I Z A Institute
of Labor Economics
Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 18314

The Rise of Robotic Process Automation in Chile: Technological Adoption, Perceptions, and Potential Social Impact in a Post-COVID Economy

Francisco Ríos
Camilo Peña
Pablo Agnese

DECEMBER 2025

I Z A Institute
of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 18314

The Rise of Robotic Process Automation in Chile: Technological Adoption, Perceptions, and Potential Social Impact in a Post-COVID Economy

Francisco Ríos
Universidad de Playa Ancha

Camilo Peña
Universidad de Playa Ancha

Pablo Agnese
UIC Barcelona and IZA

DECEMBER 2025

ISSN: 2365-9793

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

The Rise of Robotic Process Automation in Chile: Technological Adoption, Perceptions, and Potential Social Impact in a Post-COVID Economy

This paper reviews RPA adoption in Chile and estimates its future social impact. A survey of 103 professionals—mainly from services, mining, and engineering—shows most firms have not begun implementing RPA. Early adopters prioritize strategic alignment, tech readiness, and scalability, citing benefits such as productivity and efficiency, but also challenges like skills gaps, maintenance, and job-loss concerns. Large companies in IT, mining, and services lead post-Covid adoption. Using data from 1.5M firms, the study estimates that full RPA deployment in purchasing could displace up to 75,000 jobs, with a social cost of USD 1B, largely affecting services, commerce, healthcare, the public sector, and engineering. The Metropolitan Region would be most impacted, potentially losing over 45,000 jobs. The findings show how developing economies can adopt advanced technologies while managing social impacts.

JEL Classification: L86, M15, O32, O33

Keywords: robotic process automation, adoption, perceptions social impact, Chile, Post COVID-19

Corresponding author:
Pablo Agnese
UIC Barcelona
Inmaculada 22
08017 Barcelona
Spain
E-mail: pagnese@uic.es

1.- Introduction

Robotic Process Automation (RPA) is an emerging technology that uses software robots to automate repetitive and rule-based tasks or processes in a business or organization. In this regard, it allows organizations to automate repetitive clerical tasks by executing scripts that encode sequences of fine-grained interactions with Web and desktop applications (Leno et al., 2021). RPA aims to replace people by automation done in an ‘‘outside-in’’ manner (van der Aalst et al., 2018), where these robots are programmed to perform tasks such as data entry, data manipulation, calculations, form filling, document generation, and other repetitive tasks that were previously done by humans. In this way, RPA not only increases efficiency and accuracy but also allows employees to focus on more complex and strategic tasks (Slaby, 2012; Lacity and Willcocks, 2015; Suri et al., 2017; Tran and Ho Tran Minh, 2018).

RPA is not limited to a specific industry or type of task. It can be applicable in various sectors, including banking and finance, insurance, healthcare, customer service, human resources, supply chain management, and more (Pramod, 2022; Marciniak, & Stanisławski, 2021; Doğuç, 2021; Deloitte, 2019b). Likewise, RPA can be implemented at different scales, accommodating both small and large organizations, but although its potential is visible in bigger companies, it is not so obvious in small and medium-sized enterprises (Erdmann & Sandkuhl, 2023).

As illustrated in Figure. 1, the number of publications related to RPA technology has been increasing during the past 10 years, with an exponent growth during Covid-19. However, even when RPA has been gaining attention in corporate digital transformation, academic research still lacks a theoretical analysis (Hofmann et al., 2020).

Pre-Covid-19 RPA implementations in Chile and the world were already considerable (Deloitte, 2018a; 2019a; 2019b), with companies in financial services, telecommunications, and manufacturing sectors implementing solutions to automate repetitive tasks. Nevertheless, Covid-19 altered many organizations' operations and accelerated the failure of those without resilient supply chains. The pandemic thus accelerated the adoption of RPA in multiple economic sectors, including areas previously unexplored or slow to implement (Tailor and Kuman, 2021; Susilo et al, 2021; Lambourdiere et al., 2022; Greca et al, 2022; Kedziora & Smolander, 2022; Flechsig et al., 2022; Cervenka & Hlavaty, 2022; Güner & Han, 2023; Bogoevici, 2024).

Although RPA implementations are still in their early stages, and up to 50% of RPA-related projects could fail due to their novelty and varying implementation approaches (Herm, et al, 2023), there is potential for further growth as organizations adopt RPA-driven solutions and increase awareness of their benefits.

As RPA continues to evolve, business leaders must strategically embrace this technology, striking a balance between automation and human-centric functions to gain a competitive edge in the dynamic business landscape (Antwiadjei, 2021). It is however important to highlight the necessity of treating the implementation of RPA technology in the organization as a change, and not only as an IT solution (Pypłacz & Žukovskis, 2023).

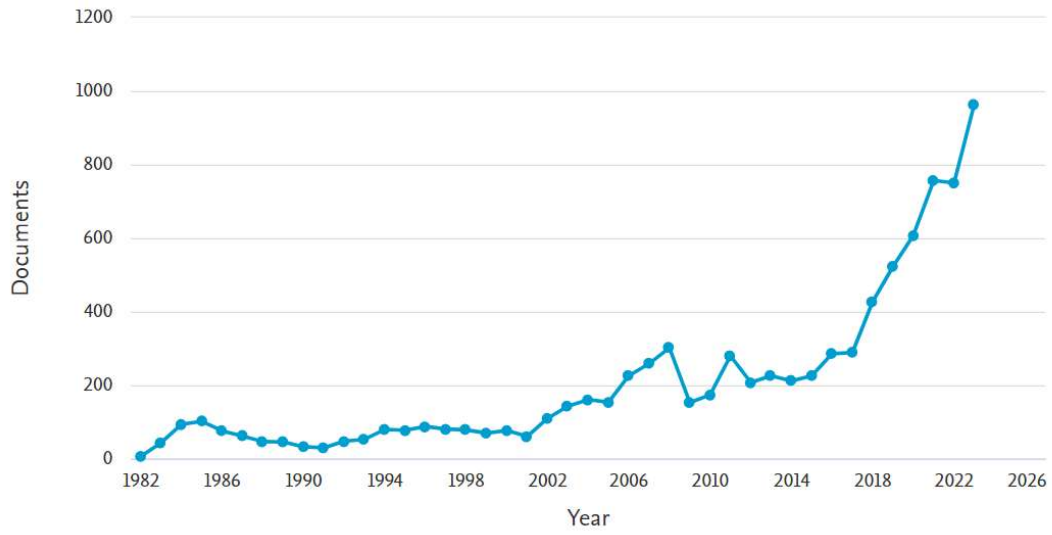

Figure. **1** Number of RPA technology related publications by year (Source: Scopus; search keyword: "RPA").

This paper provides a bibliographic overview about RPA and raises both qualitative and quantitative questions at the exploratory level. We seek to analyze and assess the executives' perceptions about RPA adoption in Chile's different industrial sectors post Covid-19, while estimating its social and technological impact.

RPA implementation in Chile could offer insights into how developing economies are adopting advanced technologies. As a regional tech leader, Chile serves as a model for other Latin American countries, demonstrating how emerging markets can integrate automation. Therefore, this research is particularly significant for key sectors like mining, construction, and services, which are vital to Chile's economy and involve labor-intensive processes that can benefit greatly from RPA.

We try to provide some answers to the following questions: How has RPA been developing around the world? What are the main challenges and problems? Within this context, are Chilean companies familiar with RPA technology? What is the status of RPA implementation in Chile in post-Covid times? Are large companies leading RPA implementation in Chile? What about small companies? What is the economic sector most involved in RPA implementation? What is the social impact of full RPA adoption in Chile's economy? What is Chile's region most affected by jobs losses resulting from RPA implementation?

There is abundant literature about RPA applications in the world[2] and several studies have been done by market research companies related to opinions and perceptions about RPA adoption in different industrial sectors worldwide (Deloitte, 2017; 2018a, 2018b; 2019a; 2019b; Larios Soldevilla & Atoche Socola, 2023). Our paper fills the gap in the literature by focusing on post Covid-19 Chile.

In the first part of this research, we developed a survey which sought to reflect the opinions and perceptions around RPA technology in Chile. The survey was made up pf 12 questions, and it was conducted in the second semester of 2023, after the Covid-19 alert was called off in Chile[3]. The questionnaire was sent to a sample of professionals and executives, including experts in supply chain, IT consultants, procurement managers, contracts managers, engineering, and innovation consultants involved in different industrial sectors.

We surveyed 103 participants in total, primarily from Chile (97%). The majority were decision-makers, including team members, with only 7% of them working in IT. The respondents were mainly from service, mining and engineering & the construction sector, with less relevant sectors including service, engineering & construction, and finance. Our results show that the most relevant criteria for RPA implementation in Chile were alignment with strategic objectives, technology implementation process, and future opportunities for integration with other technologies. Most participants have not started RPA implementation yet, with 6% using it on a considerable scale. Benefits of RPA include work optimization, greater productivity, and time optimization. Future challenges include developing new labor skills, robot maintenance, and long-term unemployment. Disadvantages include the need

[2] See Aguirre and Rodríguez, (2017); Anagnoste, (2018); Cewe, et al. (2017); Forrester (2014); Gadre et al. (2017); Hallikainen et al., (2018); Lacity et al., (2016); Leopold et al., (2018), Mindfields. (2015) among others.

[3] On August 31, 2023, the health alert for Covid-19 and respiratory diseases that had been in force since February 5, 2020 ended (Minsal, 2023).

for rule-based tasks, increased process complexity, and the creation of new tasks for workers. Essential factors for optimal RPA implementation include high process standardization, interaction with multiple systems, and tasks prone to human errors. Future opportunities include integration with text mining and data analysis. Finally, our results suggest large companies have the largest level of RPA integration, in which the IT sector is leading in the implementation of this technology, followed by mining and service.

In the second part, data on 1.5 million of companies operating in Chile—including sector, workforce, salaries, and regional GDP—were collected from different sources, to assess the economic and social impact of large-scale job losses due to RPA adoption at both national and regional levels. Our findings suggest RPA implementation in purchasing could displace up to 75,000 jobs, mainly in services, commerce, healthcare, public administration, and engineering, with a social cost of USD 1 billion. The Metropolitan Region would be most affected, potentially losing over 45,000 jobs, or 0.8% of its GDP.

Our findings show that RPA implementation in Chile is growing steadily, although adoption is still in its early stages, with significant potential for further growth. However, this technological integration could also bring a negative social impact in the Chilean economy in the long term. Our research highlights how developing economies could adopt advanced technologies, while facing negative externalities and balancing automation with social impact management.

This paper is organized as follows. We describe the study context about Chile's RPA adoption in section 2. We present our methodology, including the literature review, the executives survey and the social impacts of RPA integration in section 3. Our literature review and a full-fledged empirical analysis are shown under section 4. We present our discussions in section 5, while conclusions are shown in section 6. Finally, section 7 discusses the implications and section 8 our study's limitations.

2.- Description of the Study Context

2.1.- Robotic Process Automation: Global Trends and Emerging Adoption in Chile

According to Manikandan (2024), the global RPA market size was valued at USD 1.57 billion in 2020 and is expected to grow at a compound annual growth rate (CAGR) of 32.8% from 2021 to 2028. In this context,

consulting companies have conducted studies (Deloitte, 2018b) showing that RPA is becoming a strategic or enterprise-wide initiative, with 53% of respondents already adopting it and 19% planning to do so in the next two years[4]. Thus, RPA is expected to deliver a significant portion of current transactional activities, with an average of 20% of full-time equivalent capacity provided by robots. Regarding economics, the payback period for RPA implementation is just under 12 months, with an average of 9.3 months. However, organizations are continuing to invest in RPA, with 78% expecting to significantly increase investment over the next three years. RPA continues to outperform expectations in non-financial benefits such as accuracy, timelines, flexibility, and improved compliance, with 61% reporting cost reductions being met or exceeded. This has led to increased job satisfaction and the redeployment of the human workforce to higher value-added activities.

Similar studies (Deloitte, 2019b) have also showed that RPA implementations are reported to have a high success rate in meeting expectations globally (76 percent), with 41 percent of respondents indicating RPA met expectations and 35 percent indicating RPA exceeded expectations[5]. Globally, and across all regions, the most common reason for using RPA is to reduce costs and increase productivity (80 percent), with Europe and APAC both above the global average at 83 percent. The second most common reason for implementing RPA is to tighten data security and business control (69 percent).

In this regard, the implementation of RPA in Chile is growing steadily. As in many countries, organizations in Chile are increasingly recognizing the benefits of RPA, including improved efficiency, cost savings, and increased accuracy in business processes.

While RPA adoption in Chile was not as widespread as in the US, or even Latam (See Table 1), several companies, particularly those in the financial services and telecommunications sectors, have been actively implementing RPA solutions (Larios Soldevilla & Atoche Socola, 2023). These organizations were leveraging RPA technology to automate repetitive and rule-based tasks, thereby freeing their employees to focus on more strategic and value-added activities.

---

[4] This survey involved over 400 global organizations, analyzing responses from various industries worth £1,500 billion (Deloitte, 2018b).

[5] This survey includes responses from more than 1,200 executives and senior business leaders across all major global regions, with strong representation from every major industry (Deloitte, 2019b).

Table 1. Technology implementation levels (Deloitte, 2019a)[6].

Country	Implementation	In Process
Global	25%	33%
US	30%	24%
Latam	17%	37%
Brazil	20%	27%
Mexico	14%	47%
Chile	16%	32%

Although there is little literature focused on Chile's RPA implementation in large and SME companies, there is significant potential for further growth in the long term. Organizations are gradually adopting RPA solutions, and as awareness about their benefits increases, it is likely that more companies across various industries will embrace RPA in the coming years.

2.2.- Economic Impacts of Robotic Process Automation in the World: Productivity Gains and Employment Shifts

One of the most significant benefits of RPA lies in its ability to enhance efficiency and productivity across industries and economic sectors (Alberth and Mattern, 2017; Madakam et al., 2019, William & William 2019; Ko, 2020; Hyun et al., 2021; Jaiwani and Gopalkrishnan, 2022; Saha, 2023; Lo et al., 2024; Huda et al., 2025; Razak et al., 2025). There is currently a growing demand for professionals with RPA skills, including RPA developers, RPA architects, and RPA project managers (Taulli, 2020; Aryal, 2021; Zhang, C., & Vasarhelyi, 2022; Nahak et al., 2023; Padmanabhan, 2023; Lebens et al.,2023).

[6] The survey includes responses from 167 executives and senior business leaders in Brazil, Chile, and Mexico, with strong representation from every major industry (Deloitte, 2019a). In this way, 25 of surveyed are from Chile.

It is known that the use of RPA allows employees to focus on more relevant tasks and, in many organizations, employees are being redeployed to more meaningful, value-adding roles, while new teams focus on automation governance, bot maintenance, while process designs are being formed. (Slaby, 2012; Lacity and Willcocks, 2015; Suri et al., 2017; Tran and Ho Tran Minh, 2018; Antwiadjei & Najaf, 2023).

However, while RPA's contribution to productivity and new job creation is clear, its impact on current employment presents a more nuanced picture. Concerns about job displacement are particularly relevant in industries that depend heavily on clerical and administrative work like accounting firms (Jacob, n.d.; Thompson, 2018; Lui & Shum, 2022; Kaur et al., 2024; Altarazi et al., 2024; Sharma, 2025). As software robots increasingly handle routine functions, certain positions may indeed become obsolete in the future (Lamberton et al.,2017; Yarlagadda, 2018; Tofan, 2024; Kumar at al., 2025).

3.- Methodology

3.1.- A Literature Review

This overview was carried out through an iterative process of defining appropriate research terms and reviewing the literature to develop a deep analysis of this technology. The details of the research methodology utilized in this paper are presented in Table 2.

Table 2. Details of the bibliographic review conducted in this research.

Stage	**Description**
Search methodology	The literature review considered publications about RPA over the last 10 years, from 2013 to 2023. The search included different points of view such as technology, applications, integration, economic feasibility, perceptions, challenges and market surveys. An initial search was carried out through the Google Scholar and Scopus citation databases to identify relevant publications. The list of papers was obtained from different publishers, including magazines, companies, and universities.

Methodology implementation	The literature search was conducted using Boolean keyword combinations "(robotic process automation OR RPA)". The keywords used were "RPA challenges", "RPA integration", "RPA perceptions", "RPA survey", "RPA market", "RPA Economic feasibility", "RPA technology".
Reviewing, refining, and filtering database	The papers identified in the search were analyzed and evaluated by reviewing abstracts and conclusions. The full text was read for relevant articles. Less relevant papers were filtered out after being read in full based on academic judgment.

After that, a quantitative and qualitative research at the exploratory level was done, seeking to analyze and assess the status of robotic process automation technology in purchasing processes in different sectors in Chile.

3.2.- Survey Application

Several surveys by global institutions were first reviewed (Deloitte, 2017; 2018a, 2018b; 2019a; 2019b; Larios Soldevilla & Atoche Socola, 2023). After that, a survey to assess the implementation of RPA technology in Chile was developed, which seeks to analyze opinions and perceptions about RPA adoption in Chile's different industrial sectors. The details of the survey application are presented in Table 3.

Table 3. Details of survey application conducted in this research.

Stage	**Description**
Survey Validation	To ensure the validity and reliability of the survey, we adopted a rigorous design and validation process. First, the survey questions were developed based on a thorough literature review of RPA adoption and feedback from a panel of subject-matter experts, ensuring content validity. After that, a pilot study was conducted with experts from the academy, RPA specialists, and

	professionals from the industry to refine the wording of questions, improving clarity and comprehensiveness.
Survey Application	The survey was blind and confidential, and it took 5 minutes to answer. Concerning the structure, it consisted of 12 questions. It was conducted in the second semester of 2023 (Post Covid-19), using Google Forms as the survey tool[7]. The sample was selected using a randomized strategy and the questionnaire was sent to a sample of professionals and executives, including, experts in supply chain, IT consultants, procurement managers, contracts managers, engineering, and innovation consultants involved in different Chile's industrial sectors[8]. The questionnaire was also made available through LinkedIn. In addition, the support from stakeholders in Chile's supply chain industry was secured, as to inform the community about the execution of the survey. For details see Appendix 1.
Population and Target Size	According to the Servicio de Impuestos Internos's database[9], as of 2022, there were approximately 1,508,032 registered companies in Chile's different economic sector, of which 1,076,391 had not dependent workers and 431,641 had dependent workers. Microenterprise (77%), Small & Medium (17.5%), medium ($.4%) and large company (1.2%)

[7] https://docs.google.com/forms/d/e/1FAIpQLSfMH-Z7TwdLz2tUaGy_Wp4zG83xfYtkBU6ebZwn_dNiaSB7fA/viewform

[8] In a similar way as Fragapane et al. (2023).

[9] Servicio de Impuestos Internos" (SII) is the Chilean Internal Revenue Service, responsible for administering and collecting taxes in Chile. It's a government agency that oversees tax compliance, collects taxes, and provides tax-related services to individuals and businesses.

3.3.- Social Impact of RPA Integration in Chile

Information was collected on all companies operating in Chile with the aim of characterizing them by economic sector, number of workers, salaries, and regional Gross Domestic Product (GDP). This information will help to understand the distribution and economic impact, as well as the social consequences of massive job losses resulting from the integration of Robotic Process Automation (RPA) across different economic sectors in the country, both at the national and regional levels. The details of companies operating in Chile are shown in Table 4 and Figure 2.

Table 4. Details of gathering information on companies operating in Chile.

Stage	**Description**
Identification of Information Sources	The following main official sources, which provide updated and reliable data, were used: • Servicio de Impuestos Internos (SII): provides tax statistics, economic activity classification (GIRO), and sales figures. • Instituto Nacional de Estadísticas (INE): offers data on employment, salaries, business structure, structural surveys, and regional GDP. • Central Bank of Chile provides macroeconomic data, including national and regional GDP broken down by sector.
Data Collection and Extraction	With the sources identified, data was collected from publicly available datasets or through formal information access requests. This collection involved downloading files from institutional websites or, when necessary, submitting requests to obtain more detailed microdata. During this stage, it was crucial to ensure that the data was up to date as of 2022 (date of the survey) and that it was comparable across sources. It was also verified that the data was available by region, economic sector, and company size (based on annual sales and number of employees).
Classification and Standardization of Information	Once the data was obtained, it was classified and standardized. For this: • The industrial classification used in the survey was applied to group companies into economic sectors uniformly.

	• Companies were grouped by region according to Chile's administrative divisions. • Companies were segmented by size (micro, small, medium, and large), based on the criteria set by the Ministry of Economy. This classification allowed for an orderly and coherent comparison of companies according to their economic and labor impact.
Data Consolidation, Validation, and Cleaning	At this stage, all the information was consolidated into a single database. A data cleaning process was carried out to correct errors, remove duplicates, and standardize formats. In addition, cross-validation among sources was conducted to detect inconsistencies or significant discrepancies.
Analysis and Visualization of Results	Once the data was cleaned and consolidated, analysis was performed simulating seral scenarios and assuming 1% workers are purchasing staff. Finally, tables and graphics were generated to clearly interpret the information.

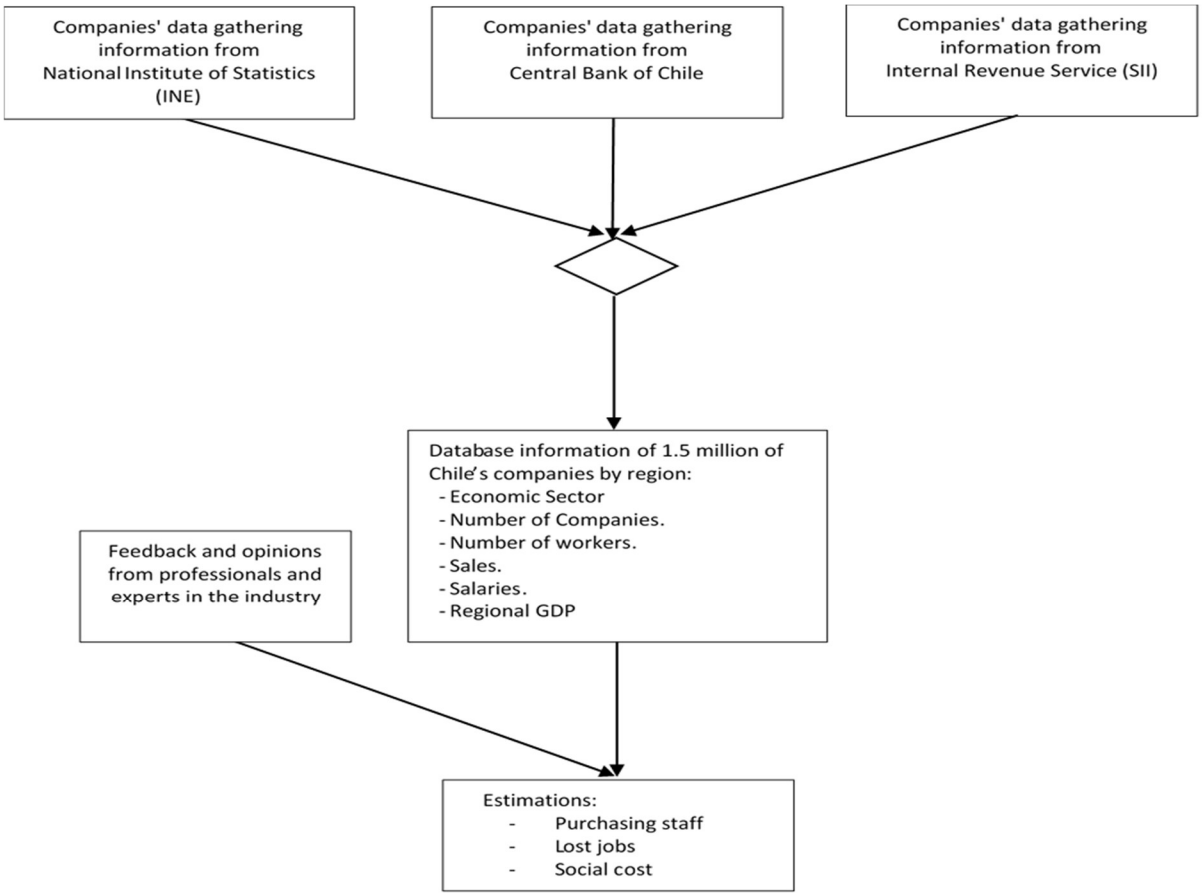

Figure 2. Information gathering procedure on companies operating in Chile.

4.- Results

4.1.- Literature Review

4.1.1.- Robotic Process Automation Technology

Robotic Process Automation uses software robots or bots to automate repetitive and rule-based tasks within business processes. RPA bots mimic human actions within computer systems, interacting with software applications and systems to perform tasks such as data entry, data manipulation, document processing, calculations, and more.

RPA bots can be programmed to follow predefined rules and workflows, allowing them to automate tasks that previously required human intervention. They can extract data from various sources, complete forms, perform calculations, and even communicate with other systems or applications. In addition, it is known that RPA bots can

work with existing software applications without the need for complex IT integration or significant changes to existing systems.

In this way, RPA integrates with systems through the application's user interface (UI). Therefore, RPA bots interact with systems and applications through their UI, just like a human would. In addition, bots can transfer data between different applications through the UI (Asatiani and Penttinen, 2016; Lacity et al., 2016)

Currently, RPA technology has gained popularity across industries and is used in various functions such as finance, human resources, customer service, supply chain management, and more. It is often seen as a stepping stone towards digital transformation and intelligent automation, as it provides a foundation for organizations to optimize processes and pave the way for further automation initiatives. In this way, an overview about RPA technology is summarized in Appendix A2. (see Table A1).

According to Santos et al. (2020) some of the main criteria that a process must fulfil to be successfully automated by RPA includes voluminous transactions, frequent interaction with multiple systems, use of systems with a stable environment, ease of decomposition into unambiguous rules, no need or limited work intervention, limited need to handle exceptions , awareness of current costs, tasks prone to human errors, high process maturity, high level of process standardization, high quality of data, low need of cognitive requirements and high availability of digital data. Other criteria for RPA implementation are summarized in Table A2 in Appendix 2 based on expert opinions.

Moreover, RPA offers several benefits and advantages to organizations, including increased efficiency, improved accuracy, reduced manual errors, enhanced productivity, 24/7 operations, scalability, and cost savings. These characteristics allow employees to focus on more strategic and value-added tasks by automating repetitive, mundane, and time-consuming activities.

When implemented correctly, RPA can have multiple advantages. As seen in Table A3 in Appendix 2, some include: 24/7 availability, scalability, and reusability, while also reducing errors and increasing productivity. It also offers FTE savings, system integration, and a quick ROI.

4.1.2.- Perceptions about the Use and Integration of RPA

Previous studies on the use and integration of RPA abound in the literature (Deloitte, 2017, 2018a, 2018b; 2019a; 2019b; Kregel et al., 2021; Cooper et al., 2022; Waizenegger & Techatassanasoontorn, 2022; Gomes & Seruca, 2023; Salih Aydıner et al., 2023). Perception could vary among different stakeholders, including organizations,

employees, and industry experts. For instance, Kregel et al. (2021) suggest that RPA can now be considered a mature technology, which significantly influences its own acceptance (Tschandl et al., 2021). Likewise, it is also positively changing the work employees perform, while improving employee career prospects (Cooper et al, 2022). Table A4 and Table A5 in Appendix 3 summarize some perceptions about RPA based on expert opinions and the literature overview.

Thus, perceptions about RPA may vary depending on the level of understanding, experience, and organizational objectives. While it is generally seen as a promising technology for process automation, stakeholders' perceptions can be influenced by factors such as industry, company culture, employee engagement, and overall digital strategy.

Finally, there are many challenges and opportunities that should be addressed, so that in the future the adoption and implementation of RPA solutions can be more widely implemented and understood. Challenges include robot maintenance, competition between robots and humans, error-prone synergies, robots with extensive access rights, unclear division of responsibilities, and lack of understanding of what RPA means and its application. Further, the integration with machine learning and artificial intelligence, analytics, process mining and text mining, are also opportunities to explore (Santos et al., 2020).

4.2.- Survey

4.2.1.- Sample Characterization

Our survey had a sample of 103 individuals and a response rate of approximately 0.24% of the total population of 431,641 companies operating in Chile. With a confidence level of 95%, our margin of error is approximately 9.6. Regarding the data on the origin of the participants (103), 97% of them were from Chile and 3% from oversees. In addition, most surveyed (73 survey respondents) were familiar with RPA and 27 of them did not know the technology. In this context, micro and large companies lead this preference (see Table 5).

As seen in Figure. 3; 28% of them were from micro and small companies, 17% from medium companies, and 47% from large companies. There are also participants from public services and independent professionals who represent around 8%.

Table 5. Respondents who are familiar with RPA technology by company size.

Company Size	Respondents	Percentage (%)
Microenterprise	17	85.0%
Small	4	44.4%
Medium	9	50.0%
Large company	40	83.3%
Public Service	0	0.0%
Professionals	2	66.7%
Others	1	25.0%
Total	**73**	**70.9%**

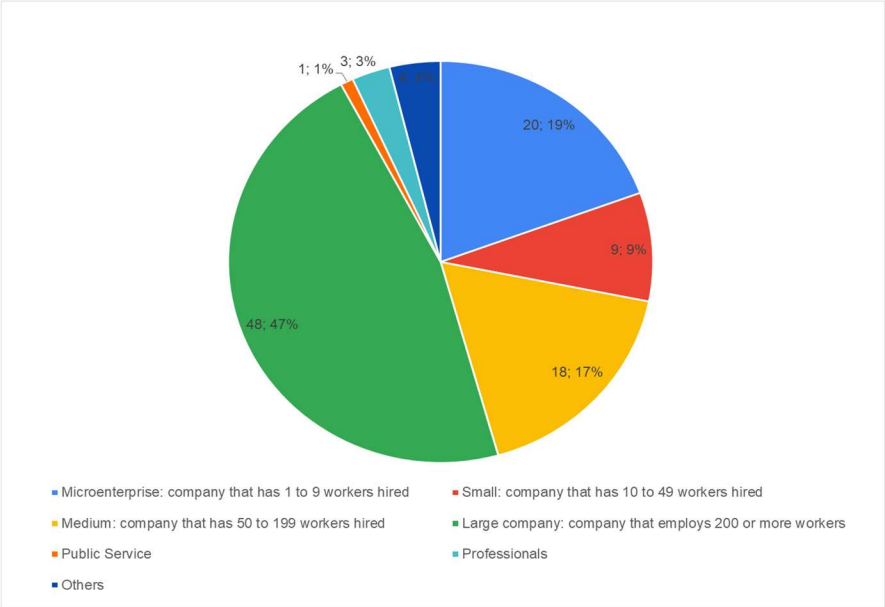

Figure 3. Respondents by Company Size.

Concerning the respondents' role, and even though most of them were decision makers or held a leadership position (including managers and team leaders), there were also a significant number of team members who participated in the survey (See Figure 4). In addition, it is also interesting to mention that around 7% worked in IT.

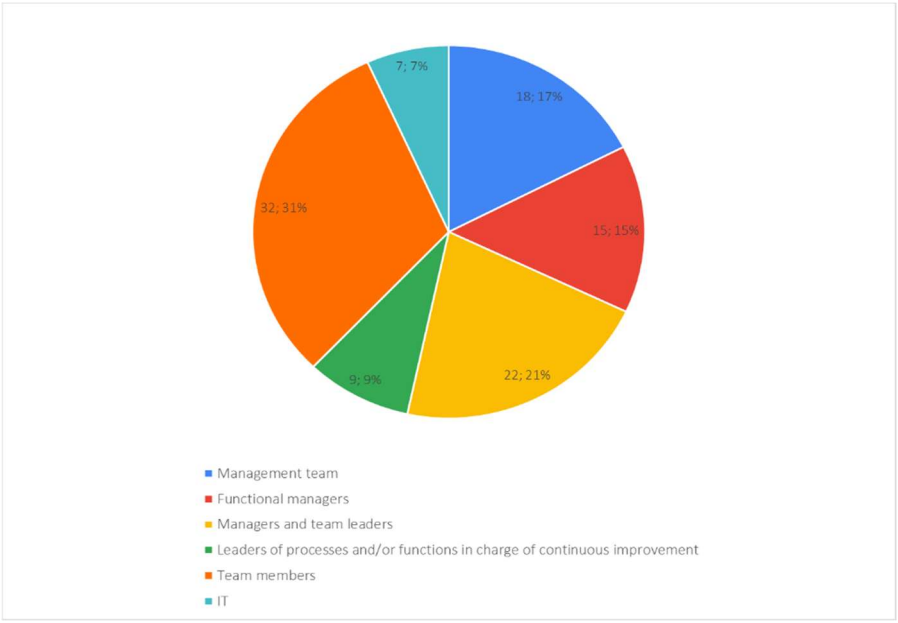

Figure 4. Respondents by role.

When classifying the respondents by industrial sector, they were mostly from services (38%), mining (20%), and engineering and construction (11%) (see Figure 5). Other less relevant segments were services, engineering & construction, and finance, which reached 15% of the total. The rest of the sectors represented less than 5% each, which amounted to 15% of the surveyed.

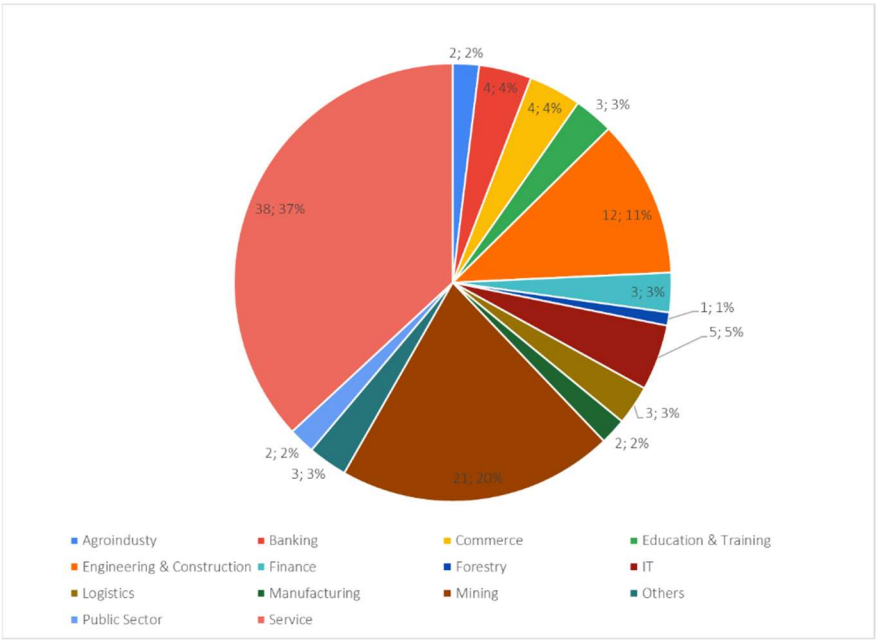

Figure 5. Respondents by industrial sector.

4.2.2.- Status of Implementation

As can be seen in Figure 6, the most relevant criteria for making the decision for RPA implementation were the alignment with the strategic objectives of the business, the process where technology would be implemented, and tactical issues like future opportunities to integrate RPA with other technologies. Nevertheless, it is interesting to note that more than half of the participants believed all alternatives could be considered as relevant criteria.

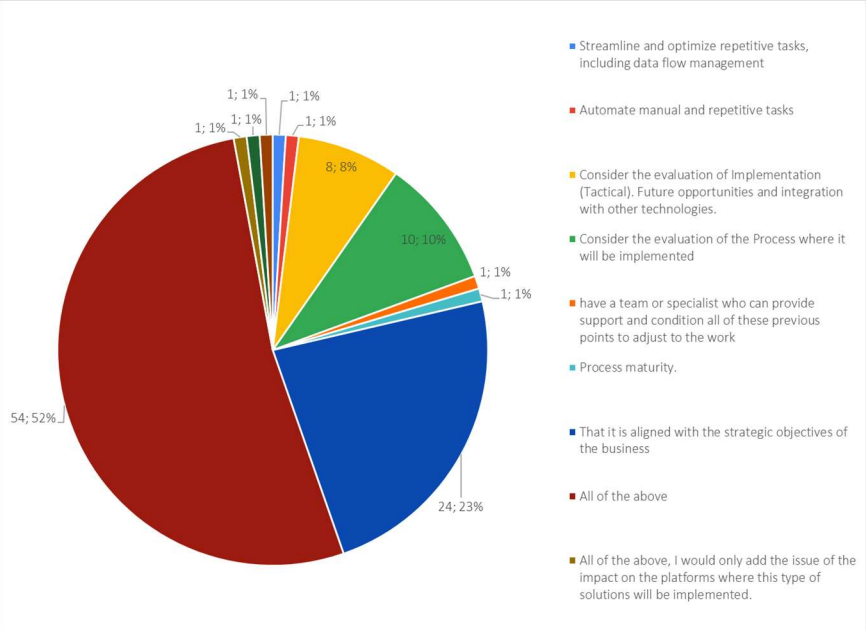

Figure 6. The most relevant criteria for making the decision for RPA implementation.

When considering whether RPA was being used to streamline processes within the companies, 66% had not yet started, 15% were developing a proof of concept, and 10% had already implemented the technology. Finally, 6% of participants were using RPA on a considerable scale with more than 50 robots (see Figure 7).

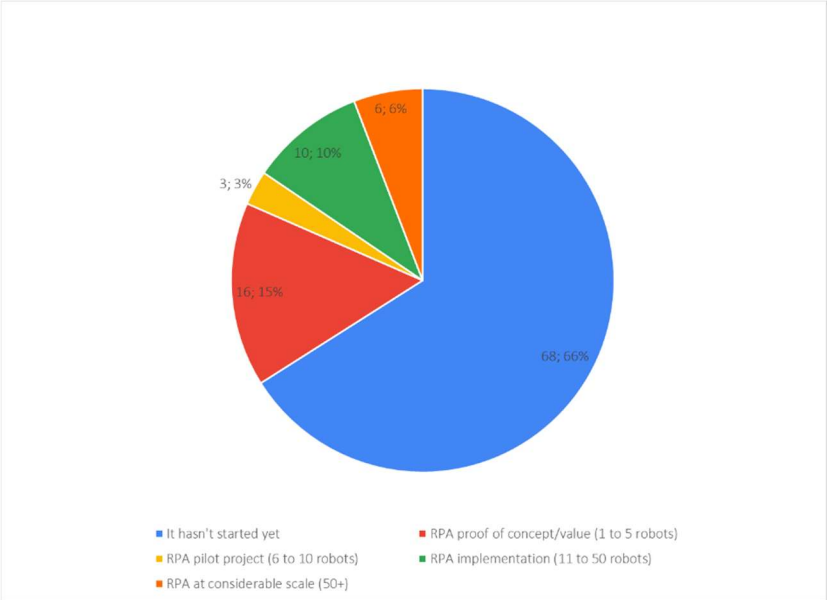

Figure 7. Status of RPA implementation in Chilean companies.

As we expected, large companies had the largest level of RPA implementation, while medium companies were barely developing proof of concept/pilot test in Chile. Most micro and small companies, in turn, have not yet started (see Table 6). As seen in Table 7, it seems that the IT sector has the most implementation development of this technology, followed by mining and service.

Table 6. Status of RPA implementation in Chilean companies by company size.

Status	**Micro**	**Small**	**Medium**	**Large**	**Public Service**	**Professionals others**	**Total**
It hasn't started yet.	15	8	13	26	1	5	68
RPA proof of concept (1 to 5 robots).	2	1	2	9	0	2	16
RPA pilot project	0	0	2	1	0	0	3

(6 to 10 robots).							
RPA implementation (11 to 50 robots).	2	0	0	8	0	0	10
RPA at considerable scale (50+).	1	0	1	4	0	0	6
Total	**20**	**9**	**18**	**48**	**1**	**7**	**103**

Table 7. Status of RPA implementation in Chilean companies by economic sector.

Industrial Sector	**Status of implementation**					**Total**
	It hasn't started yet	**RPA proof of concept/value (1 to 5 robots)**	**RPA pilot project (6 to 10 robots)**	**RPA implementation (11 to 50 robots)**	**RPA at considerable scale (50+)**	
Agroindustry	1	0	1	0	0	2
Banking	2	1	0	0	1	4
Commerce	4	0	0	0	0	4
Education & Training	3	0	0	0	0	3
Engineering & Construction	8	2	2	0	0	12
Finance	1	1	0	0	1	3
Forestry	1	0	0	0	0	1
IT	0	1	0	3	1	5

Logistics	3	0	0	0	0	3
Manufacturing	2	0	0	0	0	2
Mining	12	6	0	3	0	21
Others	2	1	0	0	0	3
Public Sector	2	0	0	0	0	2
Service	27	4	0	4	3	38
Total	**68**	**16**	**3**	**10**	**6**	**103**

4.2.3.- Perception about RPA

When assessing the benefits that the implementation of RPA would bring, we find that work optimization, greater productivity, and time optimization lead the preferences. Nevertheless, it is interesting to note that the ability of RPA to work 24/7 was ranked last (See Table 8).

Table 8. Benefits of RPA.

Benefits	**Responses**
Work optimization (employees dedicated to more relevant jobs).	67
Greater productivity (reduction of errors).	65
Time optimization (speed in completing tasks).	57
Costs reduction.	42
Work 24/7.	24
Others.	3

Table 9 showcases the future challenges RPA implementation might have. In this context, the development of new labor skills, robot maintenance, and unemployment generation in the long term lead the preferences. At the opposite end we find wide access rights for robots, the fact that robots can make mistakes faster, and lack of familiarity with the concept.

Table 9. Future challenges RPA implementation might have.

Challenge	Total
Development of workers' new skills to work with robots.	60
Robot maintenance.	40
Unemployment generation in the long term.	40
Unclear division of responsibilities between IT and business units.	32
Lack of understanding of RPA meaning and its application.	29
Human and robot competition.	26
Wide access rights for robots.	17
Others.	6
Robots can make mistakes faster.	5
Lack of familiarity with the concept.	1

Concerning the biggest disadvantage when implementing RPA, and as illustrated in Figure 8, 36% of participants believed that RPA was only suitable for processes that included rule-based tasks. In addition, 28% of them had the opinion that RPA increased process complexity and 18% of people believed creation of new tasks for workers was also a disadvantage, since robots had to be supervised or assisted by human workers.

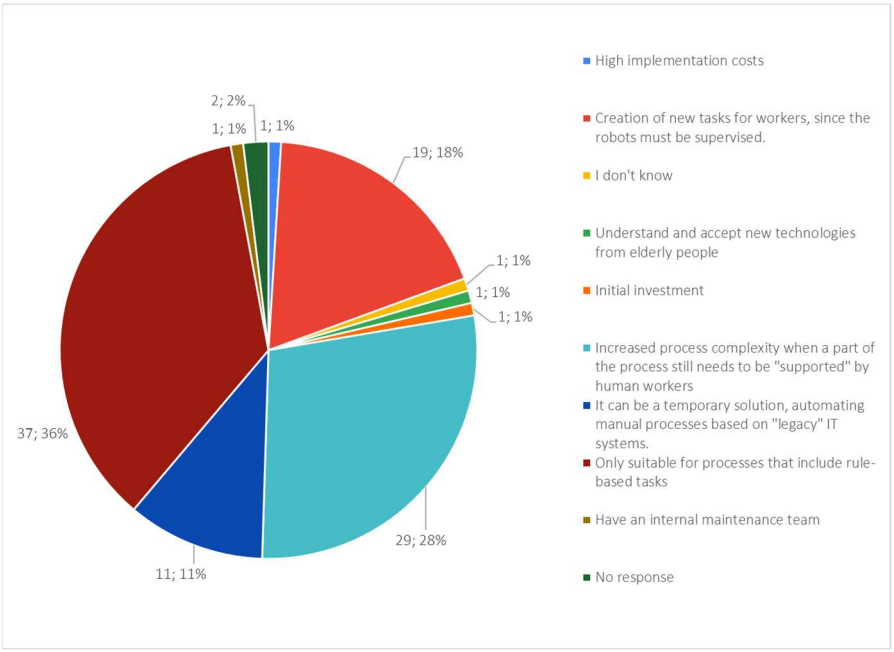

Figure 8. The biggest disadvantage when implementing RPA in Chilean companies.

Table 10 shows the essential factors for an optimal implementation of RPA in companies. The high level of process standardization, the interaction with multiple systems, and tasks prone to human errors lead the preferences of participants. At the opposite end, we found the low need for cognitive requirements and limited labor intervention were not considered as important factors to implement RPA.

Table 10. Factors for an optimal implementation of RPA in Chilean companies.

Factors	**Participants**
High level of process standardization	55
Interaction with multiple systems	49
Tasks prone to human errors	47
Large transactions	46
High-quality data	37
Low need for cognitive requirements	18
No need or limited labor intervention	13

Finally, Table 11 shows perceptions about future opportunities in using RPA. Not surprisingly, the integration with AI leads the preferences.

Table 11. Future opportunities in the use of RPA.

Opportunities	**Participants**
Integration with Text Mining	1
Integration with Data Analysis	11
Integration with Process Mining	36
Integration with Artificial Intelligence	55

4.3.- Social Impact of RPA Integration in Chile

4.3.1.- Distribution of Companies and Labor Force by Economic Sector

In our analysis we found that there are more 1.5 million companies registered in Chile, from which around 434 thousand have dependent workers (both permanent and fixed-term contracts). As seen in Figure 9 and 10, Region Metropolitana concentrates the high level of business and workers in sectors like services, engineering & construction and commerce.

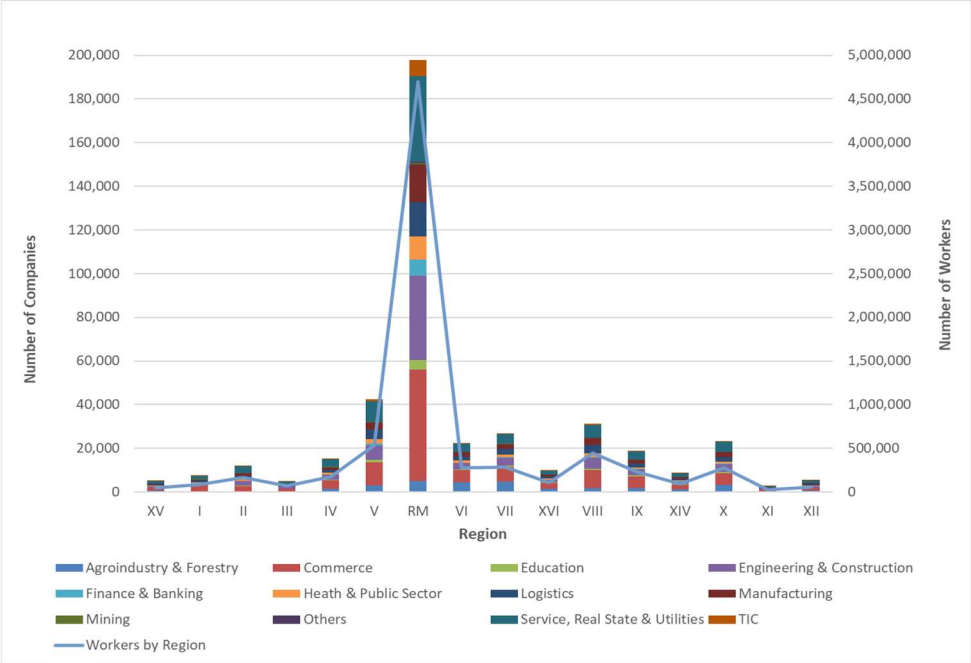

Figure 9. Distribution of companies by economic sector in Chile in 2022.

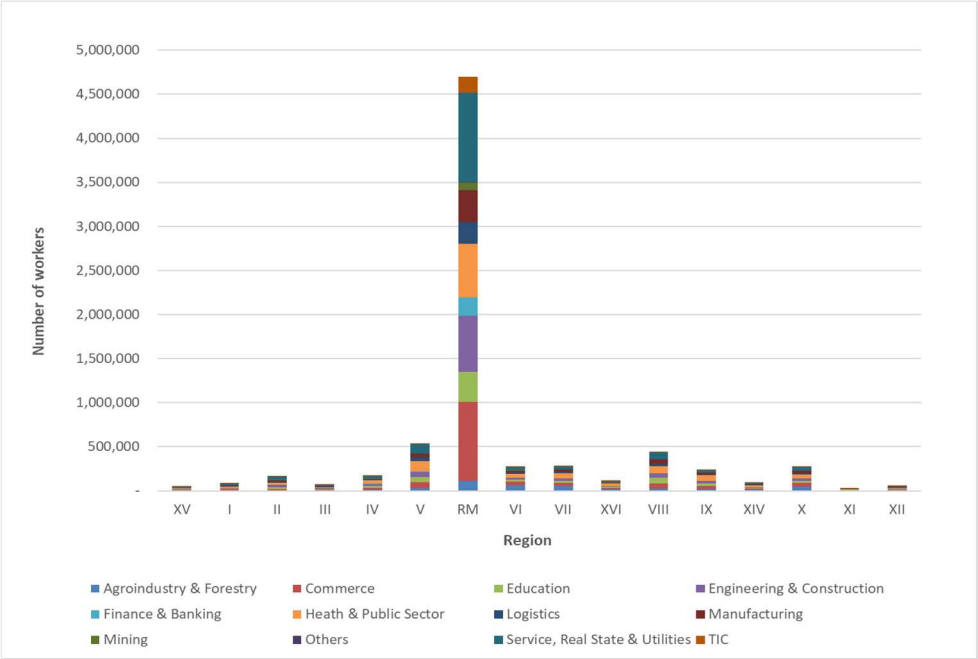

Figure 10. Distribution of dependent workers by economic sector in Chile in 2022.

Regarding the average salary, we found RM and II region are the zones of Chile where the average salary is the highest likely because of mining and banking activities (see Figure 11).

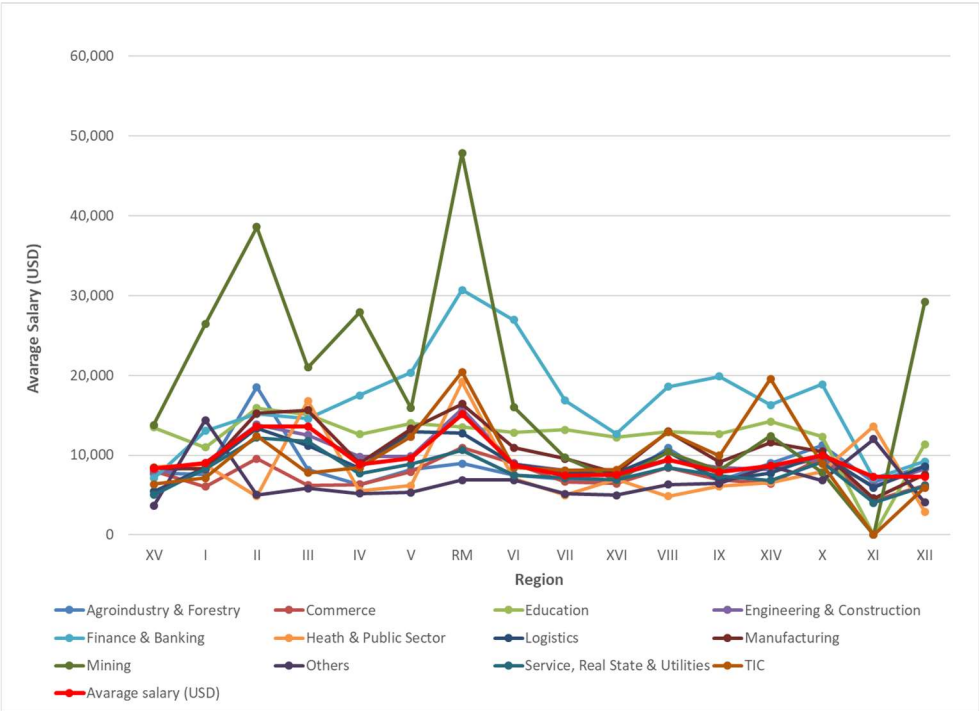

Figure 11. Average of annual salary per worker by economic sector and region in Chile (in USD)

4.3.1.- Effects of Purchasing Staff Reduction on Lost Jobs and Social Cost by Economic Sector

When simulating the effects of purchasing staff reduction on lost jobs by industrial sector we found that services, commerce, health & public sector, engineering & construction are the economic activities more impacted by RPA. We found that around 75 thousand workers who work as buyers could be at risk of losing their employment, which could imply a social cost of USD 1,000 million (See Figure 12 and 13).

When analyzing the effects of purchasing staff reduction on lost jobs by region we found that RM would be the most impacted zone in Chile if RPA were implemented at a large scale and all purchases were done using this technology. In RM it could generate more than 45,000 job losses in the long run, which represents around 0.8% of regional GDP (See Figure 14 and 15).

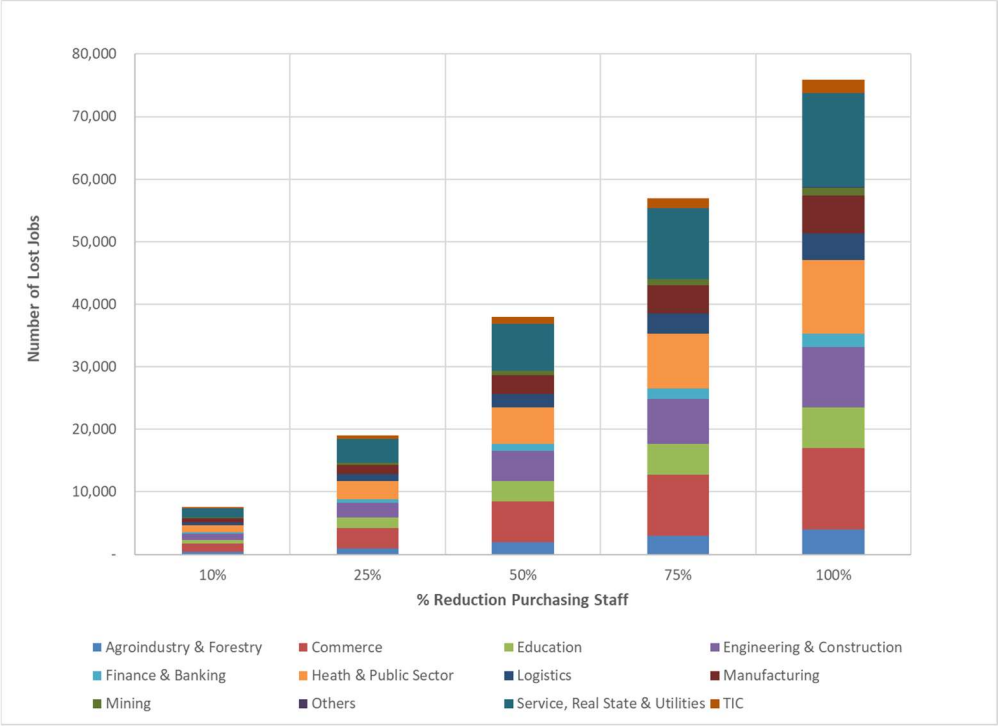

Figure 12. Effects of purchasing staff reduction on lost jobs by economic sector in Chile in 2022.

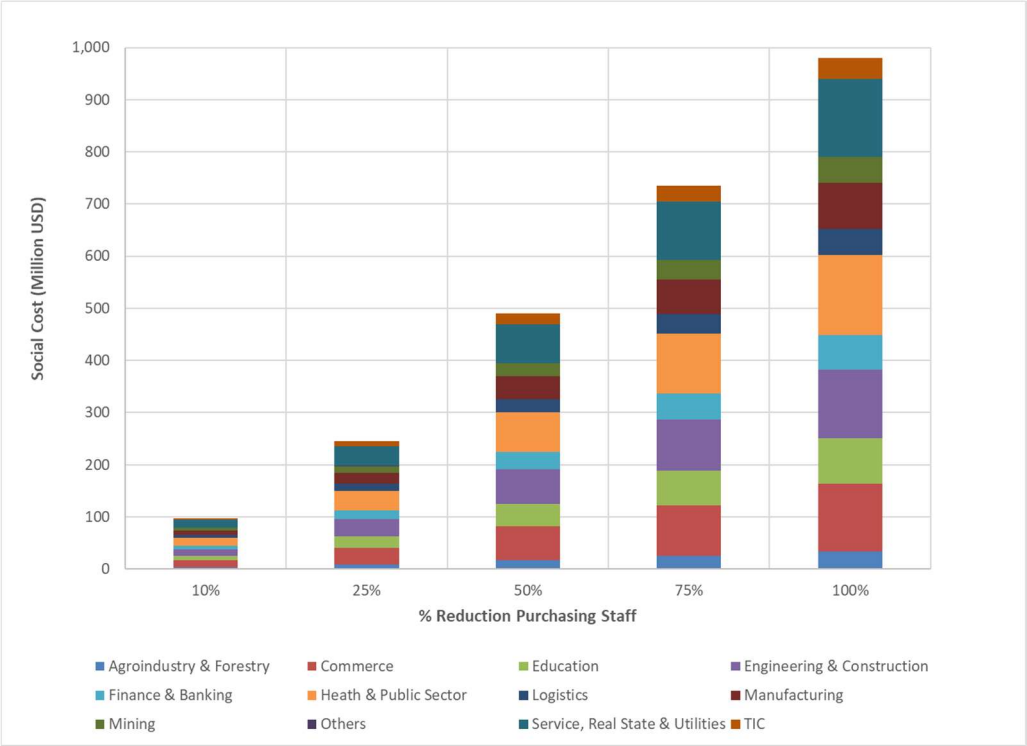

Figure 13. Effects of purchasing staff reduction on social cost by economic sector in Chile in 2022.

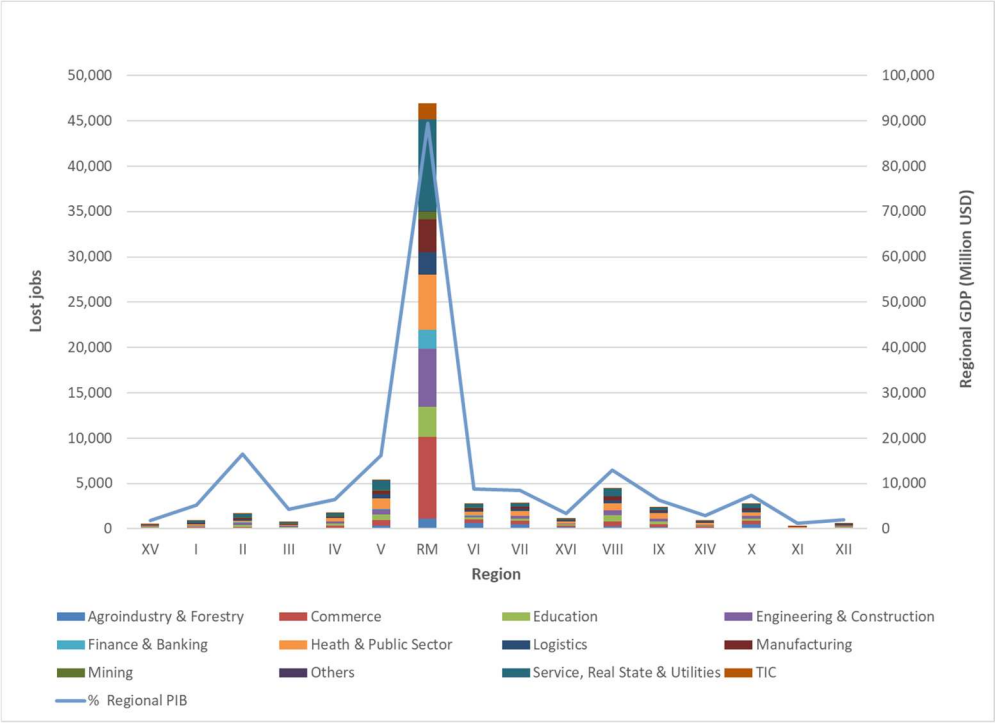

Figure 14. Estimation of lost jobs due to RPA integration by economic sector and region in Chile

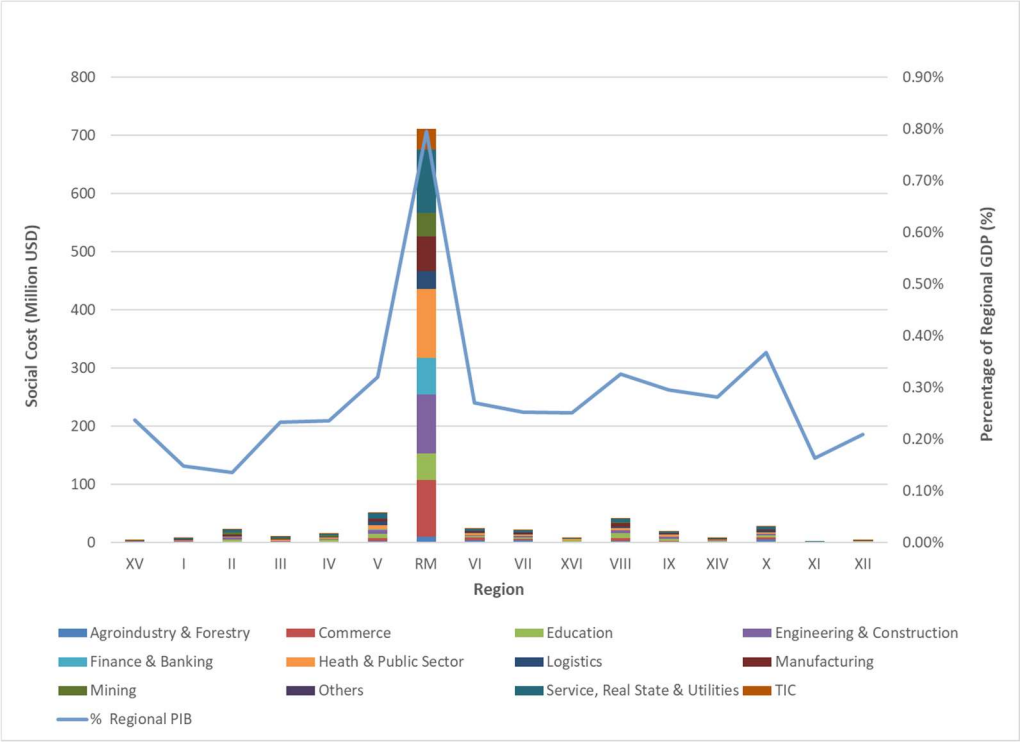

Figure 15. Estimation of social costs due to RPA integration by economic sector and region in Chile.

5.- Discussions

5.1.- Literature Review

RPA is rapidly emerging as a transformative technology that automates rule-based, repetitive tasks across various industries, leading to improved efficiency, cost savings, and enhanced process quality. While widely adopted in sectors such as finance, accounting, procurement, and supply chain management, RPA also faces numerous challenges related to organizational readiness, governance, and integration with existing systems.

The literature highlights the strategic potential of RPA to support digital transformation, particularly when combined with Business Process Management (BPM) and enhanced through Artificial Intelligence (AI). However, successful implementation requires more than technical capability—it demands structured process selection, adaptive and resilient management, and active involvement of workers, even those with no IT background.

Despite significant practical adoption, academic research on RPA remains relatively underdeveloped, especially in the areas of evaluation frameworks, cost estimation, and sustainability impacts via the Triple Bottom Line

(TBL). Case studies from both private and public sectors demonstrate the benefits and obstacles of RPA, with human-robot collaboration and human-in-the-loop models emerging as key enablers of value.

Finally, the integration of RPA with mining and intelligent decision-making tools offers promising pathways for future development. Yet, to realize its full potential, RPA must evolve from task automation to strategic augmentation of human work, supported by interdisciplinary research and cross-functional collaboration.

5.2.- Sample Size and Status of RPA Implementation in Chile

When comparing the results of our research with similar studies (Deloitte, 2019a), we found similar levels of RPA implementation (16%) in Chile, but different levels in process stage (18 % vs 32%). It is important to mention that the survey applied by Deloitte (2019a) considered a sample of 25 executives and professionals from different economic sectors such as consumer and industrial products, financial services, technology, media and telecommunications, life science and health care and the public sector. Thus, and considering that there were around 367,460 companies in Chile[10], the smaller data set results in a higher margin of error. In this regard, Deloitte (2019a) mentioned this research limitation in the report.

In our survey, we collected information from more than 100 people, and most of respondents (66%) were from large and medium companies, while small companies, including microenterprises, were less represented (30%). In this way, our sample differs from Servicio de Impuestos Internos‘s data, which suggests that around 6% are medium and large companies, while 94% are small and microenterprises.

5.3.- Size of Companies and RPA Implementation

Our results show that large companies had the largest level of RPA implementation, while micro and small companies have not started yet. In this context, although RPA technology could be perceived as mature technology (Kregel et al., 2021), it seems budget restrictions could be limiting the implementation in the industry. Most of micro and small companies in Chile are still familiar with RPA, but they are also vulnerable to insolvencies due to limited resources, which poses risks to their survival in the context of industry 4.0 (Peña et al., 2024). Likewise,

[10] Companies that had dependent workers in 2019, when the Deloitte’s survey was done.

industry 4.0 implementation in SMEs faces challenges such as lack of experience, limited resources, lack of methods, government policies, among others (Castillo-Vergara, 2023; Geldres et al., 2023). Under this view, SMEs often have lower readiness to invest in new technologies and may hesitate to explore new technology applications unless a clear business case is presented (Erdmann & Sandkuhl,2023).

In addition, our results are in line with Kwak & Lee (2024), who suggest that technical, organizational, and environmental factors also have a significant impact on small and medium-sized enterprises' intention to adopt RPA. Thus, company size has a moderating effect affecting the intention to adopt RPA.

5.4.- Economic Sector with Highest RPA Technology Implementation

Despite a small number of respondents in this category (5), it is not surprising that the IT sector has the largest integration level of RPA in Chile (4/5). However, many IT companies could also be struggling to successfully implement RPA due to a tradeoff between planning and execution. In this regard, it has been reported that companies are willing to implement RPA, but face challenges in expenses, training, motivation, and employee perceptions of job loss. Sahara et al., 2019).

Considering the areas with most respondents in this survey, it seems that service is leading RPA implementation in Chile. We found that 18% of these companies (7/38) had implemented more than 50 robots followed by the mining sector with 14% (3/21). Regarding the mining sector and considering that it is the one sector which most contributes to the Chilean economy (Cochilco, 2022; Consejo Minero, 2023; Cardemil, 2023; Agnese & Rios, 2024), around 29 % (6/21) of these companies are barely developing a proof of concept. Nevertheless, we are not surprised with this finding, due to the fact that this industry is very conservative when it comes to integrate new technologies in their core business operations (Sánchez and Philipp, 2020; Calzada, 2022), Indeed, it has historically shown low levels of expenditure in R&D (Sánchez and Philipp, 2020 ; Filippou and King, 2011), and while it is known that mining and supplier companies are implementing industry 4.0 technologies today, big contracts are riskier than small contracts under the future effects of Industry 4.0 technologies (Peña et al., 2024).

Even though up to 50% of the projects fail due to their novelty and varying implementation approaches (Herm, et al, 2023), it seems that they are open to implementing RPA technology in their future purchasing processes.

5.5.- Public Policies to Incentivize the Contracting of Displaced Workers

It is a widely held perception that robotic technology and artificial intelligence could potentially lead to unemployment and displaced jobs in the economy[11]. Hence, the rise of RPA in Chile could also have a social impact. What should government authorities do to face this situation?

It is known that Chile has effectively used stabilization funds like the FEES (Fondo de Estabilización Económica y Social) to manage economic shocks, such as COVID-19 for instance. These funds have acted as countercyclical tools to reduce the risks linked to Chile's resource-dependent economy (Agnese and Ríos, 2024). Continued collaboration with the mining and energy sectors can enhance their strategic impact in the future—we believe policymakers could foster the mining development in Chile by enhancing FEES and considering the use of these funds to mitigate the social impact in the economy because of RPA adoption.

Another measure refers to taxes' application, as discussed in previous studies[12]. It is known that governments generally levy taxes on companies based on factors such as revenue and profits. In general, these taxes contribute to fund public services and infrastructure development. Would it then be possible to think about applying taxes to businesses that use RPA technology for financing the negative externality related to displaced workers? This is an interesting question, and policymakers could also consider royalties for financing training programs for displaced workers. However, before thinking about their implementation, specific tax policies should be analyzed in depth while considering variables like company size and the economic sector.

Finally, policymakers could also encourage the contracting of displaced workers by the use of subsidies and benefits as instruments. Indeed, authorities could implement a mix of financial, educational, and regulatory policies, with taxes and subsidies being just one part of a broader strategy.

---

[11] See Ford, 2015; Smith, 2016; Pol & Reveley, 2017; McClure, 2018; McGaughey, 2022; Bordot, 2022; Alahakoon & Bandara, 2023; Damelang & Otto,2024; Sharfaei & Bittner, 2024; Cuccu & Royuela, 2024 among others.

[12] See Erdoğdu & Karaca, 2017; Soled & Thomas, 2018; Abbott & Bogenschneider, 2018; Mazur,2018; Atkinson, 2019; Mann, 2019; Bogenschneider, 2022; Kang et al., 2024 among others.

5.6.- Ethical Responsibilities in Addressing the Social Costs of RPA

The adoption of Robotic Process Automation (RPA) in Chile brings clear efficiency and productivity benefits but also raises significant ethical concerns due to its potential to displace thousands of jobs. As automation expands, both organizations and policymakers carry ethical responsibilities to manage these social impacts responsibly.

We believe that companies implementing RPA should prioritize workforce reskilling and upskilling, ensuring employees can transition into roles that complement new technologies. Thus, transparent communication, gradual implementation, and a human-centered approach—where automation augments rather than replaces human work—are essential. Ethical adoption also involves integrating RPA impacts into broader corporate social responsibility strategies, including community support and partnerships with education providers.

At the policy level, we also believe policymakers must design frameworks that promote inclusive automation. This includes incentives for ethical corporate behavior, strengthened social safety nets, and support for technical training. Labor market reforms should anticipate structural shifts by updating regulations and promoting digital skills. Special attention must be given to regions like the Metropolitan Region, which faces the greatest risk of job displacement.

Ultimately, managing the rise of RPA ethically requires collaboration between the public and private sectors. Chile could lead in responsible automation by aligning technological progress with social inclusion, ensuring that innovation benefits both productivity and people.

6.- Conclusions

This paper provides a bibliographic overview about RPA and qualitative and quantitative analyses at the exploratory level. It seeks to analyze opinions and perceptions about RPA adoption in Chile's different industrial sectors post Covid-19.

Robotic Process Automation implementation in Chile and the world has been steadily growing in recent years as organizations recognize the benefits of this technology. The adoption of RPA has been visible across various industries, including logistics, banking, tax, finance, insurance, healthcare, telecommunications, retail, forestry, agroindustry, mining, engineering & construction among others. Organizations across the world within these industries have embraced RPA to streamline operations and enhance customer service.

Our literature overview shows that RPA is, in essence, a technology that automates repetitive tasks, improving efficiency and productivity. It is often associated with cost savings and workforce optimization. However, it requires upfront investment and may not be suitable for all tasks and business. Currently, some employees worry about job security, but RPA's purpose is to automate repetitive tasks.

RPA is flexible and adaptable but may have limitations in handling unstructured data or complex decision-making. Likewise, integration with existing systems can be challenging due to lack of standardization and complex IT environments. In addition, RPA can also serve as a foundation for advanced automation technologies and digital transformation.

Research on perceptions to RPA is lacking, but Robotic Process Automation is considered a mature technology, with a positive impact on work experience and career prospects. However, lower-level employees report no such improvements in some companies around the world. Moreover, the strategic implications of RPA implementation have showed time and cost efficiency improvements in business. However, no labor reduction or cost reduction in some business units post-RPA implementation have been observed.

In the first part of the paper, we produce a survey involving 103 participants, primarily from post Covid-19 Chile, and focusing on the adoption of Robotic Process Automation (RPA). The majority of respondents were decision-makers (more than 60%) from service, mining and engineering & construction sectors, with less relevant sectors including service, engineering & construction, and finance.

Our results show the most relevant criteria for RPA implementation were alignment with strategic objectives, technology implementation process, and future opportunities for integration with other technologies. Most participants had not started RPA implementation (66%) yet, with 6% using it on a considerable scale. Benefits of RPA include work optimization, greater productivity, and time optimization. Future challenges include developing new labor skills, robot maintenance, and long-term unemployment. Disadvantages include the need for rule-based tasks, increased process complexity, and the creation of new tasks for workers. Essential factors for optimal RPA implementation include high process standardization, interaction with multiple systems, and tasks prone to human errors. Future opportunities include integration with text mining and data analysis. Finally, our results suggest large companies have the largest level of RPA implementation, in which IT sector is leading the implementation development of this technology, followed by mining and service.

In the second part of the paper, our simulation suggests that the widespread implementation of RPA in purchasing roles could lead to significant job displacement, particularly in the services, commerce, healthcare, public administration, and engineering sectors. An estimated 75,000 jobs may be at risk, with a potential social cost of USD 1 billion. The Metropolitan Region would be the most affected, possibly losing over 45,000 jobs—equivalent to 0.8% of its regional GDP.

The implementation of Robotic Process Automation (RPA) in Chile is growing steadily post Covid- 19. However, it is important to note that the implementation of RPA in Chile is still in its early stages, and there is significant potential for further growth. Organizations should consider conducting a thorough assessment of their processes, identifying suitable use cases, and collaborating with experienced RPA providers to achieve successful implementation. Additionally, organizations should ensure proper management and training to prepare employees for the shift to automated processes.

Finally, RPA implementation in Chile could offer insights into how developing economies are adopting advanced technologies. As a regional tech leader, Chile serves as a model for other Latin American countries, demonstrating how emerging markets can integrate automation and how policymakers can deal with the social impacts generated in the economy.

7.- Implications

Regarding the first part of our research, our survey's findings suggest that the adoption of RPA post Covid 19 is gaining momentum in Chile, particularly in sectors such as services, mining, and engineering & construction. This trend indicates that adoption rates may increase in the coming years as organizations recognize the advantages of RPA. However, for RPA implementation to be successful, it is crucial to align it with the organization's strategic objectives. Companies need to carefully consider their goals and priorities during the implementation process to ensure that RPA delivers the desired outcomes.

In addition to strategic alignment, our research emphasizes the need for investment in IT infrastructure to support RPA. Thus, the implementation of this technology would require organizations to update their systems and infrastructure, which is a critical factor for successful RPA adoption. Furthermore, our study also identifies a future challenge in developing new labor skills, indicating that organizations will need to invest in employee training programs to ensure that their workforce can effectively work with RPA systems.

The potential for RPA to transform industries is also highlighted, with the technology offering opportunities for work optimization, increased productivity, and time savings, particularly in industries that rely heavily on manual processes. However, there are several challenges associated with RPA, such as robot maintenance, long-term unemployment due to automation, and the need for clearly defined, rule-based tasks. It is essential for organizations to proactively address these challenges to achieve successful RPA implementation.

Another important aspect is the integration of RPA with other technologies. Our study points to future opportunities for combining RPA with tools like text mining and data analysis, which will be key for maximizing its benefits. In this context, we believe organizations may need to invest in integrating RPA with these technologies to optimize performance. Moreover, considering that high process standardization is identified as a critical factor for optimal RPA implementation, organizations may need to standardize their processes and workflows before deploying RPA to ensure the technology operates effectively and efficiently.

Regarding the second part of our research, incentivizing the hiring of workers displaced by RPA could bring important benefits but also involve trade-offs. Economically, it helps reduce unemployment by facilitating smoother transitions between jobs, though it requires significant public spending and may risk inefficient allocation if not well-targeted. Socially, these policies could promote inclusion, reduce inequality, and help maintain stability, but they should be carefully designed to avoid skill mismatches or perceptions of unfairness. Politically, we believe such measures could demonstrate proactive governance and build public trust, though they may also attract criticism if seen as insufficient or favoring certain groups. Technologically, these incentives could encourage more human-centered approaches to automation and support investment in reskilling technologies; however, they could also unintentionally slow innovation if firms view the incentives as overly restrictive. Ultimately, while these policies can ease the impact of automation, their success depends on being flexible, data-driven, and aligned with broader economic and workforce strategies.

8.- Limitations

While our paper offers valuable insights into the adoption of Robotic Process Automation (RPA) post Covid – 19 in Chile, certain limitations should be considered when interpreting the results. One key limitation is the relatively small sample size of 103 participants, representing only 0.24% of the population. This may not be fully representative of the broader population and could limit the statistical significance of the findings. Additionally,

smaller companies and microenterprises were underrepresented in the survey, further affecting the diversity of responses.

Another limitation is the narrow industry representation. Most respondents came from the service, mining, and engineering & construction sectors, while industries such as healthcare, telecommunications, and agroindustry were less represented. This imbalance may prevent a comprehensive understanding of RPA adoption across all sectors.

Authors' Declarations

- Availability of Data and Materials: Not applicable.

- Conflict of Interest: On behalf of all authors, the corresponding author states that there is no conflict of interest.

- Funding Information: The authors received no financial support for the research, authorship, and/or publication of this article.

- Ethics approval/declarations: All the material is owned by the authors, and/or no permissions are needed.

- Consent to participate: Not applicable.

- Consent for publication: All authors consent to publish this article, and no additional permissions are needed.

- Code availability: Not applicable.

- Acknowledgements: Not applicable.

References

- Aalst, W.M.P. van der, Bichler, M. and Heinzl, A. (2018), "Robotic Process Automation", Business & Information Systems Engineering, pp. 1–4.
- Abbott, R., & Bogenschneider, B. (2018). Should robots pay taxes: Tax policy in the age of automation. Harv. L. & Pol'y Rev., 12, 145

- Agnese, P., & Rios, F. (2024). Spillover effects of energy transition metals in Chile. Energy Economics, 134, 107589.
- Aguirre, S. and Rodriguez, A. (2017), "Automation of a Business Process Using Robotic Process Automation (RPA): A Case Study", Applied Computer Sciences in Engineering, presented at the Workshop on Engineering Applications, Springer, Cham, pp. 65–71.
- Alahakoon, A. M. A. R. B., & Bandara, G. A. I. M. (2023). Analyzing the socio-economic impact of automation and job displacement. J. Res. Technol. Eng. 4 (3), 2023, 22–29
- Alberth, M. and Mattern, M. (2017), "Understanding robotic process automation (RPA)", The CAPCO Institute Journal of Financial Transformation, 46, 54-61. available at: https://www.capco.com/-/media/CapcoMedia/Capco-Institute/Journal46/JOURNAL46_full_web.ashx#page=104.
- Altarazi, F., Santos, D., & Wong, E. (2024). Robotic Process Automation (RPA) Implementation Challenges: A Literature Review. In 9th North American Conference on Industrial Engineering and Operations Management.
- Anagnoste, S. (2017), "Robotic Automation Process - The next major revolution in terms of back office operations improvement", Proceedings of the International Conference on Business Excellence, Vol. 11, available at: https://doi.org/10.1515/picbe-2017-0072.
- Anagnoste, S. (2018), "Setting Up a Robotic Process Automation Center of Excellence", Management Dynamics in the Knowledge Economy, 6 (2), 307–322.
- Antwiadjei, L., & Najaf, H. (2023). The Impact of Low-Code and RPA on Workforce Dynamics and Skill Requirements. Asian Journal of Multidisciplinary Research & Review, 4(3), 107-115.
- Agostinelli, S., Lupia, M., Marrella, A., & Mecella, M. (2022). Reactive synthesis of software robots in RPA from user interface logs. Computers in Industry, 142, 103721.
- Antwiadjei, L. (2021). Evolution of Business Organizations: An Analysis of Robotic Process Automation. Eduzone: International Peer Reviewed/Refereed Multidisciplinary Journal, 10(2), 101-105.
- Aryal, D. (2021). Higher education accounting students on developing AI and RPA competencies. Haaga-Helia University of Applied Scienes.
- Asatiani, A. and Penttinen, E. (2016), "Turning robotic process automation into commercial success – Case OpusCapita", Journal of Information Technology Teaching Cases, 6 (2), 67–74.
- Atkinson, R. D. (2019). The case against taxing robots. Available at SSRN 3382824.

- Axmann, B., Harmoko, H., Herm, L. V., & Janiesch, C. (2021). A framework of cost drivers for robotic process automation projects. In Business Process Management: Blockchain and Robotic Process Automation Forum: BPM 2021 Blockchain and RPA Forum, Rome, Italy, September 6–10, 2021, Proceedings 19 (pp. 7-22). Springer International Publishing.
- Bogenschneider, B. N. (2022). Empirical evidence on robot taxation: literature review and technical analysis. Am. U. Bus. L. Rev., 11, 1.
- Bogoevici, F. (2024). Strategies for Improving Productivity through Digital Upgrades: Case Study on RPA Technology. In Proceedings of the International Conference on Business Excellence (Vol. 18, No. 1, pp. 3167-3184).
- Bordot, F. (2022). Artificial intelligence, robots and unemployment: Evidence from OECD countries. Journal of Innovation Economics & Management, 37(1), 117-138.
- Bunge, M. (1967), Scientific Research I: The Search for System, Springer-Verlag, Berlin Heidelberg, available at: //www.springer.com/gp/book/9783642481376 (accessed 23 November 2018).
- Cabello, R., Escalona, M. J., & Enríquez, J. G. (2020). Beyond the hype: RPA horizon for robot-human interaction. In Business Process Management: Blockchain and Robotic Process Automation Forum: BPM 2020 Blockchain and RPA Forum, Seville, Spain, September 13–18, 2020, Proceedings 18 (pp. 185-199). Springer International Publishing.
- Calzada, B. (2022) Innovation in mining: what are the challenges and opportunities along the value chain for Latin American suppliers? Min Econ 35(1), 35–51
- Cardemil, M. (2023). Impactos socioeconómicos de la minería en Chile. Serie Informes Nº 04-23, 04/04/2023. Departamento de Estudios, Extensión y Publicaciones - Biblioteca del Congreso Nacional. https://obtienearchivo.bcn.cl/obtienearchivo?id=repositorio/10221/34140/1/Informe_N_04_23_Impactos_socioeconomicos_de_la_mineria_en_Chile.pdf
- Castillo-Vergara, M. (2023). Industria 4.0 en la Pyme: Management & Technology. J. Technol. Manag. Innov. 18 (2), 3-5
- Cervenka, P., & Hlavaty, I. (2022). The impact of the covid 19 pandemic on the development of digital process automation in small and medium-sized enterprises. Economic and Social Development: Book of Proceedings, 357-363.

- Cewe, C., Koch, D. and Mertens, R. (2017), "Minimal Effort Requirements Engineering for Robotic Process Automation with Test Driven Development and Screen Recording", Business Process Management Workshops, presented at the International Conference on Business Process Management, Springer, Cham, pp. 642–648.
- Cochilco (2022). Anuario de Estadísticas del Cobre y Otros Minerales. https://www.cochilco.cl/Lists/Anuario/Attachments/27/ANUARIO_ESTADISTICO_COCHILCO%20A%C3%91O%202022.pdf
- Consejo Minero (2023). Cifras actualizadas de la minería. Available in https://consejominero.cl/wp-content/uploads/2023/11/Cifras-Actualizadas-de-la-Mineria-2023-Octubre.pdf
- Cooper, L. A., Holderness Jr, D. K., Sorensen, T. L., & Wood, D. A. (2022). Perceptions of robotic process automation in Big 4 public accounting firms: Do firm leaders and lower-level employees agree? Journal of Emerging Technologies in Accounting, 19(1), 33-51.
- Cuccu, L., & Royuela, V. (2024). Just reallocated? Robots displacement, and job quality. British Journal of Industrial Relations, 62(4), 705-731.
- Damelang, A., & Otto, M. (2024). Who is replaced by robots? Robotization and the risk of unemployment for different types of workers. Work and Occupations, 51(2), 181–206.
- Dey, S., & Das, A. (2019). Robotic process automation: assessment of the technology for transformation of business processes. International Journal of Business Process Integration and Management, 9(3), 220-230.
- Deloitte (2017). "Automatización Robótica de Procesos (RPA). April 2017.
- Deloitte (2018a). "El momento de los robots: ¿Está preparado para aprovechar las ventajas?
- Deloitte (2018b). "The robots are ready. Are you? Untapped advantage in your digital workforce".
- Deloitte (2019a). "Save-to-transform as a catalyst for embracing digital disruption: Deloitte's Second Biennial Global Cost Survey: Cost management practices and trends in Latin America". August 2019.
- Deloitte (2019b). Save-to-transform as a catalyst for embracing digital disruption Deloitte's: second biennial global cost survey. Global Cost Report 2019-2020
- Doğuç, Ö. (2021). Robotic process automation (RPA) applications in COVID-19. In Management Strategies to Survive in a Competitive Environment: How to Improve Company Performance (pp. 233-247). Cham: Springer International Publishing.

- Enríquez, J. G., Jiménez-Ramírez, A., Domínguez-Mayo, F. J., & García-García, J. A. (2020). Robotic process automation: a scientific and industrial systematic mapping study. IEEE Access, 8, 39113-39129.
- Erdmann, S., & Sandkuhl, K. (2023). Robotic Process Automation in Small Enterprises: An Investigation into Application Potential. Complex Systems Informatics and Modeling Quarterly, (34), 84-105.
- Erdoğdu, M. M., & Karaca, C. (2017). The fourth industrial revolution and a possible robot tax. Institutions & economic policies: Effects on social justice, employment, environmental protection & growth, 103–122
- Eulerich, M., Waddoups, N., Wagener, M., & Wood, D. A. (2022). Development of a framework of key internal control and governance principles for robotic process automation (RPA). Available at SSRN 4311271.
- Filippou D, King MG (2011) R&D prospects in the mining and metals industry. Resource Policy, 36(3), 276-284.
- Flechsig, C., Anslinger, F., & Lasch, R. (2022). Robotic Process Automation in purchasing and supply management: A multiple case study on potentials, barriers, and implementation. Journal of Purchasing and Supply Management, 28(1), 100718.
- Flechsig, C., Lohmer, J., & Lasch, R. (2019). Realizing the full potential of robotic process automation through a combination with BPM. In Logistics Management: Strategies and Instruments for digitalizing and decarbonizing supply chains-Proceedings of the German Academic Association for Business Research, Halle, 2019 (pp. 104-119). Springer International Publishing.
- Ford, M. (2015b). The rise of the robots: Technology and the threat of mass unemployment. International Journal of HRD Practice Policy and Research, 111, 111–112
- Forrester. (2014), Building A Center Of Expertise To Support Robotic Automation, Forrester, available at: http://neoops.com/wp-content/uploads/2014/03/Forrester-RA-COE.pdf (accessed 20 July 2018).
- Fragapane, G., Eleftheriadis, R., Powell, D., & Antony, J. (2023). A global survey on the current state of practice in Zero Defect Manufacturing and its impact on production performance. Computers in Industry, 148, 103879.
- Fung, H.P. (2014), Criteria, Use Cases and Effects of Information Technology Process Automation (ITPA), SSRN Scholarly Paper No. ID 2540023, Social Science Research Network, Rochester, NY, available at: https://papers.ssrn.com/abstract=2540023 (accessed 26 June 2018).

- Gadre, A., Jessel, B. and Gulati, K. (2017), “Rethinking robotics? Take a step back”, The CAPCO Institute Journal of Financial Transformation, 46, 34-35. available at: https://www.capco.com/-/media/CapcoMedia/Capco-Institute/Journal46/JOURNAL46_full_web.ashx#page=104.
- Geldes, C., Castillo-Vergara, M., & Muñoz-Cisterna, V. (2024). Desafíos de la Industria 4.0 en las PYMES. Observatorio Económico, 1(184), 14–16. https://doi.org/10.11565/oe.v1i184.536
- Gomes, M., & Seruca, I. (2023). The perception of the management and lower-level employees of the impacts of using Robotic Process Automation: the case of a shared services company. Procedia Computer Science, 219, 129-138.
- Greca, S., Zymeri, D., & Kosta, A. (2022). The implementation of RPA in case of scholarship in University of Tirana during the Covid time. ICSNS XXI-2022, 6.
- Güner, E. O., & Han, S. (2023). Robotic process automation as routine capability: a case study of a public organization in Turkey.
- Hallikainen, P., Bekkhus, R. and Pan, S.L. (2018), “How OpusCapita Used Internal RPA Capabilities to Offer Services to Clients.”, MIS Quarterly Executive, 17(1).
- Herm, L. V., Janiesch, C., Helm, A., Imgrund, F., Hofmann, A., & Winkelmann, A. (2023). A framework for implementing robotic process automation projects. Information Systems and e-Business Management, 21(1), 1-35.
- Hofmann, P., Samp, C. & Urbach, N. (2020). Robotic process automation. Electron Markets 30, 99–106. https://doi.org/10.1007/s12525-019-00365-8
- Huda, M., Rahayu, A., Furqon, C., Sultan, M. A., & Susilawati Sugiana, N. S. (2025). Analyzing the Impact of Robotic Process Automation (RPA) on Productivity and Firm Performance in the Service Sector. International Journal of Advanced Computer Science & Applications, 16(6).
- Hyun, Y., Lee, D., Chae, U., Ko, J., & Lee, J. (2021). Improvement of business productivity by applying robotic process automation. Applied sciences, 11(22), 10656.
- Jaiwani, M., & Gopalkrishnan, S. (2022, September). Adoption of RPA and AI to enhance the productivity of employees and overall efficiency of Indian private banks: an inquiry. In 2022 International Seminar on Application for Technology of Information and Communication (iSemantic) (pp. 191-197). IEEE.
- Jacob, M. W. (n.d.) Automation and Robotic Process Automation (RPA) in Financial Auditing: Efficiency vs. Job Displacement.

- Järvelin, K. and Wilson, T.D. (2003), “On Conceptual Models for Information Seeking and Retrieval Research”, Information Research, 9 (1)
- Jovanović, S. Z., Đurić, J. S., & Šibalija, T. V. (2018). Robotic process automation: overview and opportunities. International Journal Advanced Quality, 46(3-4), 34-39.
- Kang, D., Lee, J. H., & Quach, S. (2024). The Welfare Effects of a Robot Tax: Evidence from a Tax Credit for Automation Technologies in Korea.
- Kasslin, H. (2017), Heavyweight and Lightweight Process Automation - How Do Companies Select between RPA and Back-End Automation? Master’s Thesis, Aalto University, available at: https://aaltodoc.aalto.fi:443/handle/123456789/26827 (accessed 2 August 2018).
- Kaur, L., Verma, P. K., Kaur, G., & Jain, S. (2024). AI and RPA in Healthcare: A Look at the Human Impact on Patient Care. lnternational Journal of Recent Engineering Science.11(6), 178-186
- Kedziora, D., & Smolander, K. (2022). Responding to healthcare emergency outbreak of COVID-19 pandemic with Robotic Process Automation (RPA).
- Khramov, D. (2018), Robotic and Machine Learning: How to Help Support to Process Customer Tickets More Effectively, Bachelor’s Thesis, Metropolia University of Applied Sciences.
- Kirchmer, M. (2017), “Robotic Process Automation–Pragmatic Solution or Dangerous Illusion?”, BTOESInsights.
- KO, E. (2020). A Study of the impact of the adoption of Robotic Process Automation (RPA) on work productivity in the retail banking industry (Doctoral dissertation, KDI School).
- Kokina, J., & Blanchette, S. (2019). Early evidence of digital labor in accounting: Innovation with Robotic Process Automation. International Journal of Accounting Information Systems, 35, 100431.
- Kregel, I., Koch, J., & Plattfaut, R. (2021). Beyond the hype: robotic process automation's public perception over time. Journal of organizational computing and electronic commerce, 31(2), 130-150.
- Kumar, M., Dagar, M., Yadav, M., Choudhury, T., & Luu, T. M. N. (2025). Navigating the Future: Challenges and Opportunities in Intelligent RPA Implementation. Intelligent Robotic Process Automation: Development, Vulnerability and Applications, 393-420.
- Kwak, Y. K., & Lee, W. B. (2024). A Study on Factors Affecting the Degree of RPA Patching Using the TOE Framework-Focusing on the Effect of Adjusting the Size of Small and Medium-sized Businesses. Journal of Korean Society for Quality Management, 52(1), 149-172.

- Kyheröinen, T. (2018), Implementation of Robotic Process Automation to a Target Process – a Case Study, Master's Thesis, Aalto University, 9 May, available at: https://aaltodoc.aalto.fi:443/handle/123456789/31518 (accessed 2 August 2018).
- Lacity, M. and Willcocks, L. (2015), "Robotic Process Automation: The Next Transformation Lever for Shared Services", The Outsourcing Unit Working Research Paper Series.
- Lacity, M., Willcocks, L.P. and Craig, A. (2016), "Robotic process automation at Telefonica O2", MIS Quarterly Executive, 15 (1).
- Lacity, M.C. and Willcocks, L.P. (2017), "A new approach to automating services", MIT Sloan Management Review, Vol. Fall, available at: http://sloanreview.mit.edu/ (accessed 26 June 2018).
- Lamberton, C., Brigo, D., & Hoy, D. (2017). Impact of Robotics, RPA and AI on the insurance industry: challenges and opportunities. Journal of Financial Perspectives, 4(1).
- Lambourdiere, E. G., Corbin, E. L., & Ledru, H. (2022). RPA implementation and the digitalization of logistics operations in the COVID-19 era: a case study. In Increasing supply chain performance in digital society (pp. 78-100). IGI Global.
- Larios Soldevilla, O. A., & Atoche Socola, C. J. (2023). La automatización robótica de procesos y su relación con la operatividad de los procesos contables en las empresas de telecomunicaciones y banca en los países de Argentina, Chile, Colombia y Perú en el año 2021. Contabilidad Y Negocios, 18(35), 67-95.
- Lebens, M., Munmun, M., & Finnegan, R. (2023). Robotic process automation (RPA) platforms to boost students' career readiness. In Perspectives and Trends in Education and Technology: Selected Papers from ICITED 2022 (pp. 265-273). Singapore: Springer Nature Singapore.
- Le Clair, C. (2018), The Forrester Wave TM: Robotic Process Automation, Q2 2018 The 15 Providers That Matter Most And How They Stack Up.
- Le Clair, C., Cullen, A. and King, M. (2017), The Forrester Wave TM : Robotic Process Automation, Q1 2017, Forrester, available at: https://www.forrester.com/report/The+Forrester+Wave+Robotic+Process+Automation+Q1+2017//E-RES131182.
- Leno, V., Polyvyanyy, A., Dumas, M. et al. (2021). Robotic Process Mining: Vision and Challenges. Bus Inf Syst Eng 63, 301–314. https://doi.org/10.1007/s12599-020-00641-4

- Leopold, H., Aa, H. van der and Reijers, H.A. (2018), "Identifying Candidate Tasks for Robotic Process Automation in Textual Process Descriptions", Enterprise, Business-Process and Information Systems Modeling, pp. 67–81.
- Lintukangas, A. (2017), Improving Indirect Procurement Process by Utilizing Robotic Process Automation, Master's Thesis, LAPPEENRANTA UNIVERSITY OF TECHNOLOGY - School of Business and Management, available at: https://core.ac.uk/download/pdf/84594991.pdf (accessed 2 August 2018).
- Lo, W., Yang, C. M., Zhang, Q., & Li, M. (2024). Increased productivity and reduced waste with robotic process automation and generative AI-powered IoE services. Journal of Web Engineering, 23(1), 53-87.
- Lui, G., & Shum, C. (2022). Impact of robotic process automation on future employment of accounting professionals. Proceedings of the 55th Hawaii International Conference on System Sciences | 2022
- Madakam, S., Holmukhe, R. M., & Jaiswal, D. K. (2019). The future digital work force: robotic process automation (RPA). JISTEM-Journal of Information Systems and Technology Management, 16, e201916001.
- Manikandan, S. V. (2024). Intelligent Automation and Workforce Transformation: A Multidimensional Analysis of Employment Dynamics and Skills Evolution. International Journal of Innovative Research in Science, Engineering and Technology, 13(8), 15261-15272.
- Mann, R. F. (2019). I robot: U tax? Considering the tax policy implications of automation. McGill Law Journal, 64(4), 763–807.
- Marciniak, P., & Stanisławski, R. (2021). Internal determinants in the field of RPA technology implementation on the example of selected companies in the context of industry 4.0 assumptions. Information, 12(6), 222.
- Mazur, O. (2018). Taxing the robots. Pepp. L. Rev., 46, 277.
- McClure, P. K. (2018). "You're fired," says the robot: the rise of automation in the workplace, technophobes, and fears of unemployment. Social Science Computer Review, 36(2), 139-156.
- McGaughey, E. (2022). Will robots automate your job away? Full employment, basic income and economic democracy. Industrial Law Journal, 51(3), 511–559.
- Mindfields. (2015), Robotic Process Automation Driving the next Wave of Cost Rationalisation, Mindfields, available at: https://www.scribd.com/doc/296828726/Robotics-Process-Automation-September2015-v17-1 (accessed 22 July 2018).
- Minsal (2023). Fin de la Alerta Sanitaria. 5 de septiembre de 2023. Availeble in https://saludresponde.minsal.cl/fin-del-la-alerta-sanitaria/.

- Moreira, S., Mamede, H. S., & Santos, A. (2023). Process automation using RPA–a literature review. Procedia Computer Science, 219, 244-254
- Nahak, K., Mishra, A., & Dash, S. S. (2023). Exploring The Future Of Robotic Process Automation In The Digital Workforce. Journal of Data Acquisition and Processing, 38(2), 2446.
- Padmanabhan, S. (2023). Digital transformation is reshaping the workforce. Research Trends in Science and Technology, 1, 10-17.
- Patrício, L., Ávila, P., Varela, L., Cruz-Cunha, M. M., Ferreira, L. P., Bastos, J., ... & Silva, J. (2023). Literature review of decision models for the sustainable implementation of Robotic Process Automation. Procedia Computer Science, 219, 870-878.
- Peña Ramírez, C., Ríos Muñoz, F., & Espinoza Brito, L. (2024). Contractor Companies' Small Projects Facing Mining 4.0 in Chile: How Risky Is the Implementation of Industry 4.0 for Them? Journal of Technology Management & Innovation, 19(1), 79–109. https://doi.org/10.4067/S0718-27242024000100079
- Perdana, A., Lee, W. E., & Kim, C. M. (2023). Prototyping and implementing Robotic Process Automation in accounting firms: Benefits, challenges and opportunities to audit automation. International Journal of Accounting Information Systems, 51, 100641.
- Plattfaut, R., Borghoff, V., Godefroid, M., Koch, J., Trampler, M., & Coners, A. (2022). The critical success factors for robotic process automation. Computers in Industry, 138, 103646.
- Pol, E., & Reveley, J. (2017). Robot induced technological unemployment: Towards a youth-focused coping strategy. Psychosociological Issues in Human Resource Management, 5(2), 169-186
- Pramod, D. (2022), "Robotic process automation for industry: adoption status, benefits, challenges and research agenda", Benchmarking: An International Journal, Vol. 29 No. 5, pp. 1562-1586. https://doi.org/10.1108/BIJ-01-2021-0033
- Pypłacz, P., & Žukovskis, J. (2023). Implementing Robotic Process Automation in small and medium-sized enterprises-implications for organisations. Procedia Computer Science, 225, 337-346.
- Rajawat, A. S., Rawat, R., Barhanpurkar, K., Shaw, R. N., & Ghosh, A. (2021). Robotic process automation with increasing productivity and improving product quality using artificial intelligence and machine learning. In Artificial Intelligence for Future Generation Robotics (pp. 1-13). Elsevier.

- Razak, Q., Baig, M. A., Parveen, S., & Soomro, A. A. (2025). The Integration of Robotic Process Automation (RPA) in HR Operations: A Game Changer for Efficiency. The Critical Review of Social Sciences Studies, 3(3), 797-812.
- Ribeiro, J., Lima, R., Eckhardt, T., & Paiva, S. (2021). Robotic process automation and artificial intelligence in industry 4.0–a literature review. Procedia Computer Science, 181, 51-58.
- Ruiz, R. C., Ramírez, A. J., Cuaresma, M. J. E., & Enríquez, J. G. (2022). Hybridizing humans and robots: An RPA horizon envisaged from the trenches. Computers in industry, 138, 103615.
- Saha, R., Kulahri, V., Kumar, G., Rai, M., & Lim, S. J. (2019). Analyzing the tradeoff between planning and execution of robotics process automation implementation in IT sector. Int. J. Control Autom., 12(1), 1-10.
- Saha, B. (2023). Robotic Process Automation (RPA) in onboarding and offboarding: Impact on payroll accuracy. IJCSPUB, 13(2), 237-256.
- Salih Aydıner, A., Ortaköy, S., & Özsürünç, Z. (2023). Employees' perception of value-added activity increases Robotic Process Automation with time and cost efficiency: a case study. International Journal of Information Systems and Project Management, 11(1), 30-49.
- Sánchez, F, & Philipp, H. (2020) Innovation in the Mining Industry: Technological Trends and a Case Study of the Challenges of Disruptive Innovation. Min Metall Explor 37(5), 1385–1399.
- Santos, F., Pereira, R. & Vasconcelos, J. B. (2020). Towards robotic process automation implementation: an end-to-end perspective. Business Process Management Journal. 26 (2), 405-420"
- Schermann, M., Böhmann, T. and Krcmar, H. (2009), "Explicating Design Theories with Conceptual Models: Towards a Theoretical Role of Reference Models", in Becker, J., Krcmar, H. and Niehaves, B. (Eds.), Wissenschaftstheorie und gestaltungsorientierte Wirtschaftsinformatik, Physica-Verlag HD, Heidelberg, pp. 175–194.
- Sharfaei, S., & Bittner, J. (2024). Technological employment: Evidence from worldwide robot adoption. Technological Forecasting and Social Change, 209, 123742.
- Sharma, V. (2025). The evolution of robotic process automation in human resources: From recruitment to retention. International Journal of Multidisciplinary Research and Growth Evaluation, 5(5), 1053-1058.
- Shukrallah, R. (2021). Robotic Process Automation: Implementation in Private/Public Sectors and Opportunities for Cultural Heritage Organizations. Johns Hopkins University, December 18, 2021

- Sigurðardóttir, G.L. (2018), Robotic Process Automation: Dynamic Roadmap for Successful Implementation, Master's Thesis, Reykjavík University, 20 June, available at: https://skemman.is/handle/1946/31385 (accessed 2 August 2018).
- Slaby, J.R. (2012), Robotic Automation Emerges as a Threat to Traditional Low-Cost Outsourcing, available at: https://www.horsesforsources.com/wp-content/uploads/2016/06/RS-1210_Robotic-automationemerges-as-a-threat-060516.pdf.
- Smith, N. (2016). Interview: Automation threatens all our jobs, says Martin Ford. Engineering & Technology, 11(2), 50–53.
- Soled, J. A., & Thomas, K. D. (2018). Automation and the Income Tax. Colum. J. Tax L., 10, 1.
- Stople, A., Steinsund, H., Iden, J., & Bygstad, B. (2017). Lightweight IT and the IT function: experiences from robotic process automation in a Norwegian bank. Bibsys Open Journal Systems, 25(1), 1-11.
- Šperka, R., & Halaška, M. (2023). The performance assessment framework (PPAFR) for RPA implementation in a loan application process using process mining. Information Systems and e-Business Management, 21(2), 277-321.
- Suri, V. K., Elia, M., & van Hillegersberg, J. (2017). Software bots-the next frontier for shared services and functional excellence. In Global Sourcing of Digital Services: Micro and Macro Perspectives: 11th Global Sourcing Workshop 2017, La Thuile, Italy, February 22-25, 2017, Revised Selected Papers 11 (pp. 81-94). Springer International Publishing.
- Susilo, A., Prabowo, H., Kosasih, W., Kartono, R., & Utami Tjhin, V. (2021, December). The implementation of robotic process automation for banking sector case study of a private bank in Indonesia. In Proceedings of the 2021 9th International Conference on Information Technology: IoT and Smart City (pp. 365-371).
- Syed, R., Suriadi, S., Adams, M., Bandara, W., Leemans, S. J., Ouyang, C., ... & Reijers, H. A. (2020). Robotic process automation: contemporary themes and challenges. Computers in Industry, 115, 103162.
- Tailor, R. K., & Kumar, M. S. (2021). Application of Robotic Process Automation (RPA) in Service Sector during COVID 19. Webology (ISSN: 1735-188X), 18(6).
- Taulli, T. (2020). RPA skills. In The Robotic Process Automation handbook: A guide to implementing RPA systems (pp. 27-51). Berkeley, CA: Apress.

- Timbadia, D. H., Shah, P. J., Sudhanvan, S., & Agrawal, S. (2020, February). Robotic process automation through advanced process analysis model. In 2020 International Conference on Inventive Computation Technologies (ICICT) (pp. 953-959). IEEE.
- Tofan, D. O. (2024). Human Resources–A RPA Perspective. In European Financial Resilience and Regulation 25 Years United under Euro-Proceedings of the International Conference EUFIRE-RE 2024 (pp. 376-392). Editura Universităţii» Alexandru Ioan Cuza «din Iaşi.
- Thompson, A. (2018). Robotic Process Automation (RPA) in Banking Operations. International Journal of Artificial Intelligence and Machine Learning, 1(2).
- Tornbohm, C. and Dunie, R. (2017), Market Guide for Robotic Process Automation Software, Gartner, p. 35.
- Tran, D. and Ho Tran Minh, T. (2018), Workflow Methodology Development of RPA Solution for A Vietnamese Bank: A Case Study of Korkia Oy, Bachelor's Thesis, Laurea University of Applied Sciences, available at: http://www.theseus.fi/handle/10024/148869 (accessed 2 August 2018).
- Tschandl, M., Mezhuyev, V., & Möstl, D. (2021, April). Robotic Process Automation Technology Acceptance: A Case Study from Austrian Companies. In International Conference on Emerging Technologies and Intelligent Systems (pp. 815-826). Cham: Springer International Publishing.
- van der Aalst, W.M.P., Bichler, M. & Heinzl, A. (2018). Robotic Process Automation. Bus Inf Syst Eng 60, 269–272. https://doi.org/10.1007/s12599-018-0542-4
- van Hoek, R., Larsen, J. G., & Lacity, M. (2022). Robotic process automation in Maersk procurement–applicability of action principles and research opportunities. International Journal of Physical Distribution & Logistics Management, 52(3), 285-298.
- Viale, L., & Zouari, D. (2020, July). Impact of digitalization on procurement: the case of robotic process automation. In Supply Chain Forum: An International Journal 21 (3), 185-195. Taylor & Francis.
- Viehhauser, J. (2020). Is robotic process automation becoming intelligent? Early evidence of influences of artificial intelligence on robotic process automation. In Business Process Management: Blockchain and Robotic Process Automation Forum: BPM 2020 Blockchain and RPA Forum, Seville, Spain, September 13–18, 2020, Proceedings 18 (pp. 101-115). Springer International Publishing.
- Vishnu, S., Agochiya, V. and Palkar, R. (2017), "Data-centered Dependencies and Opportunities for Robotics Process Automation in Banking", Journal of Financial Transformation, 45, 68–76.

- Waizenegger, L., & Techatassanasoontorn, A. A. (2022). When robots join our team: A configuration theory of employees' perceptions of and reactions to Robotic Process Automation. Australasian Journal of Information Systems, 26.
- Wewerka, J., & Reichert, M. (2021, September). Checklist-based support of knowledge workers in robotic process automation projects. In 2021 IEEE 23rd Conference on Business Informatics (CBI) (Vol. 1, pp. 52-61). IEEE.
- William, W., & William, L. (2019, November). Improving corporate secretary productivity using robotic process automation. In 2019 International Conference on Technologies and Applications of Artificial Intelligence (TAAI) (pp. 1-5). IEEE.
- Xu, L., Mak, S., & Brintrup, A. (2021). Will bots take over the supply chain? Revisiting agent-based supply chain automation. International Journal of Production Economics, 241, 108279.
- Yarlagadda, R. T. (2018). The RPA and AI automation. International Journal of Creative Research Thoughts (IJCRT), ISSN, 2320-2882.
- Zhang, C., & Vasarhelyi, M. A. (2022). How to teach a 14-week robotic process automation (RPA) course for accounting students. Issues in Accounting Education, 37(3), 21-39.

Appendices

Appendix 1.- Survey on the Implementation of Robotic Process Automation (RPA) Technology in Chile

Please answer this brief survey on the Implementation of Robotic Process Automation (RPA) Technology in Chile. This research is an international collaboration between Chilean and European universities. The survey is blind and confidential. It is 12 questions and it takes 8 minutes to answer. For questions or request of information, please write to the following emails: friosmunoz@uic.es or camilo.pena@upla.cl

Section I

a) Company/Organization Size.

- Microenterprise: company that has 1 to 9 workers hired.
- Small: company that has 10 to 49 workers hired.
- Medium: company that has 50 to 199 workers hired.
- Large company: company that employs 200 or more workers.
- Public Service.
- Professionals.
- Others.

b) Country or Region.

- Country.
- Chile.
- Other Countries.

c) Industrial sector that your Company/organization represents.

- Agroindustry.
- Banking.
- Commerce.
- Education & Training.
- Engineering & Construction.
- Finance.
- Forestry.
- IT.

- Logistics.
- Manufacturing.
- Mining.
- Others.
- Public Sector.
- Service.

d) Are you or your company/organization familiar with or have you heard about Robotic Process Automation (RPA) Technology? If your answer is negative, go to the end of the survey and send. Thanks in advance.

- Yes.
- No.
- No Response.

Section II

1. Professional profile

- Management team.
- Functional managers.
- Managers and team leaders.
- Leaders of processes and/or functions in charge of continuous improvement.
- Team members.
- IT.

2. In your opinion, what is the most relevant criterion for making the decision for RPA implementation?

- Streamline and optimize repetitive tasks, including data flow management
- Automate manual and repetitive tasks
- Consider the evaluation of Implementation (Tactical). Future opportunities and integration with other technologies.
- Consider the evaluation of the Process where it will be implemented
- Have a team or specialist who can provide support and condition all of these previous points to adjust to the work.
- Process maturity.
- That it is aligned with the strategic objectives of the business.

- All of the above.
- All of the above, I would only add the issue of the impact on the platforms where this type of solutions will be implemented.
- A correct survey of processes that allows validating that the minimum requirements to use RPA are met and its application solves a business pain.
- No response.

3. Is the RPA tool currently used to streamline processes within your company or project?

- It hasn't started yet.
- RPA proof of concept/value (1 to 5 robots).
- RPA pilot project (6 to 10 robots).
- RPA implementation (11 to 50 robots).
- RPA at considerable scale (50+).

4. What is the greatest benefit that the implementation of RPA would bring? (Select maximum 3).

- Greater productivity (reduction of errors).
- Costs reduction.
- Work 24/7.
- Time optimization (speed in completing tasks).
- Work optimization (employees dedicated to more relevant jobs).
- Others.

5. What future challenges might the implementation of RPA have? Select maximum 3 alternatives.

- Development of people's new labor skills to work with robots.
- Robot maintenance.
- Unemployment generation in the long term.
- Unclear division of responsibilities between IT and business units.
- Lack of understanding of RPA meaning and its application.
- Human and robot competition.
- Wide access rights for robots.
- Others.
- Robots can make mistakes faster.
- Not familiar with the concept.

6. In your opinion, what is the biggest disadvantage when implementing RPA?

- High implementation costs.
- Creation of new tasks for workers, since robots must be supervised.
- I don't know.
- Understand and accept new technologies from elderly people.
- Initial investment.
- Increased process complexity when a part of the process still needs to be "supported" by human workers.
- It can be a temporary solution, automating manual processes based on "legacy" IT systems.
- Only suitable for processes that include rule-based tasks.
- Have an internal maintenance team.
- No response.

7. Indicate the essential factor(s) for an optimal implementation of RPA in your company or project. (Maximum 3).

- High level of process standardization.
- Interaction with multiple systems.
- Tasks prone to human errors.
- Large transactions.
- High-quality data.
- Low need for cognitive requirements.
- No need or limited labor intervention.

8. What is a real future opportunity in using RPA?

- Integration with Artificial Intelligence.
- Integration with Process Mining.
- Integration with Data Analysis.
- Integration with Text Mining.

Appendix 2.- Literature overview about RPA technology (Source: Own elaboration).

Table A1. Literature review of RPA technology.

Reference	Description	Main findings	A/I	B/I	C/P	L/ H-R	G	S/OT
Moreira et al. (2023)	This paper explores the literature review, the concept of Robotic Process Automation (RPA), its benefits, eligible processes, and challenges for successful adoption. It aims to help organizations understand the challenges and benefits of RPA in various business sectors.	Understanding Robotic Process Automation (RPA) in Organizations • RPA is a growing trend in business process restructuring and digital transformation. • It can be applied in various business processes and by organizations from any sector. • The review aims to clarify RPA's concept, benefits, eligible processes, and barriers for successful adoption. • The review contributes to the organization's clarification of RPA adoption. • It focuses on reducing the execution time of routine tasks, freeing up employees for more creative tasks. • The review also identifies the main characteristics of eligible processes and the main barriers to successful RPA adoption	x	x	x			
Patrício et al. (2023)	This paper explores Robotic Process Automation (RPA) implementation models, focusing on Triple Bottom Line (TBL) effects, highlighting the	Robotic Process Automation (RPA): A Literature Review • RPA is a rules-based system for automating business processes using software bots. • Limited literature exists on RPA decision support models.	x					

	need for improved research and evaluation models.	• The study aims to identify and analyze RPA implementation models. • The analysis considers Triple Bottom Line (TBL) effects on environmental, social, and economic aspects. • Findings suggest room for improvement in RPA research, particularly in developing an evaluation model considering TBL.						
Enríquez et al., 2020	The study analyzes robotic process automation (RPA) and identifies gaps in literature. It reviews 54 studies and 14 tools, revealing most tools don't cover all phases, highlighting the lack of technological solutions.	Robotic Process Automation: A Systematic Mapping Study • Analyzes current state-of-the-art of Robotic Process Automation (RPA). • Reviews 54 primary studies on RPA. • Reviews 14 main commercial tools of RPA. • Identifies gaps in scientific and industrial literature. • Notes some RPA lifecycle phases already solved in the market. • Highlights lack of automation in Analysis phase due to lack of technological solutions. • Presents future directions and challenges in RPA.					x	
Syed et al. (2020)	This paper reviews current RPA themes and challenges, highlighting the need for future research in this field, which uses software agents to mimic user actions for increased operational efficiency.	Robotic Process Automation (RPA): An Overview • RPA uses software agents to mimic user actions, reducing human workload. • RPA has seen significant practical adoption, with multiple vendors offering solution technologies.			x			

		• Despite its early adoption, RPA lacks theoretical foundations, hindering its application and development. • This paper presents a structured literature review identifying contemporary RPA-related themes and challenges for future research.						
Perdana et al. (2023)	The paper explores the potential of robotic process automation (RPA) in enhancing audit efficiency and accuracy within four accounting firms, discussing its strategies, benefits, challenges, and future opportunities.	Robotic Process Automation in Accounting • Examines audit scenarios within four accounting firms. • Discusses potential for robotic process automation (RPA) to enhance efficiency and accuracy. • Proposes and implements RPA-enabled solutions for more efficient and effective procedures. • Based on consultancy experiences with auditors from Big 4 and mid-sized firm. • Presents four practical business process scenarios and prototyped RPA solutions. • Explains automation strategies, development duration, benefits, and challenges. • Analyzes how RPA has automated real-world audit tasks. • Discusses future challenges and opportunities in broader RPA implementation in accounting and audit tasks.		x	x			
Kokina and Blanchette (2019)	The paper explores Robotic Process Automation (RPA) for automating accounting and finance tasks, highlighting its benefits such as cost	Robotic Process Automation in Accounting and Finance • Robotic Process Automation (RPA) automates rules-based business processes using software bots.		x				

	savings, improved documentation, and improved performance measurement.	• Study explores bot implementation for accounting and finance tasks. • Interview data from RPA adopters is analyzed. • Securing technical capability is only part of RPA implementation process. • Organizations standardize and optimize processes, develop task ranking tools, adjust governance structures, and redefine internal controls. • Benefits include cost savings, improved process documentation, lower error rates, accurate measurement of performance, and better report quality.						
Flechsig et al. (2022)	This paper presents a study of 19 organizations, which reveals that adoption Robotic Process Automation (RPA) is gaining attention in digital transformation, but adoption in purchasing and supply management is still in its infancy, influenced by factors like IT infrastructure, human resources, and regulations.	Robotic Process Automation in Public and Private Sectors • Robotic Process Automation (RPA) is gaining attention in digital transformation, but its adoption in purchasing and supply management is still in its infancy. • A case study of 19 organizations from both public and private sectors provides insights into potentials, barriers, suitable processes, and best practices for RPA implementation. • Adoption depends on organizations' digital procurement readiness and maturity. • Potentials include employee reliefs, cost savings, and increased operational efficiency. • Barriers include IT infrastructure, human resources, internal communication, financial resources, top management support,	x		x			

		organizational structures, supplier-related issues, and government regulations. • Differences exist between private and public sectors for RPA implementation.						
Ribeiro et al. (2021)	This paper explores the use of AI in Robotic Process Automation (RPA) tools to enhance operational and business processes in Industry 4.0. The tools utilize Artificial Neural Network algorithms, Text Mining, and Natural Language Processing techniques for information extraction and forecasting.	Robotic Process Automation (RPA) and AI in Industry 4.0 • RPA offers numerous advantages in automating organizational and business processes. • The use of AI algorithms and techniques enhances the accuracy and execution of RPA processes. • AI extends the objectives of RPA with the use of Artificial Neural Network algorithms, Text Mining techniques, and Natural Language Processing techniques. • These techniques aid in information extraction, recognition, classification, forecasting, and optimization of processes. • The study aims to present RPA tools associated with AI that can contribute to the improvement of organizational processes associated with Industry 4.0. • The use of AI extends the extraction of information, consequently improving operational and business processes.						x
Xu et al. (2021)	This paper discusses the slow adoption of agent-based systems in Supply Chain Management due to technology immaturity, lack of interoperability, and trust in AI,	Agent-Based Supply Chain Systems: A Review • Agent-based systems fuse information from distributed sources to create faster, better plans.	x		x			x

	highlighting the convergence effect of supporting technologies.	• Despite being proposed since the early 2000s, industrial uptake has been slow due to immaturity of technology, lack of interoperability, and trust in AI. • The paper revisits the state of agent-based supply chains and highlights the maturity of the technology. • Supporting technologies like IoT technology, digital ledgers, and learning functionalities are filling gaps in the concept, making it applicable to a wider range of functions. • The paper emphasizes the need for further research and development in this area.						
Viale & Zouari (2020)	The paper examines the practical implications of Robotic Process Automation (RPA) in procurement, analyzing seven case studies from various industries, identifying its operational, organizational, and relational impacts.	Exploring the Impact of Robotic Process Automation (RPA) in Procurement • Rapid digital transformation in supply chain processes and increasing competitiveness are transforming traditional procurement. • Research on RPA in buyers' practices is still in its infancy. • Seven case studies from various industries were selected for their successful experiences in digitalization in procurement. • Findings confirm the relevance of some attributes of procurement automation. • RPA impacts procurement in operational, organizational, and relational terms.	x	x				
Santos et al. (2019)	This paper analyzes robotic process automation (RPA) development in	RPA Development Analysis in Business Organizations					x	

	business organizations, presenting a literature review and proposing a model connecting main RPA concepts. It fills a gap in literature and synthesizes RPA main topics.	• RPA aims to automate business processes using software robots. • Importance of selecting suitable processes for RPA automation is crucial. • This paper presents a literature review on RPA to identify main concepts. • A model connecting main RPA concepts is presented, evaluated, and applicable based on past RPA case studies. • Findings show most RPA main concepts are not reported in selected RPA case studies. • The research aims to fill the gap in literature by identifying and synthesizing RPA main topics. • • The model can be used as a schema for conducting and writing RPA case studies.						
Flechsig et al. (2019)	This paper presents a methodology for combining Robotic Process Automation (RPA) with Business Process Management (BPM) to optimize as-is processes, demonstrating its potential in a case study.	Robotic Process Automation (RPA) and Business Process Management • RPA is a promising approach for automating administrative tasks in operations. • RPA procedures can only automate current processes, incorporating redundancies and excessive steps. • Combining RPA with Business Process Management (BPM) can optimize the as-is process. • The paper proposes a methodology to combine RPA and BPM, demonstrating its potential in a case study.						x

		• The paper also addresses benefits, limitations, and research opportunities.						
Viehhauser (2020)	This paper examines the impact of AI on Robotic Process Automation (RPA) capabilities, focusing on cognitive intelligence and its necessity in the field.	AI Impact on Robotic Process Automation (RPA) • AI technologies are transforming work and automating tasks. • RPA, a software solution for routine tasks, is becoming "smart" with AI and Machine Learning. • The paper explores the capabilities of intelligent RPA in academia. • Case studies with global RPA software providers and integrators provide evidence for cognitive capabilities. • The paper discusses the necessity of cognitive intelligence in RPA software.		x				x
Rajawat et al. (2021)	This chapter introduces a new approach to advanced productivity and product quality, focusing on interactive partnerships between humans and robots, reducing time, risk, and expense.	Robotics as a Replacement for Staff in Automation • Robots are ideal for repetitive roles, but not always practical. • Historically, some sectors have been robot-reluctant due to large quantities and non-serialized properties. • This chapter introduces a new approach to advanced Productivity and Product Quality, integrating control and robotics' repeatability with human versatility. • The strategy focuses on interactive and symbiotic partnerships between human staff and robots. • The proposed architecture includes components for power, protection, and interface for current production phase.				x		

		• Results show machines, robots, and humans can occupy the field comfortably without physical separation. • This reduces time, risk, and expense, increases efficiency, and improves product consistency.						
Axmann et al. (2021)	This paper shows a novel cost framework, which is developed for robotic process automation, addressing challenges in estimating costs and break-even, categorizing and prioritizing drivers in development, investment, and operation.	Robotic Process Automation Cost Estimation • Robotic process automation mimics human behavior for digitized tasks. • Estimating costs and break-even in robotic process automation projects is challenging. • No dedicated guidelines exist for defining cost components beyond person-hours and salary cost. • Literature review and structure of cost drivers for robotic process automation projects. • Novel cost framework developed for cost estimation of robotic process automation projects. • Framework includes three cost calculation perspectives for development, investment, and operation. • Framework illustrated in a robotic process automation use case.	x		x			
Cabello et al. (2020)	This paper explores these alternatives, their benefits, requirements, and future research lines, and highlights the importance	Robot-Person Interaction (RPA) in Organizations • RPA has matured in organizations, promoting "human-in-the-loop" interaction. • RPA projects often require human-robot collaboration, leading to hybrid approaches.		x	x			

	of process mining for efficiency and continuous improvement.	• Challenges can be addressed through asynchronous (landing area or task queues) and synchronous solutions (human digital augmentation). • The paper outlines benefits, requirements, and future research lines based on industrial experiences. • Process mining is crucial for process analysis efficiency, time-to-market reduction, and continuous improvement.						
Jovanović et al. (2018)	This paper discusses Robotic process automation to perform repetitive tasks, reduces costs, improves efficiency, and minimizes rework in low to middle complexity and high repetitiveness business processes.	Robotic Process Automation in Business • Business processes are essential for optimal performance and avoiding losses. • Traditional automation techniques include machines or mechanical robots. • Modern e-business processes often involve computer-based tasks. • Robotic process automation uses software to perform tasks like humans, automating processes of low to middle complexity and high repetitiveness. • Benefits of robotic process automation include reduced costs, improved process efficiency, and reduced rework tasks.		x				
Wewerka and Reichert (2021)	The paper presents a checklist-based support for knowledge workers in Robotic Process Automation projects, demonstrating no project failures, expected	Robotic Process Automation (RPA) and Knowledge Workers • RPA involves rule-based automation of business tasks by software robots mimicking human interactions. • RPA projects often fail due to lack of human support.	x		x			

	savings, error reduction, and process speed improvement.	• Knowledge workers without IT background often develop and configure software robots. • This paper proposes a checklist-based support for knowledge workers in RPA projects. • The checklist was developed based on interviews, industry case studies, and user surveys. • After three iterations, the checklist was evaluated in six industrial RPA projects, achieving full-time equivalents savings, error reduction, and process speed improvement.						
Dey and Das (2019)	This paper explores the use of robotic process automation (RPA) in business processes, identifying motivations, challenges, and perspectives of user and developer communities, aiming to help practitioners adopt RPA products.	Robotic Process Automation in Business Processes and Services • RPA is a technology solution for enterprise-wide automation of repetitive business processes. • Potential benefits include FTE savings, improved service quality, and improved delivery. • Survey of practitioners involved in RPA identifies motivations and challenges. • Complementary perspectives of RPA product development communities found. • Recommendations include aligning user and developer perspectives for value creation. • Findings can assist practitioners in developing RPA products or adopting these products in their IT ecosystems.	x		x			

van Hoek et al. (2022)	This paper presents a case study of a procurement RPA program, highlighting its value in supply chain management. They suggest RPA enhances work, allowing Maersk to focus on strategic priorities, and consider 39 generic action principles for RPA adoption.	Robotic Process Automation in Procurement: A Case Study • The authors present a case study of a multiple-year RPA adoption in procurement. • The Maersk case serves as a benchmark for decision-making and serves as a basis for further research on RPA's value, change management, behavioral aspects, and return on investment. • The authors collaborate with a Maersk co-author to capture lessons learned and develop future research questions. • Findings suggest RPA for procurement enables strategic progress and advances triple values in a supply chain setting. • RPA augments work, it does not replace it, and Maersk uses automation to focus employees on strategic priorities. • The authors develop additional action principles based on the Maersk case. • The study complements limited empirical research on RPA in procurement and supply chain management.	x	x				
Timbadia et al. (2020)	This paper presents an RPA process analysis model compared to a traditional model, revealing its efficiency over the traditional method.	Robotics Process Automation: An Efficient Automated Method • RPA is an advanced technology that mimics human interactions in business processes. • It's used in various industries like banking, finance, HR, healthcare. • The paper presents an RPA process analysis model compared to a traditional model.		x				

		• The proposed model yields efficient results over traditional methods.						
Herm et al. (2023)	A design science research approach was used to develop a framework for implementing robotic process automation projects. The framework includes three phases: initialization, implementation, and scaling, spanning eleven stages and ensuring flexibility for complex corporate environments and small and medium-sized companies	Robotic Process Automation: A Disruptive Technology • Robotic process automation automates digital yet manual tasks and business processes. • It's lightweight and mimics human behavior, but up to 50% of projects fail. • A design science research approach was used to develop a framework for robotic process automation projects. • Analysis of 35 real-life projects led to a preliminary sequential model. • Expert interviews and workshops validated and refined the model. • The framework offers flexible guidelines for complex corporate environments and small and medium-sized companies. • Structured by three phases: initialization, implementation, and scaling. • The framework manages knowledge and support processes for robotic process automation implementation projects.		x				

Šperka & Halaška (2023).	This paper develops a data-driven framework for evaluating Robotic Process Automation implementation using process mining, identifying critical factors, and designing PPAFR stages. Results show waiting times are the main cause of extended cases, and several characteristics must be considered when implementing RPA.	Research on RPA Implementation using Process Mining • The research aims to design a data-driven performance framework for RPA implementation using process mining (PPAFR). • The research summarizes trends in process mining and RPA, and outlines research objectives and methods. • Critical factors for RPA implementation are identified and process stages of PPAFR are designed. • The design is demonstrated on real data from a loan application process, involving process discovery, analysis, and simulation. • A redesign of the process is proposed, emphasizing RPA implementation. • The research identifies several characteristics that need to be considered when implementing RPA due to its impact on overall process performance.	x		x			
Pypłacz & Žukovskis (2023).	This paper explores the link between employee education, management support, and Robotic Process Automation (RPA) implementation in SMEs, highlighting the need for organizational and process changes.	Robotic Process Automation in SMEs • Robotic Process Automation (RPA) solutions are becoming more affordable and accessible for SMEs. • The study aims to understand the relationship between a company's employee education and retraining, management support, and RPA implementation.	x			x		

		• Empirical research on 248 SMEs confirmed the need to view RPA implementation as a broader organizational change, affecting employees and processes. • The study suggests that RPA technology should be treated as a change in work organization and process.						
Eulerich et al., 2022	This paper develops an RPA governance framework for a Fortune 500 company, utilizing design science research and 86 professional feedback to optimize benefits and minimize risks.	RPA Governance Framework Development • Utilizes design science research and a Fortune 500 company to address concerns about RPA governance. • Framework includes four governance areas and 14 control requirements. • Aims to maximize benefits and minimize risks of RPA use. • Validated through interviews and surveys with 86 professionals across various organizations. • Feedback indicates successful achievement of objectives.	x	x				
Ruiz et al. (2022)	The paper presents an iterative method for implementing hybrid robotic process automation in real-world settings, utilizing industrial experiences and process mining for continuous improvement and efficiency benefits.	Hybrid Robotic Process Automation (RPA) Overview • RPA technology now focuses on human-robot collaboration for real-world automation. • Hybrid RPA involves vertical segmentation of process activities. • Literature lacks a comprehensive method considering technical aspects, automation's psychological impact, and governance mechanisms.	x	x				

		• This paper proposes an iterative method based on industrial experiences. • Process mining is discussed as a tool for continuous improvement. • Initial validation in real-world processes shows significant efficiency benefits.						
Agostinelli et al. (2022)	This paper presents SmartRPA, a design science research method that interprets UI logs and automatically synthesizes SW robots for specific intermediate user inputs. The approach is implemented as an open-source tool and evaluated using syntectic and real-world data.	Robotic Process Automation in Business Process Management • Robotic Process Automation (RPA) is a technology in BPM that automates repetitive tasks. • RPA solutions access the user interface layer of software applications, providing a virtual workforce of SW robots. • Human experts observe routine execution on the UI of SW applications and implement RPA scripts. • Current practice is time-consuming and error-prone due to human experts' interpretation of routines. • This paper presents SmartRPA, a design science research method to interpret UI logs and synthesize SW robots. • The approach is implemented as an open-source tool and evaluated with four non-functional requirements using syntectic and real-world data.	x					x
Plattfaut et al. (2022)	This paper analyzes Critical Success Factors (CSF) for Robotic Process	Robotic Process Automation: Critical Success Factors Analysis	x					x

	Automation (RPA) using literature review and expert interviews. It identifies 32 CSFs in contextual clusters and discusses their relevance for other automation technologies and process improvement efforts. It highlights implications for theory and practice.	• New phenomenon in process digitalization and automation. • Need to analyze Critical Success Factors (CSF) for RPA. • Study identifies 32 CSFs based on literature review and expert interviews. • Success factors are categorized into contextual clusters. • Discusses if success factors are RPA-specific or applicable to other automation technologies. • Highlights implications for theory and practice, and areas for future research.						

Note:

A/I : Adoption/Implementation.

B/I : Benefits/Impacts.

C/P : Challenges/Problems.

L/HR : Link / Human-Robot.

G : Gaps.

S/OT : Synergies/other technologies.

Table A2. General criteria for RPA implementation based on expert opinions (Own elaboration).

Criteria	Description
Rule-based and repetitive tasks:	RPA is best suited for processes that follow a defined set of rules and involve repetitive tasks. If a process is highly variable or requires a lot of decision-making, RPA may not be the best fit.
High volume and manual intensive tasks	RPA is effective in automating tasks that involve high volumes of data, such as data entry or data migration, which would otherwise require significant manual effort.
Structured data and well-defined inputs:	RPA works well with processes that deal with structured and standardized data. The inputs and outputs of the process should be well-defined for the robots to operate effectively.
Stability and minimal changes in processes	RPA is most beneficial for stable processes that go through minimal changes. Frequent process changes may require frequent robot reconfiguration and reduce the return on investment.
Clear ROI and business case	Before integrating RPA, it is important to assess the return on investment and develop a clear business case. RPA can bring cost savings, improved accuracy, increased productivity, and faster processing time, so a thorough analysis should be done
Availability of underlying technology infrastructure	RPA requires a stable technological infrastructure to operate effectively. It should be ensured that the required systems, APIs, and integrations are available to support RPA implementation.

Security and compliance requirements	Consideration should be given to security and compliance requirements of the organization. RPA should not compromise the security or violate any regulatory or legal standards
Change management and stakeholder alignment	Implementing RPA involves changes in the way processes are executed and managed. Adequate change management and stakeholder alignment are crucial for successful integration.
Scalability and future proofing	RPA should be implemented with scalability and future needs in mind. Consider whether the chosen RPA solution can accommodate future process expansions or increased complexity.
Cost-benefit analysis:	Evaluate the costs involved in implementing RPA, including licensing, infrastructure, implementation, and maintenance, against the expected benefits and savings to determine the feasibility and viability.

Table A3. Literature overview about the main advantages and benefits of implementing RPA (Own elaboration).

Reference	**Benefits of RPA**	**Description**
Slaby, 2012; Lacity and Willcocks, 2015, 2017; Alberth and Mattern, 2017; Anagnoste, 2017; Tran and Ho Tran Minh, 2018)	It can work 24/7	RPA can work 24 hours every day, depending on how it is configured and the availability of the systems and applications it interacts with. Since RPA bots are software programs, they are not subject to typical human limitations such as working hours, breaks, or holidays. They can be scheduled to run automated tasks at any time, including outside of regular business hours, ensuring continuous and uninterrupted processing. This

		24/7 availability of RPA can lead to increased efficiency, faster turnaround times, and improved service levels.
Slaby, 2012; Lacity and Willcocks, 2015; Suri et al., 2017; Tran and Ho Tran Minh, 2018	It allows employees to focus on more relevant tasks	RPA allows employees to focus on more important tasks by taking over repetitive, mundane, and rule-based activities. Therefore, by offloading repetitive tasks to RPA bots, employees can redirect their time and energy towards more important and value-generating tasks. This helps organizations maximize their human resources, boost employee productivity, and drive innovation and growth.
Slaby, 2012; Lacity and Willcocks, 2015, 2017; Suri et al., 2017; Vishnu et al., 2017	It makes tasks faster	RPA bots operate at machine speed, enabling them to complete tasks significantly faster than humans. They can execute repetitive and rule-based tasks quickly, without human limitations such as breaks or distractions.
Alberth and Mattern, 2017	Increase Company's productivity	RPA can automate repetitive and manual tasks, making tasks faster and allowing employees to focus on more relevant and strategic and value-added work. These lead to increased productivity and efficiency within an organization.
Lacity and Willcocks, 2015; Alberth and Mattern, 2017; Suri et al.,2017; Tran and Ho Tran Minh, 2018	It results in fewer errors and consistent quality	RPA reduces human errors that can slow down task completion. Bots adhere to strict rules and consistently perform tasks accurately, resulting in increased efficiency

Slaby, 2012; Lacity and Willcocks, 2015, 2017; Suri et al., 2017; Vishnu et al., 2017; Tran and Ho Tran Minh, 2018	RPA Solutions are scalable, extensible, and reusable to meet peaks in service demand	Scalability: RPA allows organizations to easily scale up or down their automation capabilities as per their business needs. Additional bots can be deployed to handle increased workload during peak periods, ensuring that tasks are completed efficiently and on time. Similarly, bots can be scaled down when demand decreases to avoid unnecessary costs. Extensibility: RPA solutions can be extended to cover new processes or additional tasks within existing processes. Once a bot is developed and deployed for a specific task, it can be modified or expanded to handle additional tasks and integrate with other applications or systems. This extensibility allows organizations to quickly adapt and automate new processes without reinventing the wheel. Reusability: RPA bots are designed to be reusable components. The logic and functionalities developed for one bot can be easily reused or replicated for similar processes or tasks across different departments or functions within an organization. This reusability not only speeds up the implementation of new automation initiatives but also ensures consistency and standardization of processes.
Lacity and Willcocks, 2015; Suri et al., 2017; Tran and Ho Tran Minh, 2018	It allows FTE Savings	RPA reduces reliance on Full-Time Equivalent (FTEs) for repetitive tasks, enhances efficiency and scalability, and allows organizations to optimize their workforce. This results in FTE savings, cost reduction, and improved operational efficiency for organizations implementing RPA
Lacity and Willcocks, 2017; Suri et al., 2017	Quick return on investment (ROI)	RPA offers a quick return on investment (ROI) due to cost reduction, increased efficiency, scalability, error reduction, non-invasive implementation and enhanced customer among others

Appendix 3.- Perceptions about RPA based on expert opinions and the literature overview.

Table A4. Perceptions about RPA based on expert opinions (Own elaboration).

Perceptions about RPA	Description
Automation and efficiency	RPA is generally seen as a technology that can automate repetitive tasks and improve process efficiency. It is perceived as a way to eliminate manual errors, reduce processing time, and increase productivity by offloading mundane tasks to software robots.
Cost savings	RPA is often associated with cost savings as it can reduce the need for human resources, especially for repetitive tasks. Organizations perceive RPA as a way to optimize their workforce, achieve FTE savings, and cut operational costs. However, it is important to note that upfront investment is required for implementing RPA, and long-term cost savings may vary depending on factors such as process complexity and volume.
Employee concerns	Some employees may have concerns about RPA impacting job security. The perception exists that RPA may replace human jobs, leading to workforce reduction. However, organizations often emphasize that RPA's purpose is to automate repetitive tasks and allow employees to focus on more strategic and value-added activities, rather than outright job replacement.
Scalability and flexibility	RPA is considered a flexible technology that can be easily deployed and scaled. It is perceived as a tool that can adapt to changing business needs and handle increased workloads without significant disruptions or additional resources.
Technological limitations	While RPA is powerful in automating rule-based tasks, there may be limitations when it comes to handling unstructured data, complex decision-making, or tasks requiring human judgment and creativity. Some perceive RPA as a technology that complements human capabilities rather than fully replacing them.
Integration challenges	Achieving seamless integration of RPA with existing systems and applications can be perceived as a challenge. Lack of standardization, legacy systems, and complex IT environments can pose

	integration hurdles, requiring careful planning and collaboration between IT teams and business stakeholders.
Potential for innovation and digital transformation	Some organizations view RPA as a stepping stone towards more advanced automation technologies and digital transformation. RPA can lay the foundation for organizations to explore intelligent automation, machine learning, and artificial intelligence, enabling higher levels of process automation and business optimization.

Table A5. Literature overview about RPA perceptions (Own elaboration).

Reference	**Findings**
Kregel et al., 2021	The article analyzes 95,000 news articles on Robotic Process Automation (RPA) from 2015 to 2020, revealing it has passed a hype phase and is now considered a mature technology with potential for future research.
Cooper et al., 2022	This research shows Robotic Process Automation (RPA) positively impacts public accounting, improving career prospects for firm leaders and lower-level employees, but lower-level employees report no improvements, indicating future research direction.
Waizenegger & Techatassanasoontorn, 2022	The study explores employees' perceptions and reactions to robotic process automation in a New Zealand financial institution, identifying four configurations influencing collaboration, attitude, and interactions with software robots.
Gomes & Seruca, 2023.	The study explores employees' perceptions of Robotic Process Automation (RPA) implementation in a shared services company, using a questionnaire and multidimensional evaluation model to understand its impact on perception and future developments.
Salih Aydıner et al, 2023	The study explores the strategic implications of Robotic Process Automation (RPA) in the financial industry, finding that despite improvements in efficiency, no labor or cost reduction was observed.