stakeholder confidence [21][22].

Additionally, current research emphasizes how intelligent process automation (IPA), which includes tools like RPA and BC are inextricably linked [23]. Brás et al. (2023) examine the possible directions for further study in Intelligent Process Automation (IPA) and its effects on BC. This study underlines the need to comprehend how cutting-edge automation technologies, such as RPA, can improve an organization's capacity to sustain key operations amid disruptive events and successfully manage associated risks [23].

2.2 Robotic Process Automation

RPA, often known as the use of a new class of software to automate business operations, provides a disruptive strategy that is both affordable and adaptable, eliminating the need for significant infrastructural changes [24][6][2][25].

Due to its transformational potential, RPA has become extremely popular across a variety of industries [23]. It makes it possible to automate a variety of tasks, especially those that are repetitive like budget verification and financial report preparation, which have substantial application in financial administration and management [37]. RPA has also forayed into crucial fields like auditing, changing operations like trend analysis and data extraction from financial reports [44]. RPA is a flexible and adaptive technology because of its versatility, capacity to mimic human contact and integration with machine learning algorithms [[26][7][6][27][11]. Research on automated testing methods and their use in the developing Audit 4.0 landscape has highlighted how applicable they are to a variety of industries [28].

Implementing RPA could dramatically reduce operational expenses related to manual operations, which is one of its most alluring features and frequently results in an extraordinary return on investment in less than a year [14][20]. RPA, which resembles a team of software "robots," works continuously, 24 hours a day, 7 days a week, without the need for downtime. Additionally, it ensures careful auditing and achieves a precision and accuracy level that is equivalent to 100%, boosting efficiency and reducing errors [14][20]. This game-changing technology ushers in a new era of efficient, affordable, and agile corporate process automation.

Understanding the fundamental characteristics of RPA technology is crucial to comprehending its potential and operational capabilities. RPA is designed to simulate human interaction with computer systems, replicating user actions within the computer's user interface [26] . It can execute scripts, input data into fields, operate functional buttons, move the cursor, and perform all the typical user interactions, with scripts containing rules and conditions to mimic user behavior [29][14].

When initiating an RPA process, the RPA robot autonomously executes all the steps within the process flow, including interactions with user interfaces and adhering to predefined rules and conditions [22]. Additionally, RPA software possesses the capability to handle substantial volumes of data, which can be provided either through pre-installed processes or direct interaction with user interfaces, enabling the automation to process data from diverse sources [27]Advanced RPA software can even leverage Machine Learning algorithms, contributing to the robot's continuous learning and performance improvement, without requiring explicit instructions from developers [30]. The synergy of RPA and Machine Learning fuels ongoing enhancements in process performance.

When the execution of an RPA process is started, the RPA robot will autonomously perform all operations that are part of the process flow, including interactions with user interfaces, rules, and conditions to use in the business process [1].

Using this RPA software can also transport and use large volumes of data. Information can be provided to the automation either by the process already installed or by interacting with the user interface, making the automation capable of dealing with information from two different sources [[27].

The most advanced RPA software can even use Machine Learning (ML) algorithms related to the field of artificial intelligence. This allows machine learning for the robot and allows improvements without the developer having to give instructions [17].

Additionally, the current explosion in RPA academic research and practical applications highlights the technology's potential to alter a variety of industries. In an article from Rutschi and Dibbern (2020), the authors highlight the transition from manually executed procedures to automation and present a framework for constructing software robots. This framework offers the groundwork for utilizing RPA's capabilities to optimize business processes and streamline operations. To promote operational excellence, it demonstrates the increased interest in and investment in RPA [14].

CHAPTER 3. Related work

Chapter 3 serves as a comprehensive exploration of the practical applications, real-world examples, automation concerns, risk management, and a comparative risk analysis associated with RPA, also provides a holistic view of the challenges and opportunities presented by RPA, offering valuable insights for organizations embarking on their RPA journeys.

3.1. Main Practical Applications of RPA

By adopting RPA, you may be able to perform some types of activities that are currently performed manually.

These activities can be customized according to the needs of the business of interest and give perspective on how vast the field of application is [31]. RPA could make the execution of these repetitive tasks more efficient in various Activity Areas (AA), such as public administration, goods production and banking [32][33].

The activities most likely to be automated are the financial administrator or financial management tasks such as checking the budget and writing financial reports; not only have a high probability of automation, but also a great impact associated with the number of people who would benefit from a given task automation [22].

Handoko, Lindawati and Mustapha examine how RPA might alter audit procedures. RPA can be used in auditing to automate processes including trend analysis, transaction validation, and data extraction from financial reports. For instance, RPA bots can harvest financial data from several sources, compare it for inconsistencies, and generate audit reports with less manual work. This improves audit accuracy and the capacity to spot abnormalities while also increasing audit efficiency [28]

The following list provides a basic summary of the various jobs that RPA can successfully complete:

- **Data Collection**: RPA expertly obtains information from safe internal and external sources, compiling and collecting data for diverse objectives [34][28].
- **Validation and analysis**: RPA's mapping, verification, and validation procedures ensure data accuracy. It excels at effectively managing unstructured data and error model analysis [35][28]
- **Data logging**: RPA efficiently logs data by the entry of information through various interfaces and the maintenance of thorough records that include metadata [36][28].
- **Decision-Making and Calculations**: RPA automates calculations, creates rules based on decision criteria, and creates precise papers or reports [37][28].

- **Transfer and Communication**: RPA speeds up data testing and transfer, automates notifications to stakeholders, and promotes smooth communication with employees, vendors, and clients [38].
- **Reports Creation**: RPA automates report creation, offering crucial assistance for in-depth process performance analysis [6][28]

Figure 2 summarizes which activities can be carried out by RPA:

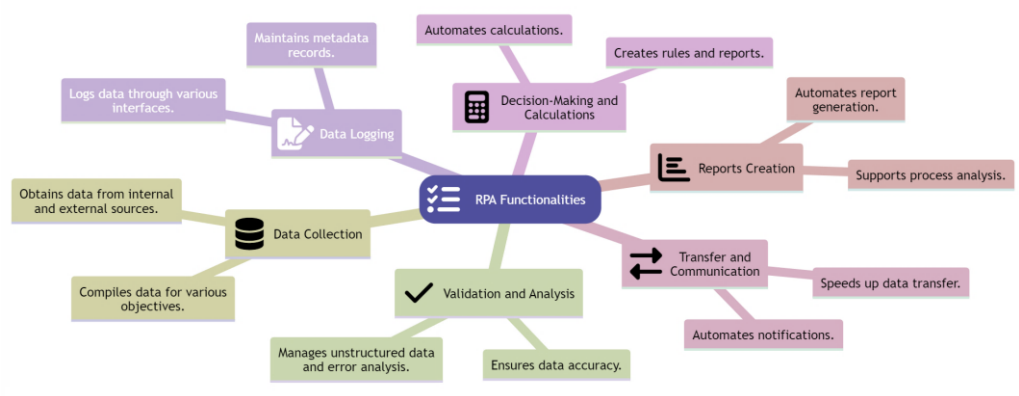

Figure 2 - RPA Practical Functionalities

3.2 Real-World Examples: Highlighting the Risks Associated with RPA

Real-world examples show the delicate interplay between RPA risks and their consequences on diverse industries and business processes as the route to integrating RPA into organizational operations. These illustrations highlight the value of thorough risk management plans and highlight the complex nature of RPA threats.

OpusCapita: Leveraging Internal RPA Capabilities to Serve Clients

A convincing real-world illustration of the technology's potential may be seen in OpusCapita's use of internal RPA capabilities to improve client services, a provider of financial process automation solutions. While highlighting the significant advantages RPA can have for both innovation and operational effectiveness, this instance also highlights the numerous issues that come with its incorporation into service delivery [20].

Data security is the most important issue at the heart of these worries. The security of client data became the most important factor when OpusCapita used RPA to improve its service offerings. The protection of sensitive data became essential to the effective application of RPA in the financial industry, highlighting the fundamental need of rigorous security measures [12]. In addition, the case highlights how important it is to adhere to industry norms, especially in the financial sector. OpusCapita's RPA journey saw the importance of following established financial norms and laws rise to the fore, illuminating the delicate balance that businesses must maintain between innovation and regulatory conformity [12].

This case serves as a sobering reminder of the necessity of an all-encompassing and thorough RPA risk management plan. To protect client data, such a strategy must include not just strict adherence to legal requirements and industry norms, but also strong security measures. Organizations must carefully address these issues as they explore the revolutionary potential of RPA to maximize benefits and minimize hazards [12].

Private Healthcare: Digitalizing Work with RPA to Create Value

The use of RPA in the private healthcare industry is illustrated in the article "*Robotic process automation - Creating value by digitalizing work in the private healthcare?*" which highlights the delicate balance between increasing operational efficiency and reducing potential dangers. The incorporation of RPA poses complex operational factors that necessitate careful attention in the healthcare industry, where accuracy and patient safety are of utmost importance [39].

RPA introduces operational complexities that are needed for a carefully considered implementation plan. The key is to improve medical treatment while streamlining administrative procedures without sacrificing patient care standards or causing disruptions. While RPA promises to add value by automating repetitive operations, its successful integration depends on a thorough and carefully thought-out strategy [39].

This concrete example highlights the urgent need for a detailed evaluation of the benefits RPA might offer in healthcare and related industries. It clarifies the importance of prudently evaluating and managing operational risks and offers a workable strategy for enterprises hoping to fully utilize RPA while upholding operational integrity [39]. As a result, it serves as a metaphor for the larger conversation within the RPA community, highlighting the significance of striking a balance between innovation and operational caution [39].

Global Accounting Services: Impacts of RPA Implementation

An example of a case study of strategic and human-centric hazards is the effects of RPA implementation in global accounting services. Routine accounting operations can be automated with

RPA, which can increase efficiency. However, RPA also brings concerns related to worker dynamics and strategy alignment. RPA's ability to improve accounting operations requires that human-centric concerns like employee upskilling and change management be addressed. RPA projects must also be strategically aligned to meet business goals and produce the intended results. The instance serves as an illustration of the significance of using a thorough approach to risk assessment that considers both strategic and workforce-related factors [18].

These actual cases show the diverse range of RPA hazards and their effects across industries. Each example emphasizes the necessity for proactive risk management measures, from using internal RPA capabilities to serve clients and digitize work in private healthcare to adopting RPA in global accounting services. Organizations can successfully manage the RPA journey while minimizing risks and boosting value generation by looking at these scenarios and comprehending their implications [18]

3.3 Automation Concerns

The thorough review of automation issues related to RPA tools, which drew conclusions from an analysis of the articles included in this study, highlights the complexity of these issues. The primary goal of RPA is to provide user-friendly, intuitive platforms that enable business representatives as well as Information Technology (IT) experts to autonomously develop software robots, thereby minimizing dependency on significant IT support. To create RPA solutions, companies frequently form specialized teams known as Centers of Excellence (CoEs), and these CoEs typically function within the organizational business side, as opposed to traditional IT domains [4][40][41].

Two well-known paradigms for software robot development emerge inside the RPA space, each with significant ramifications. To develop RPA solutions, the first model calls for tight cooperation between business units, security teams, and IT departments. The rapid production of robots is made possible by this collaborative paradigm, which also facilitates scalability and makes use of the extensive subject expertise provided by people who are directly involved in robot creation. However, if the robots created don't comply with corporate rules controlling security, compliance, and IT architecture, there is a risk of unintentionally encouraging "shadow IT" scenarios [4][40][41].

Alternately, businesses could choose a different strategy and hire or lease robots from outside service providers. In this concept, robots play the job of "digital workers," carrying out activities in accordance with the needs of the business department. Delivering and maintaining the robots, including necessary upgrades and maintenance procedures, is the external service provider's obligation [4][35].

However, it is crucial to recognize that the implementation of RPA tools, as elucidated in the literature, introduces a spectrum of risk factors. While some of these risks are universal and extend to traditional automation methods, others are inherently specific to RPA. These encompass the potential for employees to misinterpret RPA, the risk of adopting an unsuitable approach or tool for the organization's unique context, challenges in change management, employee resistance, competency gaps, and a deficiency in contemporary knowledge concerning business processes. Additionally, the literature underscores the pivotal importance of coordinated changes to system implementations to avert downtime in automated processes [6][42][43][44]

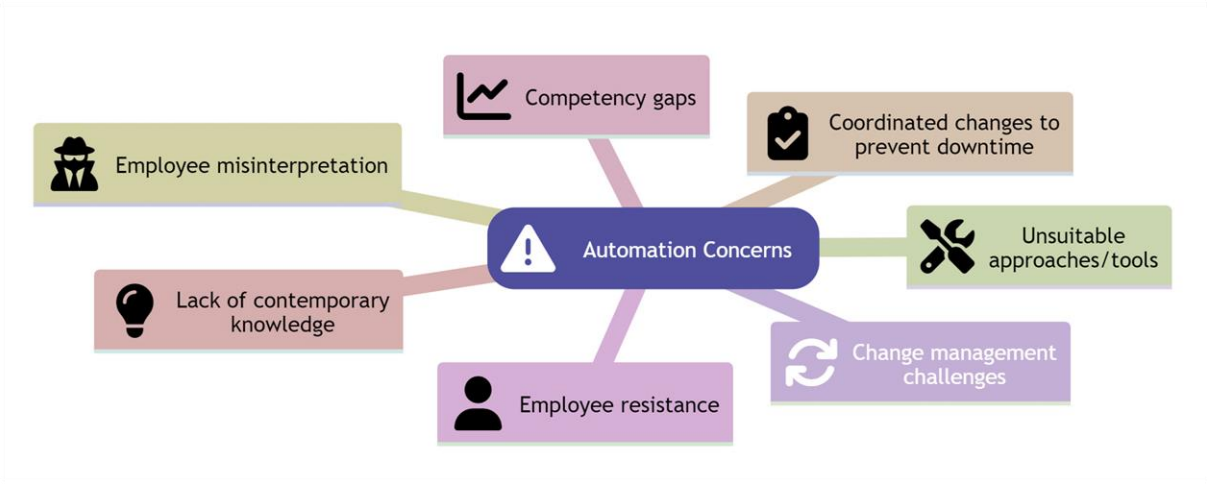

Figure 3 - RPA Automation Concerns

3.4. Risk Management in RPA

Effective risk management is essential in the field of RPA to ensure the seamless integration of automated processes into diverse business AA. One significant reference is the ISO 31000 standard, a globally recognized framework for risk management [45] Leveraging ISO 31000 provides a structured approach to identifying, assessing, and mitigating risks associated with RPA implementation.

A variety of hazards are presented by this multidimensional technological world, and they call for careful attention. Research from several papers has shown how important risk management is to the adoption of RPA. For instance, Zhang and Liu stress the value of security measures to prevent unauthorized access and data breaches, highlighting the significance of strong security procedures [6]. Additionally, Axmann and Harmoko's observations highlight the need for RPA processes to be in line with intricate regulatory standards, with focus on the compliance risks that enterprises must manage [14].

Operational issues, as described by Ratia et al., highlight the value of thorough testing and ongoing monitoring to minimize potential business operations disruptions [16]. To reduce strategic misalignments, Lacity and Willcocks point out that the strategic aspect of risk underscores the need to coordinate RPA projects with larger corporate goals [1]. Finally, human-centric issues emphasize the necessity of comprehensive change management techniques to address the effects of RPA on the workforce and corporate culture, as highlighted by Santos et al [13].

3.5. Comparative Risk Analysis by Activity Area

A recurring topic in the analysis of RPA risks is the complex interaction between security, compliance, and strategic alignment, as shown by the conclusions reached from the works of Lacity and Willcocks and Gotthardt et al. [5][10]. This nexus highlights the need for enterprises starting their RPA journeys to view security and compliance as interrelated aspects of their operational landscape rather than as separate issues.

Data protection is just one aspect of securing RPA operations; adhering to the complex web of regulatory regulations controlling the environment is also important. Organizations run the risk of exposing themselves to vulnerabilities that could inhibit the successful implementation of RPA efforts by failing to appreciate this holistic approach [5][10].

Furthermore, as these studies demonstrate, there is a critical need for alignment between operational implementation and strategic aim. Operational interruptions may result from the misalignment between RPA actions and strategic goals. As a result, strategic coherence becomes a crucial factor to consider while undertaking RPA projects, highlighting the necessity for businesses to go along this route with keen strategic insight.

The acknowledgement of issues related to human-centricity during RPA implementation has persisted throughout these debates. This highlights the value of all-encompassing change management strategies. To enable seamless integration and stakeholder alignment, managing the shift to an RPA-driven ecosystem requires not just technological prowess but also skillful management of human elements [5][10].

These observations, taken as a whole, focus on the complex web of factors relating to RPA hazards. They highlight the importance of a comprehensive strategy that incorporates security, compliance, strategic alignment, and efficient change management, all within the overarching framework of RPA implementation [5][10].

Table 1 provides a thorough overview of the many risk categories connected to RPA across a range of activity areas. It highlights the industries where these risks are investigated while categorizing the discovered threats based on common themes and aspects.

Table 1 - Risk Identification and Associated References in Various Activity Areas

Risk ID	Risk Pillar	Activity Area	References
R1	Security Risks	Financial Services	[1], [4], [5], [10], [38], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]
		Healthcare	[16], [21], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [57], [58]
		Human Resources	[30], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [59], [60]
		Energy and Utilities	[6], [18], [45], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [61]
		IT Services	[10], [38], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]
		Logistics and Transportation	[7], [17], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]
R2	Compliance Risks	Financial Services	[1], [4], [5], [10], [38], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]
		Healthcare	[16], [21], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [57], [58]
		Human Resources	[30], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [59], [60]
		Energy and Utilities	[6], [18], [45], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [61]
		IT Services	[10], [38], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56],
		Logistics and Transportation	[7], [17], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]
R3	Operational Risks	Financial Services	[1], [4], [5], [10], [38], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]
		Healthcare	[16], [21], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [57], [58]
		Human Resources	[30], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [59], [60]
		Energy and Utilities	[1], [3], [5], [8], [15], [19], [23], [28], [31]–[33], [35], [39]–[42], [46]–[69]
		IT Services	[10], [34]–[58]
		Logistics and Transportation	[7], [17], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]
R4	Strategic Risks	Financial Services	[1], [4], [5], [10], [38], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]
		Healthcare	[16], [21], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [57], [58]
		Human Resources	[30], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [59], [60]
		Energy and Utilities	[6], [18], [45], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [61]
		IT Services	[10], [38], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56],
		Logistics and Transportation	[7], [17], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]
R5	Human-Centric Risks	Financial Services	[1], [4], [5], [10], [38], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]
		Healthcare	[16], [21], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [57], [58]
		Human Resources	[30], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [59], [60]
		Energy and Utilities	[6], [18], [45], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [61]
		IT Services	[10], [38], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]
		Logistics and Transportation	[7], [17], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]

CHAPTER 4. Research Methodology

This research uses a methodological approach that blends qualitative interviews with a Systematic Literature Review (SLR). The goal of this strategy is to give a thorough and all-encompassing awareness of the risks and difficulties related to the implementation of RPA.

4.1. Systematic Literature Review

A SLR was selected as the main research methodology to gain a thorough awareness of the difficulties in the field of RPA. It provides a structured and replicable process for conducting a comprehensive review of existing literature related to a specific research question. SLR's are characterized by their systematic approach to identifying, selecting, and analyzing relevant studies, ensuring the results are both comprehensive and unbiased.

The methodology will encompass the following key steps:

1. Formulating clear research questions related to RPA risks.
2. Defining inclusion and exclusion criteria for selecting relevant studies.
3. Searching for and selecting studies based on the defined criteria.
4. Extracting data from selected studies and categorizing findings.
5. Analyzing and synthesizing the data to draw meaningful conclusions.

Figure 4 carefully outlines the methodological processes that were used throughout this review. This strategy guarantees that this study is firmly rooted in the body of information already in existence, allowing us to derive valuable insights and conclusions about the complex landscape of RPA Risks.

To compile a thorough list of pertinent articles, the initial stage included searching several databases. To make sure they were pertinent to the discussion of RPA risks and challenges, these publications were then scrutinized using specified inclusion and exclusion criteria. The formulation of research questions is also essential for organizing the investigation and focusing on particular areas of the study's interest. Research Question 1 (RQ1) explores and identifies the hazards associated with implementing RPA in diverse operational settings. The purpose of this question is to give a thorough understanding of the difficulties and potential dangers related to the implementation of RPA in various industry sectors. RQ2, on the other hand, is concerned with clarifying the steps that must be taken to mitigate the risks that have been identified.

This research topic intends to provide important insights into how firms may proactively manage and traverse the risks provided by RPA installation by delving into efficacious tactics and solutions.

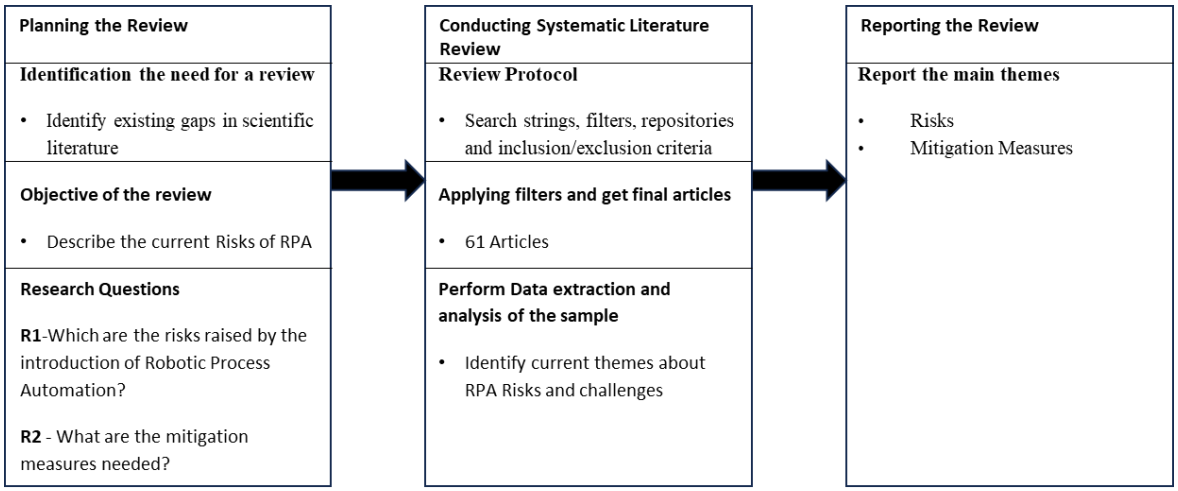

Figure 4 - Steps to Plan, Conduct and Report the SLR

To develop a targeted and thorough search strategy, the keywords for this research, including "RPA" (Robotic Process Automation), "Risk," and a mix of terms such as "Strategy", "Exploration" "Implementation", "Management" and "Operation" have been carefully picked as shown in Table 2. With the use of these keywords, it is possible to explore several RPA-related topics, such as its strategic implications, risk management, and risk assessment procedures. With this set of keywords, the study will cover a wide range of important RPA-related topics, giving readers a comprehensive grasp of the field's prospects and problems.

Table 2 - list of keywords searched in repositories

Keywords
"RPA" OR "ROBOT PROCESS AUTOMATION"
"RISK"
"STRATEGY"
"EXPLORATION"
"EVALUATION"
"IMPLEMENTATION"
"MANAGEMENT" AND "OPERATION"
"OPTIMIZATION" AND "SCALING"

The repositories of scientific articles used to identify the literature to be reviewed have been listed in Table 4. As result, the inclusion and exclusion criteria described in Table 3 were operated once the results were filtered for the previous criteria. Finally, a manual filter was applied to remove from the selection all the articles concerning the topic of Risk Perception Attitude, Rheumatic Pulmonary Artery and Remotely Piloted Aircraft or the articles where the subject of robotic automation appeared as a supplementary topic.

To obtain the list of articles to be reviewed, it was necessary to use different filters. In the first instance, a search was carried out without any filter, to be able to have a general view of the number of existing documents; the results were then narrowed by applying the keyword search only in the title and eliminating the articles that only mentioned RPA in passing or papers that are not about RPA.

Table 3 - Inclusion/exclusion criteria

Inclusion Criteria	Exclusion Criteria
Articles from 2015	Not related to RPA
Articles in English	Documents with publication date earlier than 2015
Related to main keywords	Papers by unidentified authors

Figure 5 outlines the step-by-step process employed for the selection of articles within the study. It provides a visual overview of the methodological approach, demonstrating how articles were systematically chosen for inclusion in the research, emphasizing the rigor and transparency of the selection process.

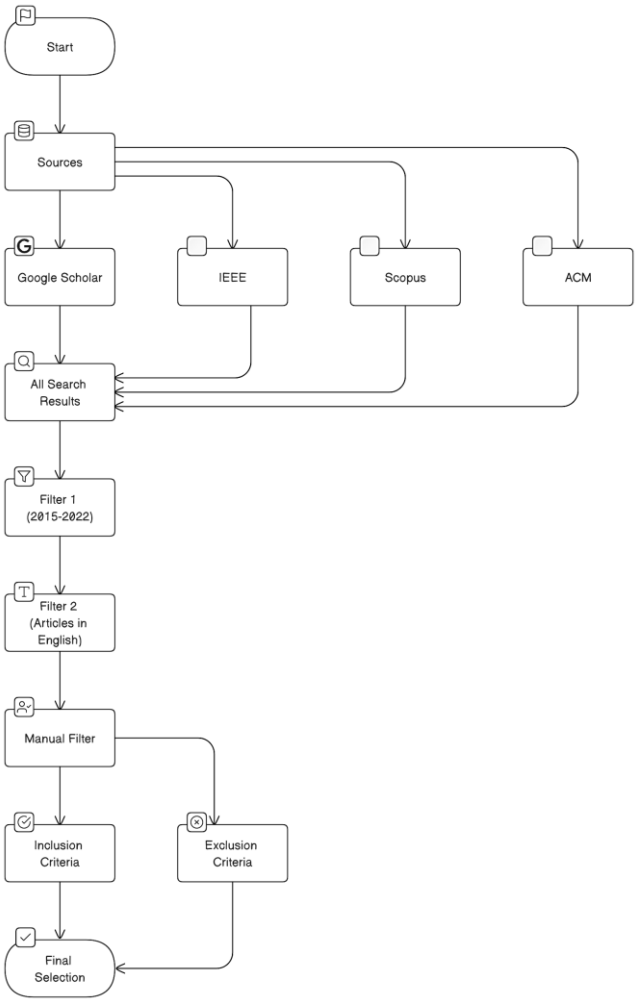

Figure 5 - Sequence of Actions for Article Selection in this Study

Table 4 documents the initial number of results obtained from various sources, the outcomes of applying specific filters, and the final number of papers collected for further analysis. The sources, including Google Scholar, IEEE, Scopus, and ACM, each present their unique set of results, highlighting the dynamic nature of this research scope.

Table 4 - Filtering process from search string ("RPA" OR "ROBOT PROCESS AUTOMATION") AND "RISK" AND ("STRATEGY" OR "EXPLORATION" OR "IMPLEMENTATION" OR ("MANAGEMENT" AND "OPERATION"))

Keywords	Sources	No filters applied	2015 - 2023	Manual filter	Final Number of papers collected
("RPA" OR "ROBOT PROCESS AUTOMATION") AND "RISK" AND ("STRATEGY" OR "EXPLORATION" OR "IMPLEMENTATION" OR ("MANAGEMENT" AND "OPERATION"))	Google Scholar	137270	76660	103	38
	IEEE	4370	3645	54	16
	Scopus	8216	7946	93	20
	ACM	2620	1326	10	8
Total	61				

The inverted pyramid Figure 6 visually emphasizes the progressive refinement process, highlighting the transition from a broad literature search to a focused and manageable set of articles that form the foundation for the research. It serves as a visual representation of the meticulous selection and screening process that led to the final dataset.

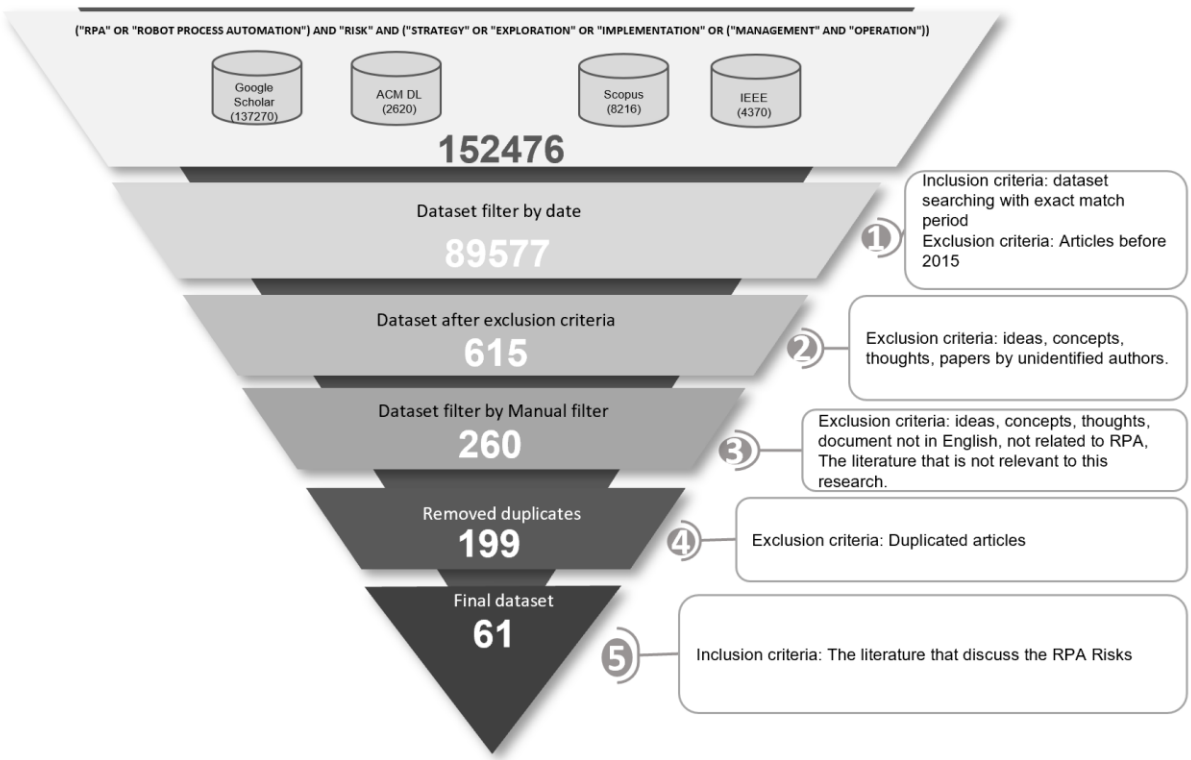

Figure 6 - Inverted Pyramid of Article Selection

4.2 In-Depth Interviews

Qualitative data collection involves in-depth interviews with key industry stakeholders, including senior executives and RPA implementation leads engaging in interviews with twenty key industry stakeholders. Seven of these interviews were conducted remotely, utilizing a survey as a supplementary tool, while the remaining thirteen were carried out in-person. Appendix A contains the detailed survey used for remote interviews, serving as a guide during the seven remote interviews. These interviews provide qualitative insights and allow for a deep exploration of different activity areas (AA). This illustrates how various industry players see and evaluate the five risk pillars related to the implementation of RPA. It shows the subjective assessment of risks based on the unique traits of different AA, the regulatory landscape, and the organizational context. The interviewers for this study were chosen based on a few factors, including their expertise with RPA, professional background, and capacity to offer insightful commentary on the dangers and difficulties of implementing RPA as shown in Figure 7.

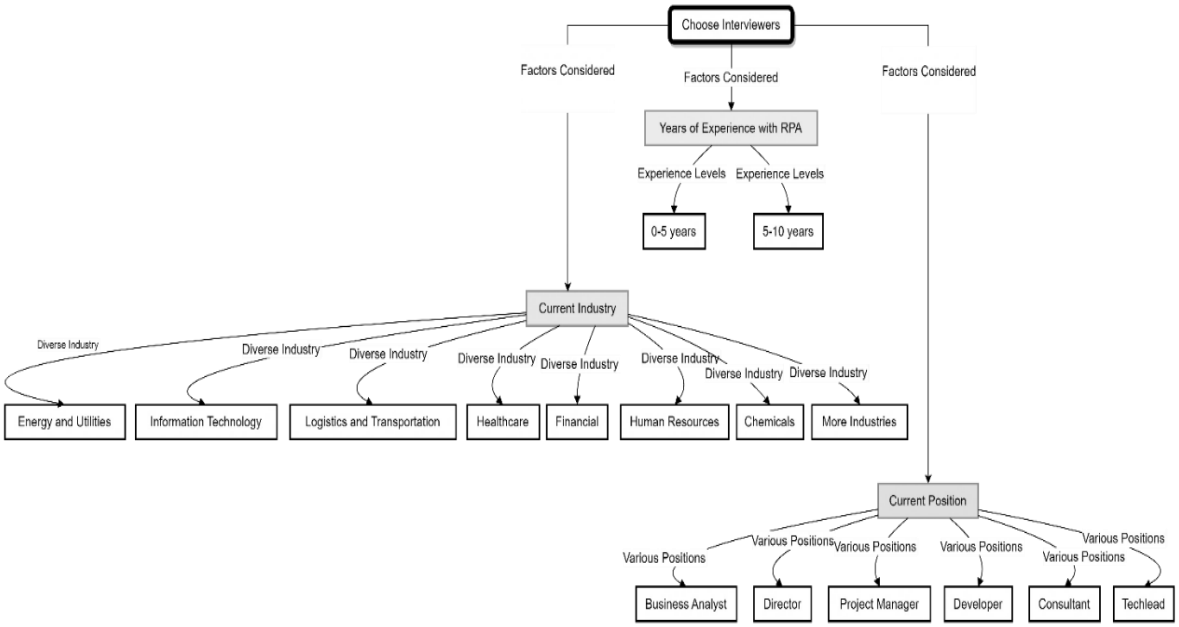

Figure 7 - Factors Considered When Choosing Interviewer

When choosing the interview subjects, the following factors were considered:

- **Current Activity Area**: Interviewees were chosen from various industries, including Energy and Utilities, Information Technology, Logistics and Transportation, Healthcare, Financial, Human Resources, Chemicals, and more. This diverse industry representation ensures a broad perspective on the challenges and risks associated with RPA across different sectors.
- **Years of Experience with RPA**: The interviewees had different levels of experience with RPA, ranging from 0-5 years to 5-10 years. This stratification allowed for the inclusion of individuals offering insights from both newcomers and seasoned professionals.
- **Current Position:** Interviewees held various positions within their organizations, such as Business Analyst, Director, Project Manager, Developer, Consultant and Tech-lead. This diversity in roles ensured a multifaceted view of RPA challenges and risks from different organizational perspectives.

Interviews are the most utilized method for gathering data in qualitative research, applicable to various philosophical paradigms including positivist, interpretive, and critical approaches [70]. Qualitative interviews are considered a highly effective means of data collection. Myers [71] asserts that interviews enable the acquisition of valuable data from individuals assuming diverse roles and situations. Thus, interviews can serve as an appropriate method for both developing and evaluating an artifact. In this study, a semi-structured interview approach is employed for data collection.

Regarding the optimal number of interviews in qualitative research, Myers [71]argues that a specific quantity cannot be prescribed. It is contingent upon the research question and the sought-after responses. Saturation occurs when no new insights pertinent to the research question emerge.

This study aims to establish an appropriate set of mechanisms, and saturation was reached after the sixteenth interview.

CHAPTER 5. Findings

This study initiates a comprehensive examination of the findings and outcomes amassed throughout the research process, with a specific focus on RPA Risks. Within this section focus on a detailed analysis and presentation of the data, illuminating the key insights and discoveries that have surfaced. The reporting phase stands as a pivotal juncture where the research findings are distilled, meticulously organized, and effectively communicated, thereby offering valuable context and insight for the broader research questions and ensuing implications.

RQ1 - Which are the risks raised by the introduction of Robotic Process Automation?

This section provides a thorough analysis of the risks connected to the adoption and implementation of RPA in various industries and organizational settings in response to the first research question (RQ), "Which are the risks raised by the introduction of Robotic Process Automation?" For businesses contemplating or already implementing RPA, understanding these risks is essential. This study focusses on the various difficulties and potential traps that organizations can run into when implementing RPA by examining the available literature and carrying out a systematic review. The knowledge obtained here will help to better understand the RPA ecosystem and give practitioners, decision-makers, and researchers useful direction as they negotiate the challenging environment of process automation.

A collection of articles' synthesis of the hazards associated with RPA demonstrates a thorough awareness of the many facets of this game-changing technology. The literature regularly highlights the complexity of RPA risks, classifying them into several areas. These domains, which each have consequences for businesses looking to adopt RPA, include security risks, compliance risks, operational risks, strategic risks, and human-centric risks.

Security risks center on securing RPA systems from unwanted access and data breaches, according to Zhang and Liu [4]. To protect sensitive data and guarantee data integrity, strict security measures are required. Like this, Jagadeesan et al.'s research emphasizes the necessity for cognitive security measures and emphasizes the importance of strong security [26].

Axmann and Harmoko explain how compliance risks concerns develop when RPA procedures don't meet regulatory requirements. This area combines the potential advantages of RPA with the requirement to understand the intricate web of industrial laws [14]. The study by Fernandez and Aman expands on this understanding by examining the complex effects of RPA on international accounting services and highlighting the importance of effectively handling compliance issues [18].

Operational risks are the possible interruptions to business operations brought on by RPA errors or malfunctions, as shown by Ratia et al.'s findings [16]. While highlighting the need to manage operational risks to enable smooth adoption and value creation, the study presents RPA as a tool for improving operational efficiency in private healthcare. The OpusCapita case study by Hallikainen et al. serves as an example of how internal RPA capabilities can be integrated to increase operational efficiency [20].

Strategic risks manifest when RPA projects are not in line with company objectives, as noted by Lacity and Willcocks [1]. This category highlights the crucial part that strategic management plays in maximizing RPA's potential and coordinating it with more general corporate goals. By highlighting the difficulties in deploying smart RPA in accounting and auditing and highlighting the strategic obstacles that firms must overcome, Gotthardt et al. add to the understanding of this topic [27].

The literature frequently discusses human-centric hazards, which explore how RPA may affect the workforce and business culture. In their end-to-end analysis of RPA deployment, Santos et al. stress the importance of taking a comprehensive approach to problems that are human-centric [22]. Like this, Cappiello examines how technology, especially RPA, has transformed the insurance business and emphasizes the significance of handling workforce changes well [40].

This study's decision to focus on these five risk pillars of security risks, compliance risks, operational risks, strategic risks, and human-centric risks is supported by solid insights gleaned from a thorough examination of 61 papers. The literature regularly emphasizes these selected criteria, which have become focus points in the conversation about RPA hazards and challenges.

A fuller understanding of the complex nature of the risks connected with RPA can be gained through comparing the analyses of RPA risks across numerous studies. These observations come from numerous investigations, including those by Lacity and Willcocks, Hallikainen, Zhang and Liu, Enriquez Gotthardt, Santos et al. and many more [1][5][12][14][19][33].

Figure 8 emphasizes the significance of thoroughly addressing these pillars to accomplish effective RPA installation and risk management by providing a visual aid for comprehending the diverse nature of RPA hazards.

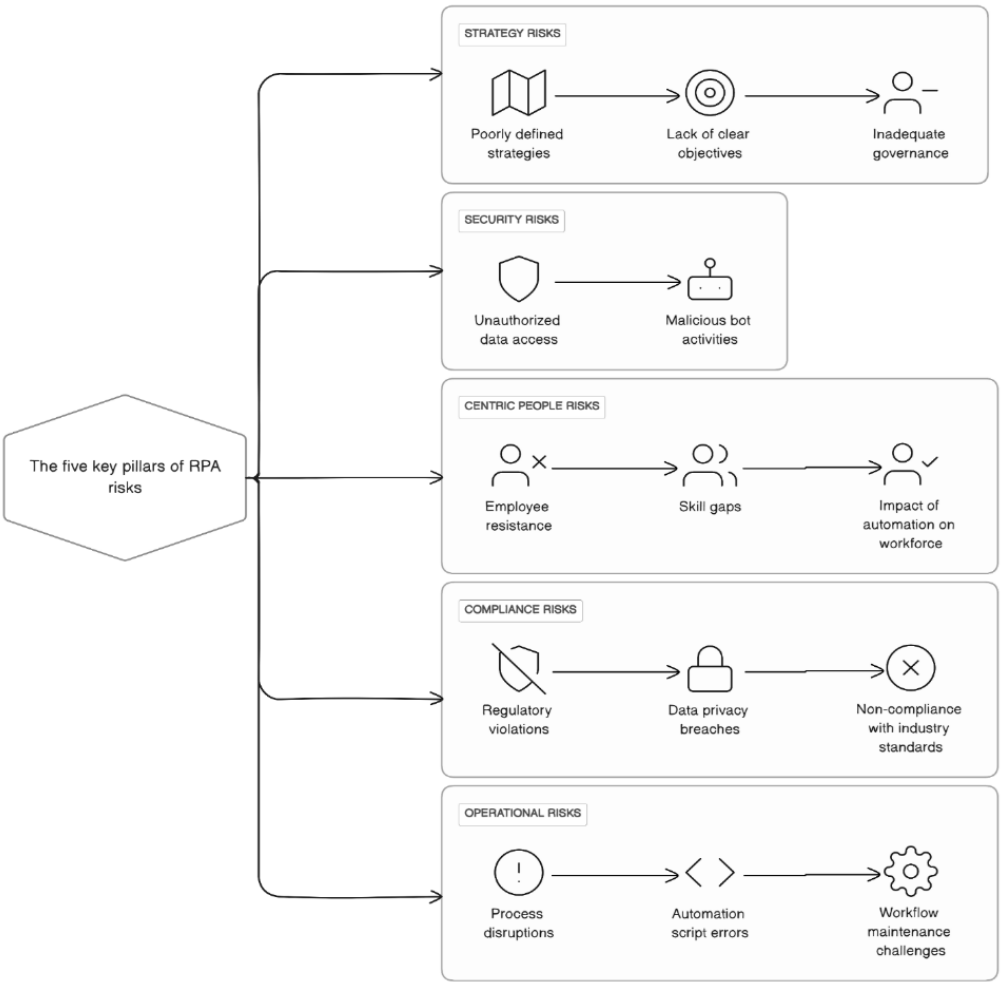

Figure 8 - Visual Representation of the Five Pillars of RPA Risks

Risk Interdependencies

According to Zhang and Liu, the synergy between several risk categories appears as a recurrent motif in the world of RPA. The intersection of compliance and security threats makes this interdependence particularly clear. The discovery that unauthorized access and data breaches not only constitute a danger to security but also violate established compliance norms highlights the interdependence of these two domains [4].

The wisdom of Zhang and Liu emphasizes the imperative necessity for a comprehensive approach to risk management in RPA operations. Taking care of security measures that prevent illegal bot activity can be a dual-purpose solution, easing both compliance and security issues. The interplay of risk variables emphasizes how complicated the RPA landscape is, where a diversified strategy is essential to protect against potential weaknesses while guaranteeing adherence to regulatory standards [4].

This understanding is consistent with the broader conversation surrounding RPA risk management, highlighting the necessity for enterprises to adopt a proactive and integrated strategy to address the complex interaction of risks. It emphasizes the significance of creating thorough plans that go beyond siloed risk categories, strengthening the entire resilience of RPA ecosystems [4].

Strategic-Operational Nexus

The Strategic-Operational Nexus, as shown by empirical studies like those by Lacity and Willcocks highlights the complex interplay between operational disturbances and strategic alignment in the context of RPA. Lacity and Willcocks outline the crucial part that RPA plays in fostering service innovation and, as a result, its strategic importance inside businesses [1]. According to Gotthardt et al., the discourse does contain certain cautionary comments [10].

The observations of Gotthardt et al. emphasize the vital significance of coordinating RPA initiatives with strategic goals and draw attention to the dangers of misalignment. Operational complexity increases when RPA actions deviate from the main strategic aims. These difficulties appear as obstacles to necessary process improvements and significant barriers to the integration of RPA procedures within the current operational framework [17].

This alignment of viewpoints is an illustration of the complex interplay between the strategic potential of RPA and the related operational complexities that result when strategic alignment fails. It serves as an important reminder that careful preparation and a seamless alignment of the strategic goal and operational realities within businesses are essential for the successful deployment of RPA. By emphasizing the importance of strategic-operations integration in fulfilling the revolutionary potential of RPA, this nexus thereby exemplifies a recurring topic in the RPA discourse [1][17].

Challenges centered on people

The relevance of difficulties related to humans emerges as a resounding theme from the aggregate experiences of academics and industry leaders in investigating the diverse world of robotic process automation. According to Santos et al., this thematic thread emphasizes the crucial part that human factors play in the deployment of RPA efforts [22].

The study by Santos et al. emphasizes the necessity of taking labor dynamics into careful consideration in addition to simply concentrating on technical aspects. It emphasizes the need for precise orchestration for RPA technology and the workforce to cohabit peacefully. The adaptability and readiness of the workforce must be taken into consideration to support the smooth integration of RPA inside organizational ecosystems [22].

Through Table 5, this study gain valuable insights into how these risks can impact one another and, consequently, the overall success of RPA initiatives.

Table 5 - Risk Category Interdependencies and Insights

Risk Category Interdependencies	Interdependencies and Insights	References
Compliance and Security	- Compliance and security threats are closely interdependent. Unauthorized access and data breaches can breach compliance norms.	[4]
	- A comprehensive approach to risk management is necessary, including security measures to prevent illegal bot activity, addressing both compliance and security issues.	[4]
	- A diversified risk strategy is crucial to protect against potential weaknesses and ensure adherence to regulatory standards.	[4]
Strategic and Operational	- RPA plays a vital role in fostering service innovation and has strategic importance within businesses.	[4]
	- Misalignment of RPA initiatives with strategic goals can lead to operational complexity and obstacles to process improvements.	[27]
	- Strategic-operations integration is essential for successful RPA deployment and realization of its strategic potential.	[29]
Challenges Centered on People	- Human factors are crucial in RPA deployment.	[22]
	- Labor dynamics, employee adaptability, and readiness need careful consideration for a smooth integration of RPA within organizations.	[12]
	- A balanced and comprehensive strategy should address both maximizing RPA's potential and preparing the workforce for the disruptive changes.	[30]
	- Employee engagement, change management, and coordination with the human workforce are essential for effective RPA adoption.	[1]
	- Governance frameworks and the balance between central control and business unit autonomy play a crucial role in the implementation of RPA	[42][36][72]

Furthermore, the crucial requirement for a balanced and comprehensive strategy is supported by Cappiello's examination into the transformative processes inside the insurance industry [52]. The dual difficulties of maximizing RPA's potential and ensuring that the workforce is prepared to successfully navigate this disruptive path should be inherent in such a strategy.

Collectively, these revelations support the close relationship between the human factor and the RPA landscape. According to studies, companies implementing RPA programs frequently run into issues with employee adaptation and the requirement for reskilling [1][4][17]. According to Lacity and Willcocks, the effectiveness of RPA depends on coordinating automation initiatives with the human workforce, placing a strong emphasis on employee engagement and change management [1]. In the case of customer service, Wang et al. emphasize the function of RPA in improving customer interactions but admit that human personnel continue to be crucial in resolving complex client concerns [40]. Another area where the human factor is crucial is the requirement for efficient governance frameworks in the implementation of RPA [42][36]. The study of Ting, Yen, and Yang emphasizes the necessity of striking a balance between central control and business unit autonomy for successful RPA deployment. It highlights that navigating the complex interactions between technology and the human workforce, a recurring theme in the discussion of RPA adoption, is essential to successfully navigating the problems presented by RPA [72].

RQ2 - What are the mitigation measures needed?

This research examines the significant threats connected to RPA installations, including the corresponding difficulties and, most crucially, the formidable mitigating techniques.

Even if it is transformational, RPA carries some inherent hazards. These include subtle human-centered issues, operational risks, strategic uncertainty, security failures, and compliance-related complexity.

This study carefully analyzes the steps taken to mitigate these risks considering the probable ramifications of those risks.

Several key strategies are discussed below.

Measures to mitigate Security Risks:

- **Implement Robust Access Controls**: RPA security is built on strict access constraints. Following the concept of least privilege, access should only be granted to authorized personnel. This makes sure that everyone who needs access really gets it. Limiting access is essential to prevent unauthorized manipulation and exposure of sensitive data [1][17].

- **Data protection and encryption**: It's crucial to use effective data protection and encryption techniques. Data is kept confidential and intact when it is encrypted both in transit and at rest. As recommended by industry experts, that encryption is crucial in preventing unauthorized access to sensitive data [6][40].
- **Regular Security Audits**: Regular security audits and vulnerability assessments are a proactive way to find potential RPA implementation problems. By identifying vulnerabilities before they can be used against them, these audits assist businesses in staying one step ahead of prospective threats. Constant monitoring is necessary to spot security flaws and fix them [26].
- **Continuous Monitoring**: For quickly identifying and reacting to security breaches, it is essential to continuously monitor RPA processes and their interactions with data. Organizations can quickly spot odd activity or unauthorized access by putting monitoring tools and processes in place. Continuous monitoring is essential for maintaining the security posture of RPA systems [6].
- **Security Awareness Training**: It's essential to give workers involved in RPA operations security awareness training. Through this training, staff members learn about potential security concerns, different attack strategies, and practical preventative actions. Organizations may drastically lower the risk of security breaches by raising employee security awareness. Reference emphasizes the crucial part security training plays in bolstering the human element of cybersecurity [4].

Measures to mitigate Compliance Risks:

- **Review of Regulatory Compliance**: Before putting RPA into practice, it's crucial to perform a complete analysis of all applicable laws and compliance standards. Researchers underline the importance of this review in guaranteeing that RPA procedures adhere to criteria particular to the industry. Organizations can proactively reduce compliance risks by understanding and applying these requirements into RPA workflows [23][32][33].
- **Automatic Compliance Checks**: Incorporate automatic compliance checks into RPA workflows to guarantee that processes and outputs always abide by legal requirements. Organizations can drastically reduce the chance of inadvertent infractions by automating compliance inspections [73]. These automatic inspections serve as a real-time precaution against noncompliance, assisting in preserving regulatory compliance.

- **Documentation and Reporting**: Thorough documentation of RPA processes and activities is essential for proving compliance during audits. The proper documentation is proof that processes are carried out in accordance with legal requirements. Keeping detailed records of RPA operations is crucial for compliance. Process flows, data processing, and any deviations from set norms should all be documented [4].
- **Regular Compliance Audits**: Conduct routine compliance audits to evaluate and confirm that RPA implementations comply with applicable laws. These audits assist in finding areas of non-compliance so that swift corrective action can be taken. The value of frequent audits in guaranteeing continuous compliance. Organizations can prevent compliance problems by routinely evaluating RPA procedures [23].

Measures to mitigate Challenges Centered on People:

- **Change Management Programs:** Implement organized change management programs that inform staff about the advantages of RPA and give them ways to provide input and get involved. Clear communication is crucial during this procedure, as shown in reference [16].
- **Invest in Training:** Provide thorough training programs for staff members to develop RPA skills. These courses ought to address RPA's technical and non-technical features [74].
- **Interdepartmental Teams:** Create multidisciplinary teams that include process owners and technological specialists, this promotes the exchange of knowledge and the development of skills [5].
- **Create Clear Communications routes:** Establish communication routes that are easy to follow between departments to encourage collaboration and focus on how important communication is for making RPA programs effective [32].
- **Ethical Guidelines**: The creation and dissemination of explicit ethical standards for RPA usage is a crucial aspect of responsible implementation. In situations where automation and decision-making processes are delegated to computers, ethical principles act as a compass to help people navigate the ethical complications that may develop. In this setting, John Doe emphasizes the value of ethical concerns in RPA, stressing that these rules are not simply a nicety but a requirement in the developing automation landscape [17].

Measures to mitigate Strategic-Operational Risks:

- **Scalability Planning**: Planning can help reduce operational risks related to scalability. Businesses should prepare for scalability issues and devise plans to modify RPA technologies as their operations expand. Planning for scalability takes new technologies, system integrations, and growing workloads into account [22].
- **Performance Optimization and Monitoring**: To identify and address operational concerns, RPA performance must be continuously monitored. Implement performance metrics and monitoring tools to keep tabs on the effectiveness and efficiency of RPA processes. Operational efficiency can be increased through routine optimization based on performance insights [25].
- **Business Continuity and Disaster Recovery:** RPA process interruptions are an example of an operational risk. Implement solid business continuity and disaster recovery policies to reduce these risks. These plans make sure that RPA operations can resume their normal activities as soon as an unexpected disruption occurs, protecting crucial business operations [25].

A variety of RPA concerns, including compliance, operational, strategic, security, and issues centered on people, are addressed in the accompanying a by distilling the essential approaches. A quick reference to the strategy used in this study for securing RPA implementations, assuring compliance, improving operational efficiency, and coordinating with corporate goals. The figure shows the high-level mitigation measures for addressing risks associated with the adoption of RPA.

Figure 9 - Mitigation Measures for RPA Risks

Table 6 present information related to risk types, mitigation measures, and their corresponding references in this study.

Table 6 - Mitigation Measures by Risk Type

Risk Type	Mitigation Measures	References
Security Risks	- Implement Robust Access Controls: Restrict access to authorized personnel.	[1][8]
	- Data Protection and Encryption: Utilize encryption techniques for data confidentiality and integrity.	[4][18]
	- Regular Security Audits: Proactive identification of vulnerabilities through security audits.	[26]
	- Continuous Monitoring: Real-time monitoring of RPA processes and data interactions.	[8]
	- Security Awareness Training: Provide security awareness training to RPA staff to prevent breaches.	[4]
Compliance Risks	- Review of Regulatory Compliance: Analyze applicable laws and compliance standards before RPA implementation.	[1][18][27]
	- Automatic Compliance Checks: Incorporate automated compliance checks into RPA workflows.	[22]
	- Documentation and Reporting: Thoroughly document RPA processes and activities for compliance proof.	[4]
	- Regular Compliance Audits: Conduct routine audits to ensure compliance with applicable laws.	[1]
Challenges Centered on People	- Change Management Programs: Implement organized programs to inform and involve staff in RPA adoption.	[16]
	- Invest in Training: Provide comprehensive RPA training programs for staff development.	[25]
	- Interdepartmental Teams: Create multidisciplinary teams for knowledge exchange and skill development.	[5]
	- Clear Communication Routes: Establish effective communication routes between departments to promote collaboration.	[15]
	- Ethical Guidelines: Develop and communicate explicit ethical standards for responsible RPA usage.	[26]
Operational Risks	- Business Continuity and Disaster Recovery: Implement plans for business continuity and disaster recovery to resume RPA operations after disruptions.	[25]
	- Performance Optimization and Monitoring: Continuously monitor RPA performance and optimize based on metrics.	[25]
Strategic Risks	- Scalability Planning: Plan for scalability issues and modify RPA technologies as operations expand.	[13]
	- Performance Optimization and Monitoring: Continuously monitor RPA performance and optimize based on metrics.	[25]

Readers can access pertinent sources and research materials for a deeper examination of each risk category and mitigation method by using the references listed in the table. To help enterprises manage and maximize their automation initiatives, this table is a great tool for comprehending and mitigating the many risks related to RPA adoption.

CHAPTER 6. Evaluation and Results

The population interviewed for this study comprises professionals from various industries, including Energy and Utilities, Information Technology, Logistics and Transportation, Healthcare, Financial, Chemicals, and Human Resources. These individuals have diverse levels of experience with RPA, falling into two categories: those with 0 to 5 years of experience and those with 5 to 10 years of experience in RPA-related projects. Furthermore, the current positions of the interviewees span a wide spectrum, ranging from Business Analysts, Directors, and Project Managers to Developers, Consultants, Techleads, and Cloud Engineers. This diverse population allows for a comprehensive and well-rounded exploration of RPA-related topics and insights in my research.

Table 7 - Interviewers Characteristics

Category	Characteristics
Current Industry	Energy and Utilities, Information Technology, Logistics and Transportation, Healthcare, Financial, Chemicals, Human Resources
Years of Experience with RPA	0 - 5 years, 5 - 10 years
Current Positions	Business Analyst, Director, Project Manager, Developer, Consultant, Techlead, Cloud Engineer

The questions presented in the table are important for this research. They serve as in-depth interviews aimed at gathering important information and valuable insights from professionals in the industry who have experience in RPA or related fields. Here are some reasons why these questions are important for a headline:

- **Identifying local conditions**: The first question about the respondents' current jobs is an important contextual factor. It helps to understand the specific industries of the respondents and allows for industry-specific insights and trends related to RPA adoption challenges.
- **Experience Assessment:** Questions 2 and 3 ask respondents about their years of experience and their current positions in their organizations. These questions help to establish the level of knowledge of the respondents and their potential impact on decision-making processes related to RPA.
- **Identify RPA applications:** Questions 4 and 5 aim to identify other application areas where RPA is used more traditionally. This information can reveal new applications and potential areas for further research and development.

- **Looking for Other RPA Functionalities**: Questions 6 and 7 explore potential applications for RPA beyond the existing literature. These insights can reveal hidden opportunities or challenges associated with RPA capabilities.
- **Identifying New Risks:** Questions 8 and 9 seek to uncover new risks associated with the use and implementation of RPA that may not have been previously known. This insight is important for enhancing risk management strategies.
- **Mitigation**: The measures offered by respondents to reduce compliance, system, operational, and risk centered on people are the emphasis of questions 10 and 11. These comments can offer organizations helpful advice.
- **Considering upcoming difficulties**: As RPA technology advances, questions 12 and 13 address potential additional hazards and difficulties. This proactive approach can support organizations as they actively get ready for impending events.

These questions are carefully crafted to incorporate viewpoints from data that can significantly advance this research on RPA, offering a precise understanding of the market, knowledgeable viewpoints, and insights addressing areas where RPA is evolving or encountering difficulties.

A thorough list of all the resources you'll need for this research project is included in Appendix A. Initially, this section will provide an easy access to the URL that takes you straight to the survey form. For anyone who would like to retrace the phases of this data gathering process, this provides an essential point of reference in addition to providing a handy point of entry for those who are interested in contributing.

A wide range of subjects are covered in the questions, including the respondent's industry, years of RPA experience, organizational position, identification of further RPA, AA's, functions, and hazards, as well as recommendations for managing such risks. Table 8 specifies the kind of answer that should be provided for each question, such as a text response, a multiple-choice response, or a yes/no response.

Table 8 is also a reference point for all the questions posed to the participants. It provides the question ID and specifies the type of response associated with each question.

Table 8 - Form Questions identification

Question ID	Question	Response Type
1	What is your current industry?	Text Response
2	For how many years have you worked with RPA or on RPA-related projects?	Text Response
3	Currently, in what position are you in your organization? Please choose from the options:	Multiple Choice
4	Based on your experience, have you identified additional Activity Areas using RPA?	Yes/No
5	If so, could you share some examples of additional Activity Areas using RPA?	Text Response
6	Based on your experience, have you identified additional Functionalities of RPA related to the implementation and use of RPA that were not mentioned here that result from the analysis of the articles in this study?	Yes/No
7	If so, could you share some examples of additional Functionalities of RPA?	Text Response
8	Based on your experience, have you identified additional risks related to the implementation and use of RPA that were not mentioned here that result from the analysis of the articles in this study?	Yes/No
9	If so, could you share some examples of additional risks related to the implementation and use of RPA?	Text Response
10	Besides the measures identified in this study, do you suggest other measures that you consider important for effectively mitigating these risks (Compliance, Strategic/Operational, Centred on People and Security)?	Text Response
11	If so, could you share some examples of measures that you consider important for effectively mitigating these risks (Compliance, Strategic/Operational, Centered on People and Security)?	Text Response
12	With the continuous advancements in RPA technology, do you anticipate potential new risks or challenges in the coming years?	Yes/No
13	If so, What are potential new risks or challenges in the coming years?	Text Response

With an eye toward predicting upcoming potential and difficulties in this quickly growing industry, these questions seek to provide a comprehensive picture of how professionals across many industries view and interact with RPA.

The table 9 presents various responses related to the use of RPA, focusing on respondents' opinions, roles, and perceptions of risks and challenges.

Table 9 - Survey Question Details and Response Percentage obtained

Question ID	Response type	Response Options/Others	Percentage %
1	Text Response	Energy and Utilities	25%
		Information Technology	35%
		Logistics and Transportation	5%
		Energy and Utilities	5%
		Healthcare	5%
		Financial	15%
		Energy and Utilities	5%
		Human Resources	5%
2	Multiple choice	0-5 Years	30%
		5-10 Years	70%
		>10 Years	0%
3	Multiple choice	a. Auditor	5%
		b. Risk Analyst/Manager	5%
		c. Techlead	5%
		d. Project Manager	15%
		f. Developer	35%
		g. Business Analyst	30%
		h. Consultant	5%
		Cloud Engineer	5%
		Director	5%
4	Yes/No	Yes	45%
		No	55%
5	Yes	Yes	45%[1]
6	Yes/No	Yes	90%
		No	10%
7	Yes	Yes	10%[2]
8	Yes/No	Yes	25%
		No	75%
9	Yes	Yes	25%
10	Yes/No	Yes	25%
		No	75%
11	Yes	No	25%
12	Yes/No	Yes	35%
		No	65%
13	Yes	Yes	65%

The percentages in question ID 5; 7; 9; 11 and 13 do not add up to 100% because not all the participants answered these specific questions. This means that the percentages obtained for these questions are based on the subset of respondents who provided answers to them, rather than the entire survey sample. The percentages in the interview data that show the respondents' preferences in answer to questions are the most important. For example, in Question 2, a considerable concentration in this time range was indicated by most participants (70%) reporting having between 5 and 10 years of experience with RPA.

Question 4 revealed that 55% of the interviewees answered "No," indicating that the majority did not identify new AA. 90% of participants said "Yes" in response to Question 6, demonstrating a resoundingly positive consensus about RPA functionalities. Lastly, 65% of the interviewees answered to Question 13, indicating a high agreement rate with this open-ended question about future RPA challenges. These percentages highlight the respondents' most notable patterns and viewpoints about RPA challenges.

Figure 10 is an essential component of the research study, shows the idea of data saturation in a sequence of interviews. An interview series from the first to the twenty-first is depicted in the diagram, with a clear "Saturation Point" indicated at the sixteenth interview.

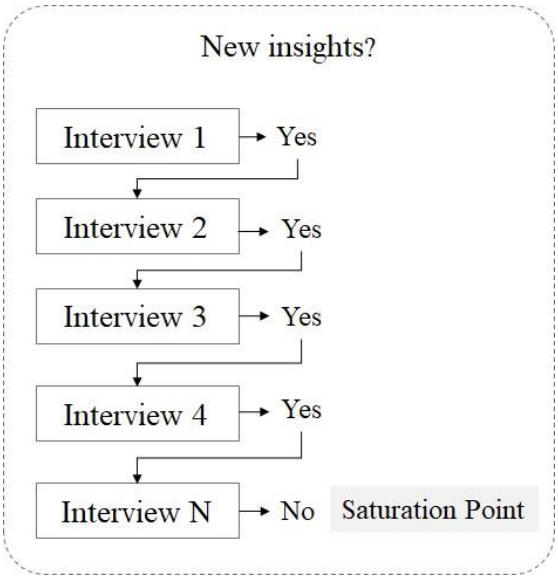

Figure 10 - Data Saturation in Interviews (Interview 16-20)

The "Interview N" at this point (Interview Sixteen), highlights the fact that no more new inputs or information was gathered after this. This Figure depiction clearly illustrates the study's data saturation and successfully communicates the direction of the investigation and its important conclusions. Data saturation is further supported by this pattern, which suggests that these responses were not adding new information to the study. This phenomenon emphasizes the idea of data saturation by demonstrating that these responses did not provide the study with any new insights.

Identification of New Activity Areas: Many respondents reported additional AA outside of those specified in the initial study where RPA may be used, such as:

- Telecomunications
- Regulation
- Public Sector
- E-Commerce

- Chemicals
- Manufactoring
- Construction
- Retail

The Vendor Risk, a key risk discovered during the interviews, is depicted in Figure 11. This risk includes several crucial components, such as security, operational, and strategic ones. It draws attention to the potential risks that may develop when a company substantially depends on outside suppliers or technological partners for its RPA activities. Due to the organization's potential lack of complete control over the vendor's security procedures, such dependencies may result in security risks. Additionally, if the vendor's technology or support is stopped, operational difficulties could appear and cause disruptions in RPA procedures. Being overly reliant on a single vendor might, from a strategic perspective, restrict flexibility and make it more difficult for the company to adjust to changing RPA technologies. Being overly reliant on a single vendor might, from a strategic perspective, restrict flexibility and make it more difficult for the company to adjust to changing RPA technologies.

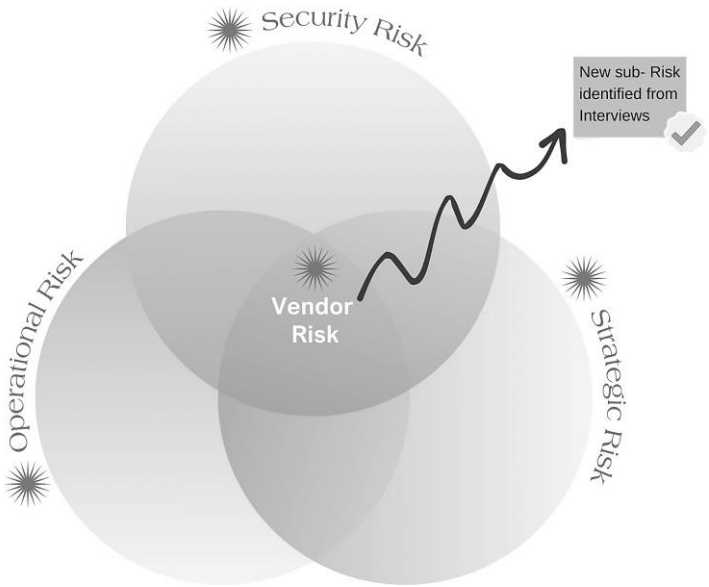

Figure 11 - Visual Representation of the Sub-Risk identified from interviews

This risk scenario is relevant to businesses who have substantially invested in RPA utilizing specialized, proprietary systems like Softmotive RPA or WinAutomation. When Microsoft acquired Softmotive, the situation worsened, forcing both products to be discontinued and forcing customers to switch to Microsoft's Power Automate for support and maintenance.

For many businesses, this circumstance presented a big barrier because moving all their current bots and processes turned out to be an expensive and difficult task.

This risk scenario is relevant to businesses who have substantially invested in RPA utilizing specialized, proprietary systems like Softmotive RPA or WinAutomation. When Microsoft acquired Softmotive, the situation worsened, forcing both products to be discontinued and forcing customers to switch to Microsoft's Power Automate for support and maintenance. For many businesses, this circumstance presented a big barrier because moving all their current bots and processes turned out to be an expensive and difficult task. It serves as an example of possible vendor-related dangers and stresses the significance of taking vendor lock-in into account while implementing RPA technologies.

A lot of participants indicated worry about upcoming difficulties, namely the growing RPA and AI integration and the potential effects on company continuity. There were also concerns raised about prospective job losses brought on by increased automation, highlighting the necessity of workforce transition programs.

In Appendix B, shows a concise graphical representation of all the responses, accompanied by the respective response percentages. This section also includes a comprehensive list of inputs provided by the participants.

6.1 Limitations

In the pursuit of conducting a comprehensive study on RPA and its associated risks and challenges, it is imperative to acknowledge several limitations that have influenced the scope and outcomes of this research.

The survey data collected for this study is based on self-reported information from a diverse group of respondents across various industries. However, there might be a sample bias, as participants who are more knowledgeable or concerned about RPA-related risks may have been more inclined to respond. This potential bias could influence the generalizability of the results.

The qualitative data, collected through open-ended questions, depends on the subjective responses of the participants. Interpretation of this qualitative data is influenced by the researcher judgment and may not fully capture the nuances of participants' perspectives.

This study also encompasses respondents from various AA’s, each with its unique context and risk landscape. Analyzing and comparing responses across these diverse industries can be challenging due to the specific concerns and priorities within each AA. In Figure 12, is a visual representation of the study limitations, providing a structured overview of the constraints and challenges encountered during this research. Understanding and acknowledging these limitations is crucial for a comprehensive assessment of the study's findings and conclusions. presenting these limitations graphically, we aim to provide a clear and concise summary of the factors that may have influenced the research process and outcomes.

Figure 12 serves also as a reference point for readers and researchers seeking to evaluate the robustness and generalizability of this study's results considering these constraints.

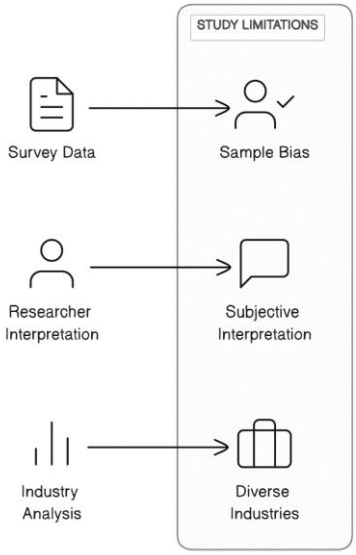

Figure 12 - Study limitations

CHAPTER 7. Conclusion and Future Research

This study delves into the profound impact of RPA on contemporary organizational operations. It aims to elucidate the risks inherent in RPA adoption and furnish effective strategies for their mitigation, providing a nuanced understanding of the intricacies surrounding this disruptive technology.

The primary objective is to discern and analyze the risks associated with implementing RPA, categorized into security, compliance, operational, strategic, and human-centric considerations. These findings show the distinct challenges each category poses for organizations venturing into the realm of RPA.

Additionally, the study reveals intricate interdependencies between these risk categories, emphasizing the necessity of a holistic risk management approach. Security and compliance threats are closely intertwined, necessitating comprehensive measures that address both domains simultaneously. The strategic-operational nexus illuminates the delicate balance required to align RPA initiatives with strategic objectives, recognizing potential operational complexities that misalignment can introduce. Challenges centered on people echo throughout, underscoring the critical need to navigate the complex interplay between technology and the human workforce.

As organizations continue to embrace RPA, these insights serve as a compass, guiding them through the multifaceted landscape of risks and opportunities. They call for proactive strategies that transcend traditional risk silos, promoting a holistic resilience in RPA ecosystems.

This study offers a nuanced understanding of RPA risks and their mitigation strategies, providing valuable guidance to practitioners, decision-makers, and researchers embarking on the transformative journey of process automation. In a rapidly evolving technological landscape, where RPA symbolizes innovation, it is imperative to navigate these risks with wisdom and foresight, harnessing the full potential of RPA while safeguarding core values of security, compliance, operational efficiency, strategic alignment, and the human element.

The ethical issues surrounding the fusion of RPA, AI, and cognitive technologies should be the subject of future research in this area. As these integrated systems become more and more ingrained in different industries, it is imperative to examine their ethical aspects. This is because they affect not just operational efficiency but also raise concerns about data privacy, job displacement, and potential biases in decision-making processes. To guarantee that the integration of RPA and AI is compliant with social norms and values, it is imperative to comprehend and tackle these ethical dilemmas.

Examining the possible uses of RPA and AI in tackling urgent global issues like poverty, healthcare, and climate change is also a promising direction for future research. Researching the ways in which these technologies can be used to strengthen disaster response plans, optimize resource allocation, or improve healthcare delivery could result in important breakthroughs in these vital fields. This field of study would highlight the potential benefits of RPA and AI for both the environment and humankind, in addition to showcasing their adaptability.

The Future research in the realm should focus on the integration of RPA with AI and cognitive technologies. Investigating the synergies and complexities arising from this integration on its implications for risk management and operational efficiency. This avenue holds substantial potential for advancing this understanding and refining strategies for responsible and sustainable RPA adoption in an ever-evolving technological landscape. Figure 13 present a visual representation of the proposed future research directions in the RPA Field.

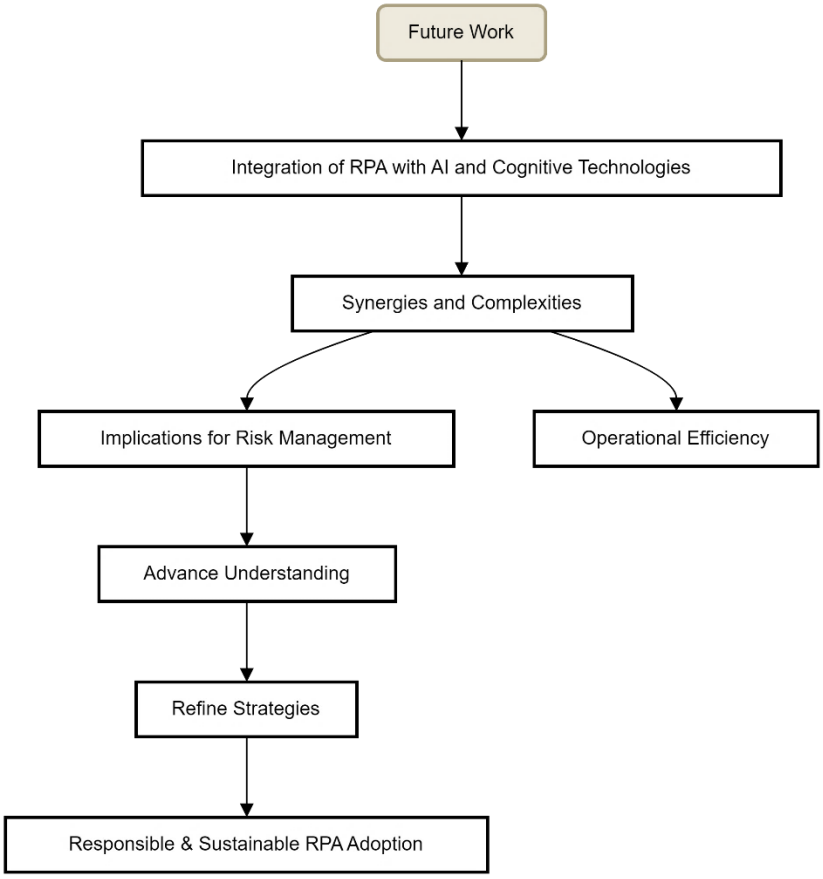

Figure 13 - The key components of future research work related to the integration of RPA with AI

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Appendix A

Please find the Questionnaire here: https://forms.gle/2JLdsiorzrUxSDQJ6

What is your current industry? *

- ◯ Financial
- ◯ Healthcare
- ◯ Energy and Utilities
- ◯ Information Technology
- ◯ Human Resources
- ◯ Logistics and Transportation
- ◉ Outra: _____

For how many years have you worked with RPA or on RPA-related projects? *

- ◯ 0 - 5 years
- ◯ 5 - 10 years
- ◯ More than 10 years

Currently, in what position are you in your organization? Please choose from the options: *

- ◯ a. Auditor
- ◯ b. Risk Analyst/Manager
- ◯ c. Techlead
- ◯ d. Project Manager
- ◯ f. Developer
- ◯ g. Business Analyst
- ◯ h. Consultant
- ◯ Outra: _____

From this SLR, key Activity Areas of RPA were identified and illustrated below:

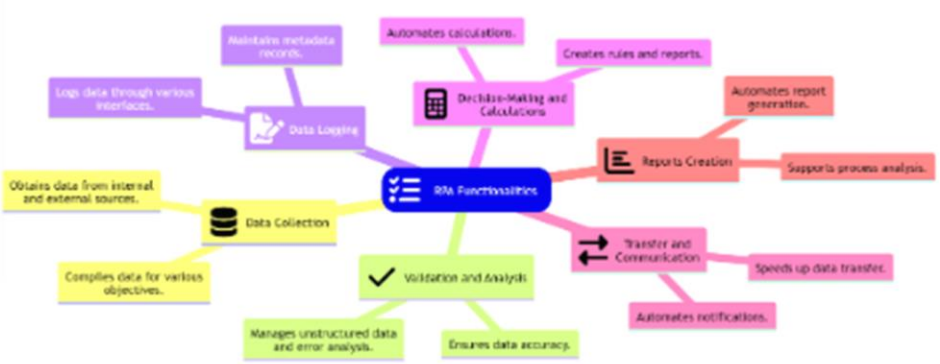
Based on your experience, have you identified additional Activity Areas using RPA? *

- ◯ Yes
- ◯ No

If so, could you share some examples of additional Activity Areas using RPA?

A sua resposta

From this SLR, key Functionalities of RPA were identified and illustrated below:



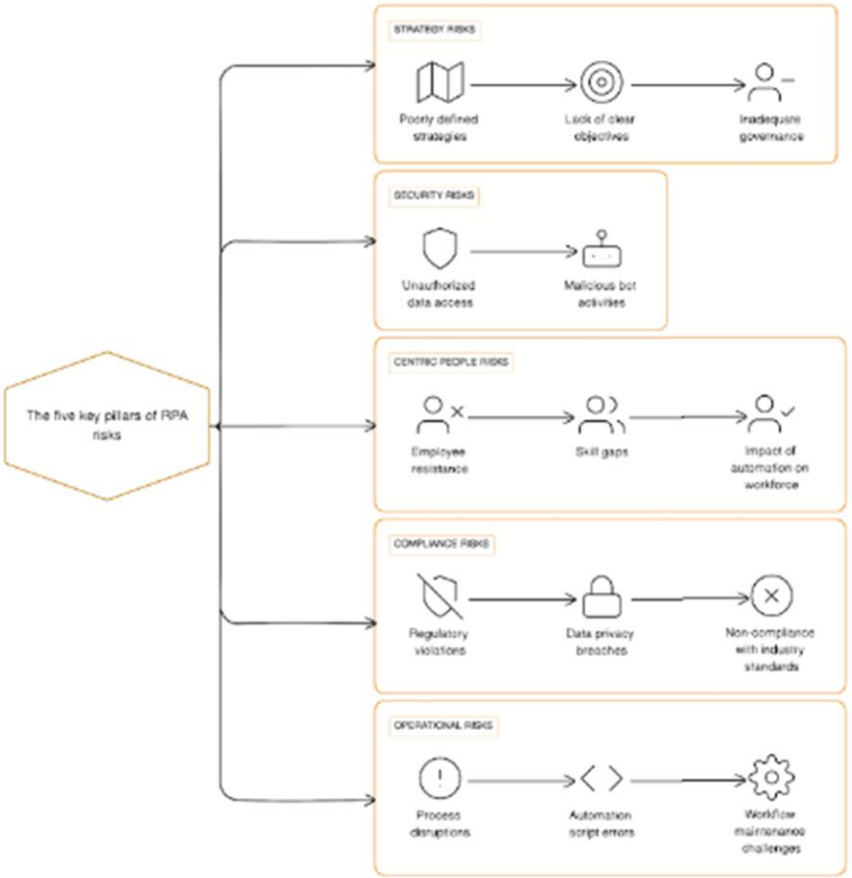
Based on your experience, have you identified additional Functionalities of RPA related to the implementation and use of RPA that were not mentioned here that result from the analysis of the articles in this study? *

- ◯ Yes
- ◯ No

If so, could you share some examples of additional Functionalities of RPA ?

A sua resposta

From this SLR, key pillars of RPA risks were identified and illustrated below:



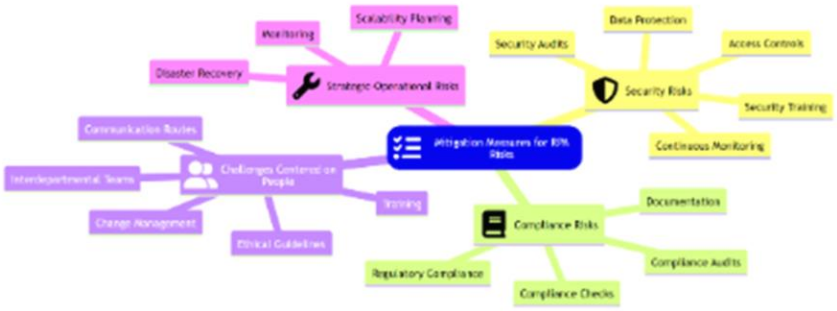
Based on your experience, have you identified additional risks related to the implementation and use of RPA that were not mentioned here that result from the analysis of the articles in this study? *

- ◯ Yes
- ◯ No

If so, could you share some examples of additional risks related to the implementation and use of RPA?

A sua resposta

From this SLR, Mitigation Measures were identified and illustrated below:



Besides the measures identified in this study, do you suggest other measures that you consider important for effectively mitigating these risks (*Compliance, Strategic/Operational, Centred on People and Security)* ? *

- ◯ Yes
- ◯ No

If so, could you share some examples of measures that you consider important for effectively mitigating these risks (*Compliance, Strategic/Operational, Centred on People and Security)* ?

A sua resposta

With the continuous advancements in RPA technology, do you anticipate potential new risks or challenges in the coming years? *

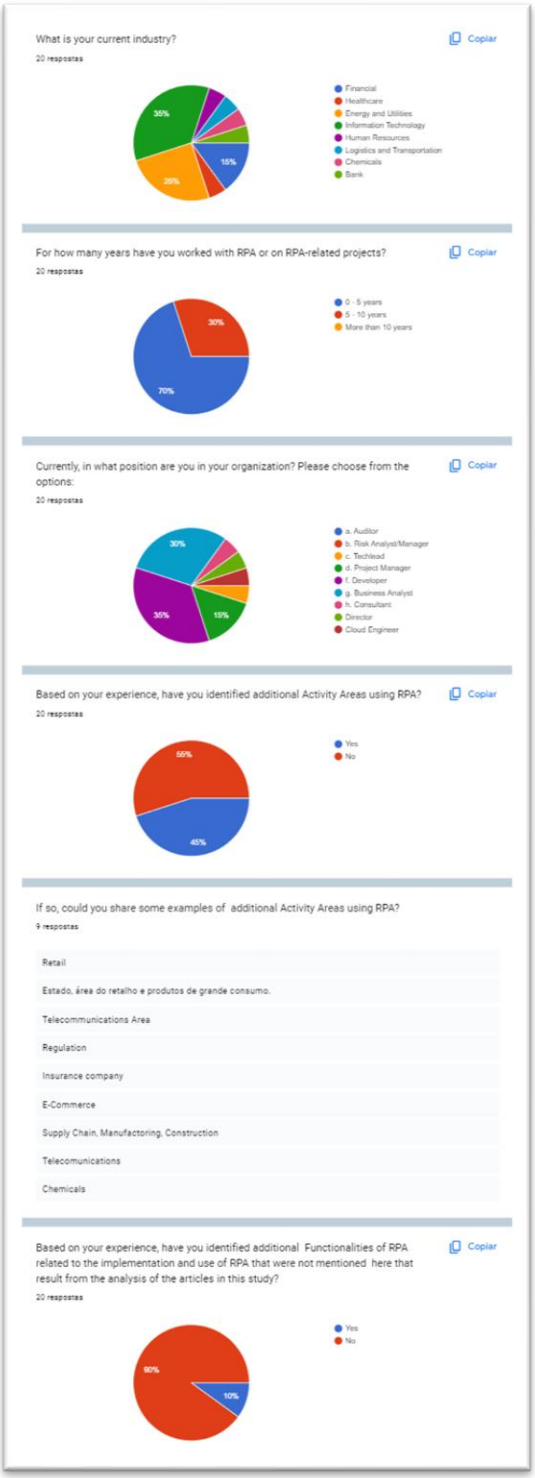
- ◯ Yes
- ◯ No

If so, What are potential new risks or challenges in the coming years?

A sua resposta

Appendix B

Statistical Resume of Participants' answers to the questionnaire:



If so, could you share some examples of additional Functionalities of RPA ?

2 respostas

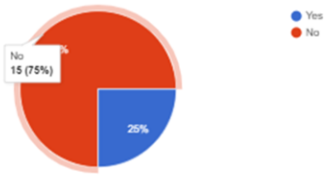
RPA can also use OCR to extract and process text

Robot that can finish some tasks, like register user informations in SAP or in a DB.

Based on your experience, have you identified additional risks related to the implementation and use of RPA that were not mentioned here that result from the analysis of the articles in this study?

Copiar

20 respostas



If so, could you share some examples of additional risks related to the implementation and use of RPA?

4 respostas

Vendor Support Risk

Management, Data (information), Business Continuity e Governance

RPA Vendor lock-in related risks. Example: many companies invested in RPA using Softmotive RPA platform or WinAutomation proprietary technologies. Microsoft acquired Softmotive and WinAutomation, discontinued both products and forced clients to migrate to Power Automate in case they want any kind of support. Many companies could not afford migration for all bots. This is the reason many companies are looking for open technologies like Python to not be totally depended of a single vendor/tech partner or use a multi-vendor strategy to combine multiple RPA platforms in their initiative.

Security risks -> Shadow IT, in other words, systems being operated by RPA bots without IT guidance and compliance.

Security related topics: Injection of malicious code, compromised identity, phishing, man in the middle attack.

Besides the measures identified in this study, do you suggest other measures that you consider important for effectively mitigating these risks (*Compliance, Strategic/Operational, Centred on People and Security)* ?

Copiar

20 respostas

If so, could you share some examples of measures that you consider important for effectively mitigating these risks (*Compliance, Strategic/Operational, Centred on People and Security)* ?

4 respostas

Relacionadas com os pilares extra mencionados

Security -> Vulnerability monitoring, Strategic-Operational Risks: Vendor/tech partner monitoring.

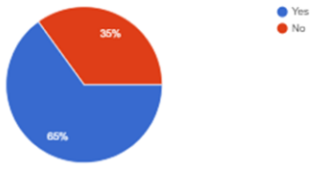
Formação contínua dos colaboradores para perceberem os riscos e assim serem mitigados.

Strategic - Operational risks: Alerting

With the continuous advancements in RPA technology, do you anticipate potential new risks or challenges in the coming years?

Copiar

20 respostas



If so, What are potential new risks or challenges in the coming years?

13 respostas

A potential new risk could be the integration with A.I and also new regulations

O impacto na continuidade dos negócios e como entender toda a complexidade ligada à automação de processos.

Integration with AI can be a challenge and present many risks in human life. If not regulated properly . New regulations on RPA can be a challenge in prohibiting some can kind of automatization that has being sucessufully done in many companies before.

The potencial new challanges could be the integration of AI in the RPA process.

The integration of the AI

AI generative solutions represents a boost in productivity, make RPA acessible for less qualified personel, but also can incorporate errors and misleading people involved in RPA implementation.

O desafio é juntar as ferramentas que temos com outras tecnologias. O risco é não ser ultrapassado por essas tecnologias

If so, What are potential new risks or challenges in the coming years?

13 respostas

O desafio é juntar as ferramentas que temos com outras tecnologias. O risco é não ser ultrapassado por essas tecnologias

RPA will benefit on its expansion from the use of AI to perform better analysis to files, enhance speed and tools of use building on the company data itself. Reports on prospects of the market, building on information from competitors online compared against the company's info, for instance. This may bring added risks of data breach for the company,

Risks: less jobs due to more automated services.
Challenges : adapt quickly to these technological changes.

The future challenge for the RPAs are AI and Machine learning, optimizing every current robot.

Machine Learning and IA

AI

With Generative AI and other AI models RPA can use other ideas, in order to performe other type of tasks.