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Adoption of Robotic Process Automation in the accounting area by a cooperative credit system: Metrics and motivators

Tailane Dias Rovaris[a], Fernanda da Silva Momo[1,a], Giovana Sordi Schiavi[a] and Laura Bratkowski[a]

[a]*University Federal of Rio Grande do Sul, Brazil*

Abstract

Research Question: What metrics guide the decision to adopt Robotic Process Automation in the accounting area of a Cooperative Credit System from the viewpoint of TOE framework?

Motivation: The research seeks to fill the gaps in the literature regarding the criteria and challenges involved in RPA implementation within accounting contexts, particularly in credit cooperatives.

Idea: This study aims to develop a framework of metrics and motivators for the adoption of Robotic Process Automation (RPA) in the accounting area of a Credit Cooperative System, based on the Technology-Organization-Environment (TOE) framework.

Data: This qualitative and descriptive research was conducted in two stages: (1) a systematic literature review to identify RPA adoption motivators within the TOE context, and (2) a single case study involving 17 cooperatives integrated into a Brazilian Credit Cooperative System.

Tools: Data collection included semi-structured interviews, to map practical metrics and motivators, observations, and documentary analysis. The data underwent content analysis using categorization based on the three pillars of the TOE model.

Findings: The study identified 61 metrics and motivators for RPA adoption, distributed across technological (24), organizational (20), and environmental (13) contexts. The primary motivators include increased operational efficiency, cost reduction, risk mitigation, ease of technology use (low-code), and external competitive pressure. Additionally, initial employee resistance and the absence of clear guidelines were highlighted as implementation challenges.

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[1] *Corresponding author:* Faculty of Economic Sciences, University Federal of Rio Grande do Sul, Brazil. Address: Av. João Pessoa, 52 - Centro Histórico, Porto Alegre - RS, 90040-000, Tel: +55-51-9947-4370, email fernanda.momo@ufrgs.br.

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Contribution: As a theoretical contribution, the study details the motivators and metrics for RPA adoption, enriching the TOE framework. In practical terms, the developed framework serves as a guide for other institutions in decision-making regarding RPA implementation, highlighting critical points such as training, security controls, and internal communication.

Keywords: robotic process automation, cooperative credit system, TOE framework.

JEL codes: M40, O33

1. Introduction

To adapt to the era of technological innovation and remain competitive in the market, organizations continually seek new technologies that help them to supply products and provide services (Wojciechowska-Filipek, 2019). The demand for efficiency and agility has led companies to consider process automation, which is rapidly transforming their organizational environment (Harrast, 2020). Aided by technological tools such as Robotic Process Automation (RPA), organizations have been automating deterministic tasks and adding more value to their services and products (Kokina & Langmann, 2022).

The implementation of RPA in repetitive administrative activities is intended to increase efficiency and productivity at work (Cooper *et al*., 2019). In addition to other technologies, RPA is one of the main drivers of accounting digitalization (Langmann & Kokina, 2021), which spurs advances in accounting, particularly in high-volume operational tasks (Cooper *et al.*, 2019). However, procedures and metrics to guide the reasoning behind the development and implementation of RPA are still lacking, meaning that special attention is required to assess the cost-benefits of process automation (Matthies, 2020).

Financial functions are under constant pressure to monitor improvements and new technologies (Kaya *et al.*, 2019). One sector that shows the greatest potential to increase efficiency is accounting, as most repetitive processes run via a computer can be automated (Zhang *et al.*, 2023; Manyika *et al.*, 2017). As the implementation of RPA in accounting becomes more mature and widespread, this field of research is expected to grow in both depth (detailed analysis of processes) and breadth (diversity of methodologies and issues addressed) (Langmann & Kokina, 2021).

In view of the potential of this technology in the accounting and financial environment (Langmann & Kokina, 2021; Harrast, 2020; Kaya *et al.*, 2019; Moll & Yigitbasioglu, 2019; Manyika *et al*., 2017), this study focuses on the financial context of Credit Cooperatives, as these are among the oldest financial institution models in Brazil and represent almost 11% of the Brazilian credit market. Thus, in

portfolio volume, they are the sixth largest players in the market after banks (Campos & Bompan, 2021). Furthermore, the potential of RPA to boost the efficiency and expansion of organizations (Harrast, 2020; Moll & Yigitbasioglu, 2019) is related to the context of the present study, since credit cooperatives showed a growth of 35% at the end of the year 2020, compared to the average of 15% of the other segments of the National Financial System (Banco Central do Brasil, 2021). This constitutes a favourable context for identifying the adoption and use of this technology.

There have been few reports on the challenges involved in implementing RPA in the accounting field and the methods that companies use to determine the processes to be automated (Kokina & Blanchette, 2019). Studies are required that provide adequate objectives, procedures, and metrics to guide decision making in RPA implementation (Syed *et al.*, 2019). In view of the need for more research related to the issue of automation in the accounting sector and the benefits it creates for organizations, the following research question was posed: What metrics guide the decision to adopt Robotic Process Automation in the accounting area of a Cooperative Credit System from the viewpoint of TOE framework? Therefore, the general objective of this study is to develop a framework of metrics and motivators for the adoption of RPA in the accounting area of a cooperative credit system, based on the TOE framework, through a systematic review of the literature and a single case study.

Owing to the benefits of automation, it is one of the main demands of financial organizations, used as a priority tool by 30% of banks worldwide (Manyika *et al.*, 2017). RPA implementation helps reduce costs, on average, from 25% to 75%, leading to improvements in performance indicators and preserving production quality (Wojciechowska-Filipek, 2019). Organizations using RPA technology in their processes have found that in addition to reductions in human resources or full-time equivalents, it improves the services they provide, as well as their agility and quality, minimizes errors, and increases employee satisfaction (Moffit *et al.*, 2018). Although RPA technology is widely used to automate financial and accounting activities, further studies are needed to explore its adoption (Kokina & Langmann, 2022). This study presents a framework with metrics and variables to address the research gaps identified by Kokina and Langmann (2022), Cooper *et al.* (2019), and Syed *et al.* (2019).

This research is structured to present the theoretical framework in the section below. Subsequently, in the second section, methodological procedures used in the mapping metrics that guide the decision to adopt RPA in a Cooperative Credit System. In the third section of this article, we present de results obtained from the single case study, applied to cooperatives integrated into a Brazilian Cooperative Credit System. Finally, the main results and contributions are presented.

2. Theoretical Framework

2.1 Robotic Process Automation and its application in accounting

Robotic Process Automation is described as a pre-configured software feature that uses business rules and step-by-step predefined activities to perform process, task, and transaction combinations autonomously (Huang & Vasarhelyi, 2019). It can integrate the activities of one or more unrelated software systems to deliver a product or service (Matthies, 2020). It is a relatively new technology that values software agents called bots, which imitate the manual path followed by a human being (Syed *et al.*, 2019). Therefore, RPA is a software technology that performs repetitive rule-based tasks on computer systems to execute business processes (Cooper *et al.*, 2021). Thus, it is a crucial tool for promoting business process optimization through the automation of individual tasks (Wewerka & Reichert, 2021).

Regarding RPA and accounting, it is noteworthy that RPA software has become more popular among companies because of the lower risk of human error, greater efficiency, and lower costs, which are considered key factors for implementing the technology (Wojciechowska-Filipek, 2019). This context has become increasingly relevant, offering promising research perspectives on accounting (Matthies, 2020). Many areas of accounting involve activities that interact with various systems with high levels of processing that require minimal decisions. In this case, the potential for RPA implementation is high (Kokina & Blanchette, 2019). Regarding accounting, RPA is applied to reduce costs and increase operational efficiency (Huang & Vasarhelyi, 2019) driving the digital transformation of accounting into multiple organizations, and accounting activities, such as those carried out on receivables, payables, or monthly closings, suitable for RPA use (Langmann & Kokina, 2021).

2.2 Framework of Technology-Organization-Environment (TOE)

The Technology-Organization-Environment framework, known by the acronym TOE, is intended to study the adoption or likelihood of adopting general technological innovations. The framework, formulated by Tornatzky and Fleischer (1990), is considered an organizational-level framework, in which the authors identify three aspects of a company's context that influence its adoption and implementation of innovations: technological, organizational, and environmental.

The technological context describes the internal and external technologies relevant to a company. Both the company's existing technologies and those available in the market may include equipment and processes (Tornatzky & Fleischer, 1990). A company's existing technologies are important in the adoption process because they set a broad limit on the scope and pace of technological change that the company

can accomplish (Collins *et al.*, 1988). For the authors, existing innovations, even if not yet used by the company, influence further advancements by demarcating the limits of what is possible and by showing how technology can allow them to evolve and adapt.

The organizational context is usually defined in terms of several descriptive measurements, such as the size and scope of the company; the centralization, formalization, and complexity of its management structure; the quality of its employees; and the number of slack resources available internally (Tornatzky & Fleischer, 1990). According to Galbraith (1973) and Tushman and Nadler (1986), this context affects adoption and implementation decisions in several ways, such as the mechanisms that link the internal subunits of an organization and how they go beyond internal limits by promoting innovation. The context also affects the presence of informal liaison officers, multifunctional teams, and employees who have formal or informal links with other departments, as well as relationships with value chain partners. Organizational structure has been studied to identify its relationship with the innovation adoption process (Tornatzky & Fleischer, 1990). Burns and Stalker (1962) and Daft and Becker (1978) argued that organic and decentralized organizational structures are associated with adoption because organizations with these types of structures place emphasis on teams, have a degree of fluidity in responsibilities for employees, and promote lateral communication, in addition to communication along the reporting lines.

The third dimension is the environment, which is the arena in which a company conducts its business, that is, its industry, direct competitors, access to resources provided by third parties, and negotiations with the government (Tornatzky & Fleischer, 1990). The industry structure has been investigated in several ways, and intense competition stimulates innovation adoption. Therefore, key companies in the value chain tend to influence innovation through their partners in order to innovate (Kamath & Liker, 1994). According to Tornatzky and Fleischer (1990), an industry's life cycle is relevant because fast-growing companies tend to innovate faster than more mature or declining industries. However, the innovation practices involved are not clear.

These three elements influence how a company perceives the need for technological innovation and how it seeks out and adopts new technologies. Since the evolution of accounting has always been closely tied to the development of information systems, studying the adoption of RPA technology in the accounting sector has become increasingly relevant. This is because accounting is considered one of the primary areas for implementation, and RPA is a central driver of its digitalization (Langmann & Kokina, 2021).

4. Method

This study consists of two stages. The first stage is a Systematic Literature Review, conducted to identify the drivers and motivators of RPA adoption with regard to the TOE framework. The second stage is a case study that maps the metrics guiding the decision to adopt RPA in a Cooperative Credit System, from the perspective of the TOE framework. The following sections describe the methodological procedures used in each stage.

3.1 Stage 1 - Drivers and motivators of the adoption of RPA with regard to TOE

A systematic literature review (SLR) was conducted to identify the drivers and motivators of RPA adoption, with regard to TOE framework. This collection was the result of a search for peer-reviewed scientific articles. The combinations of terms for accounting and RPA were considered, as well Boolean combinations ("Account*" AND "RPA" or "Account*" AND "Robotic Process Automation"). The search was carried out considering the presence of the terms in the fields of "Title," "Keywords" and "Summary." The initial base of articles collected in February 2022 comprised 135 articles published in scientific journals from the Scopus (73) and Web of Science (62) databases, considering their relevance to the applied social sciences scientific field (Wanyama *et al.*, 2021).

Following the data extraction, the articles were consolidated using an Excel spreadsheet. Duplicate articles were excluded from the consolidated database, resulting in 68 articles that were analysed to identify articles related to the use of RPA in accounting activities. We excluded 52 articles that did not meet the inclusion criteria, particularly those in the health field. In addition, 1 article was found to have been written in German and was therefore excluded from the sample.

At the end of these procedures, 16 articles remained for analysis, but only 10 were fully available for download. All ten articles were read in full. In 2024, we updated the search and added a further 2 studies. After reading the text, data analysis was performed using a systematic approach based on content analysis (Bardin, 2016), with hierarchical coding. This method was the main technique used to meet the objectives of this study, allowing for the identification of possible variables that lead to the adoption of RPA technology. The initial categories of content analysis were technological, organizational, and environmental contexts, which stem from TOE framework (Tornatzky & Fleischer,1990).

3.2 Stage 2 - Maps the metrics guiding the decision to adopt RPA in a Cooperative Credit System

To address the research issue and achieve the objective of mapping metrics that guide the decision to adopt RPA in a Cooperative Credit System, from the perspective of TOE framework, the research is classified as qualitative and descriptive. A single case study (Yin, 2015), applied to cooperatives integrated into a Cooperative Credit System, was used as a strategy to operationalize this study.

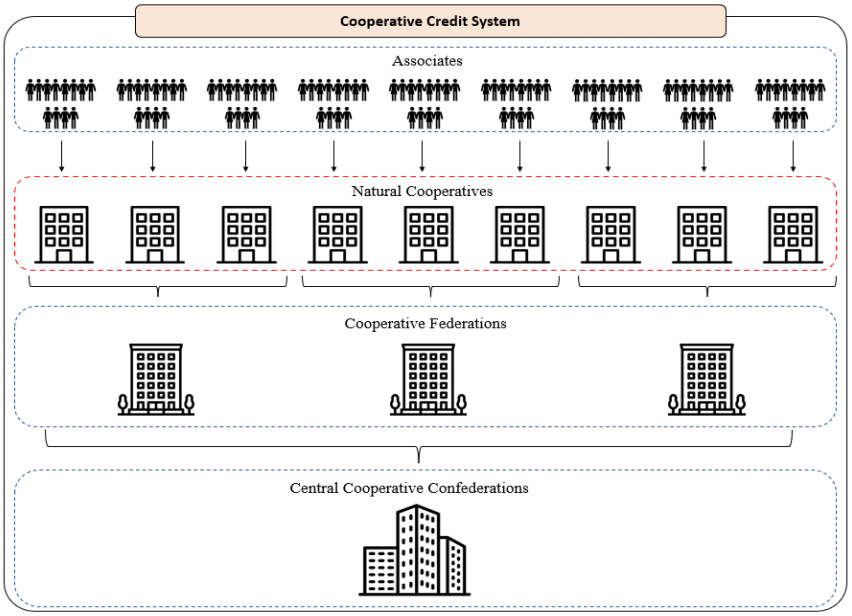
The definition of the research procedure as an integrated single case study (Yin, 2015) is based on a search to analyze the contextual conditions of multiple analysis units. Yin (2015) explained that a single case study is appropriate for several circumstances for five reasons: critical, peculiar, common, revealing, or longitudinal. The research fits into the study of "common case" where "the objective is to capture the circumstances and conditions of a daily situation [...] because of the lessons it might provide about the social processes related to some theoretical interest" (Yin, 2015, p. 55). This study proposes metrics for the adoption of RPA technology in a Cooperative Credit System. In this respect, cooperatives constitute a suitable environment for the study, considering that they are part of the Cooperative Credit System with structured organizational processes.

3.2.1 Analysis Unit

The case study is conducive to investigating a contemporary event that occurs in areal-life context, as well as when research on one or more themes is in its early stages (Yin, 2015). For the author, the unit of analysis is the "case" and needs to be associated with how the researcher established the initial questions of the study. Thus, the unit of analysis in this study is the Cooperative Credit System, which preserves the company. According to its website, it has more than five million members, operating in 25 Brazilian states and the Federal District, through more than 2,000 agencies distributed into 100 individual cooperatives, and is among the ten largest credit unions in Brazil.

According to the institution's website, for the ninth consecutive year, it was among the 'best companies for you to work for' according to the magazine Você S/A, being in the year 2020 one of the institutions with the best performance in rural credit for the Melhores & Maiores of Exame magazine. A credit cooperative is a financial institution formed by an association of people to provide financial services exclusively to its members. According to Banco Central do Brasil (2021), the National Cooperative Policy, established by Law 5.764/1971, instituted the legal regime of cooperative societies and their characteristics, principles of cooperation, and cooperative types. Figure 1 illustrates the composition of a Cooperative Credit System.

Figure 1. Cooperative Credit System



Source: Elaborated by authors.

As Figure 1 shows, the first type consists of Natural Cooperatives comprising at least 20 people, known as members in the segment. Companies whose economic activities are related to individuals or that operate for profit may be admitted. Cooperatives, described as Cooperative Federations, consist of at least three Natural Cooperatives. The third type concerns central cooperative agreements established in at least three Cooperative Federations. The unit of analysis in the present study is the Cooperative Credit System, and the data collection processes were Natural Cooperatives, seeking to cover the maximum number of RPA uses cases. The pretest was conducted at the federation level because of the entity's relevance in the Cooperative System.

3.2.2 Data Collection

The use of more than one form of data collection is associated with the scope, reliability, and validity of research (Yin, 2015). The data collection techniques used were semi-structured interviews, observations, and document collection. An interview script was developed based on the results of a systematic literature review in the first stage of the research. This content of the interview script was validated by two accounting specialists, one of whom has a doctorate in management while the other, who worked within the context of the study, has a master's degree in accounting. In addition to this validation, a pre-test was conducted with the person responsible for RPA projects at the Cooperative Credit System Confederation, in order to test the execution of the interview to be applied.

Regarding the interviewees, collaborators working with RPA were invited to participate in the study in the Natural Credit Cooperatives belonging to the Cooperative Credit System. These collaborators were chosen because they had knowledge of and were involved in decisions regarding the adoption of RPA. The criteria for the selection of the interviewees were based on a report that indicated which cooperatives had already adopted the RPA, and it was noted that by June 2022, 54 cooperatives were already using the technology and could therefore be interviewed.

Semi-structured interviews were scheduled on specific days according to the interviewees' availability from June to September 2022. Fifty-four people from cooperatives in the Cooperative Credit System whose activities were related to RPA technology were invited to take part, seventeen of whom accepted. Of the 37 people who were not interviewed, declined the invitation to participate in the study, nine could not fit the interview into their schedules, and 21 did not respond to the invitation. It should be noted that all the interviews were conducted using Microsoft Teams and, with the consent of the interviewees, they were recorded and subsequently transcribed.

In this study, the participants were assigned an identification number. Each interview has its own specific text document in which the file name is composed of the interviewee's code and the date of the interview. Table 1 shows interviewees' demographic data.

Table 1. Interviewees profiles

Interviewed	Age	Function	Time in function	Schooling	Time in the Cooperative
Interviewee 1	29 years	Process and Quality Advisor	3 years	Specialization (Lato Sensu)	9 years
Interviewee 2	42 years	IT and Automation Advisor	1 year	Specialization (Lato Sensu)	4 years
Interviewee 3	29 years	Strategy and Innovation Manager	4 years	Undergraduate	7 years
Interviewee 4	23 years	Financial Administrative Assistant	1 year	Specialization (Lato Sensu)	5 years
Interviewee 5	30 years	Process Advisor	3 years	Undergraduate	6 years
Interviewee 6	30 years	Process and Quality Advisor	1 year	Specialization (Lato Sensu)	9 years
Interviewee 7	38 years	Process Advisor	1 year	Undergraduate	1.5 years
Interviewee 8	32 years	Process and Quality Manager	1.5 years	Undergraduate	2 years
Interviewee 9	39 years	BI Analyst	1 year	Undergraduate	10 years
Interviewee 10	31 years	Administrative Manager	3 years	Undergraduate	3 years
Interviewee 11	51 years	Process Manager	2 years	Undergraduate	5 years
Interviewee 12	26 years	Systems Development Analyst	2 years	Specialization (Lato Sensu)	6 years

Interviewed	Age	Function	Time in function	Schooling	Time in the Cooperative
Interviewee 13	21 years	Process and Quality Assistant	0.5 year	Incomplete Undergraduate	1.8 years
Interviewee 14	37 years	Strategic Financial Manager	2 years	Undergraduate	6.5 years
Interviewee 15	39 years	Planning Manager	1 year	Undergraduate	7 years
Interviewee 16	25 years	Process Advisor	2.5 years	Specialization (Lato Sensu)	14 years
Interviewee 17	35 years	Innovation Manager	3 years	Undergraduate	9 years

Even though most interviewees demonstrated limited experience in RPA-specific roles, this reflects the early stage of the technology within the financial sector rather than a methodological limitation. Their considerable organizational experience (averaging six years, with a range from 1.5 to 14 years) and universal financial market expertise provide contextual knowledge for assessing RPA integration within established operational frameworks.

The observation technique consisted of watching, listening to, and examining the phenomena the researcher sought to investigate. A record sheet for the systematic observation was drafted, on which the object of observation was described, the purpose being to understand how the responsible areas use facts to aid decision making by adopting RPA in the Cooperative Credit System.

In addition to the interviews, the observations also followed the logic of availability as they did not depend solely on the researcher. During the observation period, the routine of the meetings held by the teams responsible for RPA technology in the cooperatives was analysed. Specific meeting dates were established for the researcher to observe the working dynamics of the operation, discussions, and training regarding RPA technology in the Cooperative Credit System. This resulted in two documents consisting of observations.
Finally, regarding the document collection, it should be noted that direct or indirect classification of documentation data-collection techniques can be used. In this study, the documentation technique was direct, with the data collected at the location where the phenomena occurred. The document collection consisted of internal company documents, reports, and external publications related to the institution. In total, ten documents were obtained through interviews for the analysis.

3.2.3 Data Analysis

According to Bardin (2016), content analysis involves three key steps. The first is pre-analysis, which corresponds to the stage of organizing material for analysis. The author noted that this stage includes “the choice of documents to be submitted for analysis, the formulation of hypotheses and objectives, and the elaboration of indicators that underpin the final interpretation” (Bardin, 2016, p. 125).

The second step concerns the examination of the material, which consists of analysing the "systematic application of the decisions taken" (Bardin, 2016, p. 131). The last step considered by the author is the treatment and interpretation of the results obtained, emphasizing that if the researcher has significant and reliable results, he or she can then "propose inferences and advance interpretations regarding the objectives envisaged – or concerning other unexpected discoveries" (Bardin, 2016, p. 131). The data obtained through interviews, systematic observations, and document collections were transcribed and tabulated in a text document in order to enable content analysis, in accordance with Bardin (2016), using NVivo12 software.

Regarding the categorization process of the analysed data, it is important to note that four initial categories were established: one related to the profile of the interviewees and the other three corresponding to the TOE framework (technological, environmental, and organizational contexts). After this initial categorization, the content was broken down into intermediate categories corresponding to each interview question regarding the context of the aspect of TOE in question. Eighteen subcategories were identified: six in the technological context, four in the environmental context, and eight in the technological context. Finally, all these subcategories (intermediate categories) were analysed, generating thematic categories (final categories) detailed in the following section of the data analysis.

4. Results

This subsection presents the results obtained after the data collection and analysis from stages 1 and 2. The following subsections are divided into two results sections. Section 4.1 presents the results of the Systematic Literature Review (stage 1), and section 4.2 presents the results of the case study (stage 2).

4.1 Stage 1 results - Drivers and motivators of the adoption of RPA with regard to TOE

4.1.1 Metrics and Motivators Considering the Technological Context

The technology category covers internal and external technologies that are important to a company, encompassing those already existing in the company, such as those available in the market, including equipment and processes (Tornatzky & Fleischer, 1990). There are five final categories related to the drivers to be observed for the adoption of RPA from a technological perspective: (1) knowledge of which tasks that can be automated, (2) expected effects, (3) lack of guidance, (4) broad focus on adoption, and (5) implementation and challenges.

Regarding the category of *knowledge of which tasks* can be automated, the studies considered it essential for the successful adoption of the technology that both accountants and developers have a clear understanding of which activities have automation potential. According to Matthies (2020), before beginning the process of adopting an RPA solution, it is essential to evaluate potential automation. This is one of the challenges facing RPA for business professionals (Eulerich *et al.*, 2024; Eulerich *et al.*, 2021). According to Kokina *et al*. (2021) and Gotthardt *et al*. (2020), accountants must help developers understand the activities intended to mitigate risks and seek the best process performance. Discussing and considering risks are crucial for realizing a return on RPA investments and ensuring the integrity of automated processes (Hong *et al.*, 2023).

The category that addresses the *expected effects* of the adoption and implementation of the technology reveals a consensus among all the authors, who point out that one of the main effects is the reduction of accountants' manual and repetitive tasks, allowing them to be reallocated to more strategic activities (Eulerich *et al.*, 2021; Kokina *et al.*, 2021; Gotthardt *et al.*, 2020; Matthies, 2020; Yoon, 2020; Cooper *et al.*, 2019; Huang & Vasarhelyi, 2019; Kokina & Blanchette, 2019; Yunus *et al.*, 2019; Fernandez & Aman, 2018). The *lack of guidance* category is analyzed in two articles, with Eulerich *et al.* (2021) and Gotthardt *et al.* (2020) presenting the need for companies to have a clearer understanding of the technology and clearer orientation of how to implement RPA.

The *broad focus* category of adoption is found in Eulerich *et al.* (2021), who described how implementation orientation has an almost one-dimensional focus on subsystem functionalities. We focus only on technology and ignore its social impacts on society, such as a reduced workforce. In the last category of technology, implementation and challenges, Kokina and Blanchette (2019) brought into their study the concern of understanding which motivators lead companies to adopt technology and how they relate to the processes chosen for automation.

We have seen that every category in the technological pillar is related to the need to understand how RPA is adopted, and the authors described the concerns that must be linked to the processes so that the technology can be implemented effectively in different ways. Therefore, in addition to understanding the technological aspects of RPA, it is necessary to integrate this technical knowledge into the business areas in which the technology will be implemented. In this respect, the perspective of the environmental context is explored below.

4.1.2 Metrics and Motivators Considering the Environmental Context

The environmental category covers the environment or market in which a company conducts its business (Tornatzky & Fleischer, 1990). Regarding the environmental context, four final categories related to the drivers of the adoption of RPA were observed: (1) technology knowledge sharing, (2) RPA supplier, (3) internal policy and procedures, and (4) regulations.

In the *technology knowledge sharing* category, Yoon (2020) and Yunus *et al.* (2019) pointed out that accountants need to study how the interface with technologies can be applied to strategic analysis, thus aiding decision making. Without understanding and adopting new technologies, a company cannot survive in a rapidly changing business environment (Eulerich *et al.*, 2021; Yoon, 2020; Yunus *et al.*, 2019). The *RPA supplier* category represents resources provided in the market. The three main suppliers of technology (Automation Anywhere, Blue Prism, and UiPath) are present worldwide, and they are tools that help determine which activities should be automated (Eulerich *et al.*, 2021). However, Gotthardt *et al.* (2020) pointed out that a large part of the accounting sector still operates on a smaller scale than other areas in relation to RPA technology.

The *internal policy and procedures* category means that organizations must ensure that they have formal and well-documented policies and procedures, and explain who controls, monitors, and communicates the robot's activity. According to Kokina *et al.* (2021), Gotthardt *et al.* (2020), Cooper *et al.* (2019), and Kokina and Blanchette (2019), concerns exist regarding the protection of business processes and the flow of information between different jurisdictions. The *regulations* category addresses issues of legality and regulatory compliance. As noted by Eulerich *et al.* (2021), the implemented technology must align with legal and regulatory requirements, whether these are related to government policies or data restrictions.

Finally, it is observed that all the categories within the environmental context pillar are related to the need to understand how RPA technology can pose risks to an organization, whether through increased vulnerability to regulations or the proper documentation of process automation. These aspects converge toward risk mitigation through the sharing of knowledge about the technology. In this regard, the following section explores the perspective of the organizational context.

4.1.3 Metrics and Motivators Considering the Organizational Context

The organizational category comprises descriptive organizational measurements such as the size and scope of the company, centralization, formalization, complexity

of the managerial structure, quality of employees, and the amount of slack resources available internally (Tornatzky & Fleischer, 1990). Four categories of drivers were observed in the adoption of RPA from an organizational perspective: (1) communication between the areas, (2) multidisciplinary teams, (3) managerial structures, and (4) human resources.

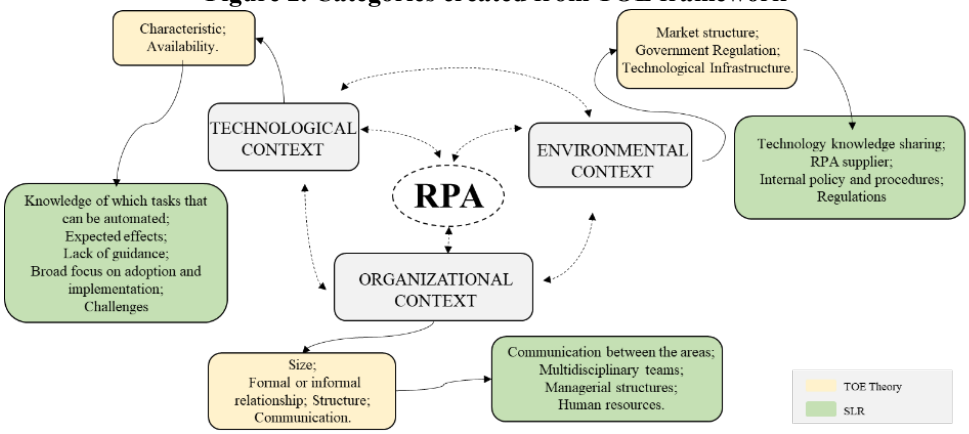
In the *communication between the areas* categories, Eulerich *et al.* (2021) emphasized the importance of having multidisciplinary teams, noting that organizations sometimes fail to adopt technology due to a lack of shared knowledge across departments, resulting from insufficient communication between different areas. *Multidisciplinary teams* are interrelated in the first category. The authors corroborated this by asking how employees decide which tasks to automate, and they said that, to a large extent, this was based on individual experiences. Gotthardt *et al.* (2020), Kokina and Blanchette (2019), and Cooper *et al.* (2019) showed that there is a great risk when automation is undertaken, and the person responsible for the activity, accountant or analyst has no basic knowledge of the technology, thereby emphasizing the importance of multidisciplinary teams for effective tool implementation.

The *managerial structure* category highlights the importance of organizations being concerned with mapping and adopting new technologies, as these actions are essential to fostering effective technology adoption. In other words, support from the managerial structure plays a key role in the decision-making process regarding the effective adoption of technology. Kokina *et al.* (2021) noted that accountants are positioning themselves in an innovative role, seeking to identify opportunities for RPA, aiming for their organizations to operate more efficiently and effectively. According to Eulerich *et al.* (2021), professionals indicate that companies do not have a general structure for the development of RPA. The authors point out that a key consideration for organizations is whether the automation of a process will save a significant number of working hours, be economically viable, ensure high delivery quality, and how these factors may impact the organization's structure (Eulerich *et al.*, 2021; Matthies, 2020; Kokina & Blanchette, 2019; Yunus *et al.*, 2019).

The *human resources* category describes how much technology can influence employees in an organization. According to Eulerich *et al.* (2021), a company's technology can change its employee motivation, creativity, and innovation. Another factor is that cost reduction may be a predominant goal in operational optimization. However, Matthies (2020) and Kokina and Blanchette (2019) emphasized that RPA does not necessarily need staff reduction as the main objective, as motivation may be linked to freeing staff from manual tasks in favour of high-value activities.

We have seen that all the categories in the organizational pillar cover all points related to people, such as the issue of communication between sectors directly reflected in the discernment of knowledge. Employees are concerned about supporting the adoption of new technology, although they feel insecure when they do not realize that the company has a general capacity for implementation on a scale. This is also related to how a company can affect its employees positively or negatively through its choice to adopt technology. Figure 2 shows the three drivers and final categories described in the search.

Figure 2. Categories created from TOE framework



Source: Elaborated by authors.

As shown in Figure 2, the technological context covers five categories, the organizational context presents four, and the environmental context describes four final categories.

4.2 Stage 2 results - Maps the metrics guiding the decision to adopt RPA in a Cooperative Credit System

This subsection presents the results obtained after the data collection and analysis. The following subsections are divided into three categories based on the initial TOE categories: subsection 4.2.1 addresses the technological context; the environmental context is presented in subsection 4.2.2; and the organizational context is presented in subsection 4.2.3.

4.2.1 Technological Context Category

The technological context describes the internal and external technologies relevant to a company. Covering the technologies that already exist in the organization, such

as the those available in the market, including equipment and processes (Tornatzky & Fleischer, 1990). Collins *et al.* (1988) commented that the process of adopting a technology was relevant for establishing a scope limit and dictating the pace of technological changes that an organization could undergo.

The technological context discussed in the theoretical framework relates to the practice observed in the case study, as cooperatives are concerned with adopting new technologies. They seek to optimize their processes, make more effective use of hardware, and study new technological solutions adopted by other companies. The search for technological innovation and digital transformation, as addressed by Wojciechowska-Filipek (2019) and Kokina and Blanchette (2019), were also motivators for cooperatives to adopt RPA technology, as mentioned by some of the interviewees.

According to Kokina and Blanchette (2019), RPA has the benefit of being a technology that delivers a cheaper and faster solution that enables greater efficiency in activities and is not always dependent on the area of information technology to be developed. This point is evident in the case study when one of the benefits considered for adopting RPA technology was the increase in processing scale, along with optimization and operational gains for employees. This is corroborated by Eulerich *et al.* (2021), who highlight in their study that the adoption of technology enhances efficiency while freeing analysts from repetitive and mundane tasks, enabling them to focus on more critical thinking activities.

One of the criteria for adopting the technology presented in the case study is that it is easy to develop the tool, which is viewed as a way of simplifying the construction process. Some interviewees pointed out that it was difficult to hire development professionals in some regions of the country. Kokina & Blanchette (2019) also noted that technology does not always depend on a company's specific IT department and can be implemented across various processes in different areas.

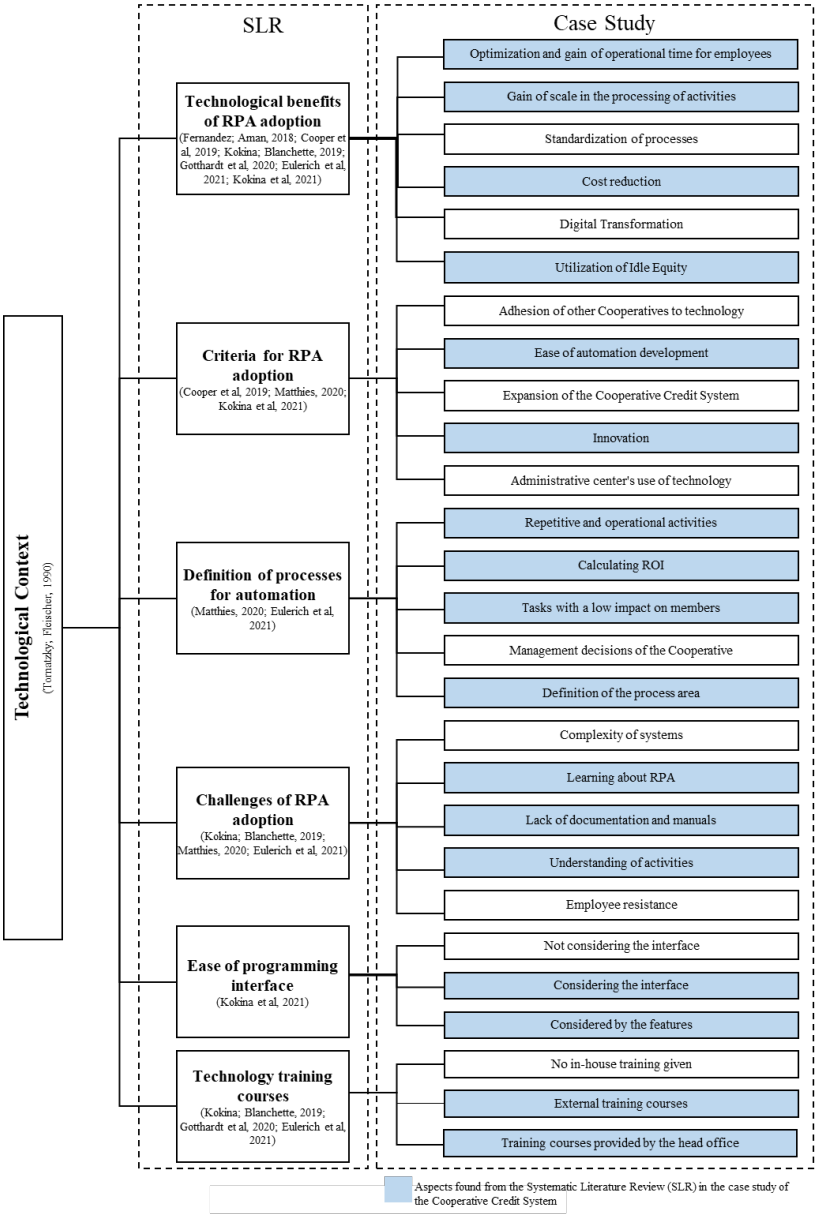
Matthies (2020) noted in her study that, before adopting a solution in RPA, it is fundamental to analyze potential automations, as this involves efforts from several areas. In practice, it can be observed that cooperatives often use mechanisms to define which tasks can be automated before beginning development, such as calculations of financial returns, operational activities, or having a low impact initially for cooperative members. Some interviewees reported that this definition is part of a technical area, responsible for creating working groups with other areas needed for decision making, mainly for processes involving financial transactions and tax processes.

One of the challenges associated with RPA technology is the transfer of knowledge from business to technology professionals, in order to understand which tasks should be automated and to identify and prioritize potential RPA applications (Eulerich *et al.*, 2021). This challenge was noted by some interviewees, who pointed out that they had difficulties understanding the activities and processes performed by collaborators. Matthies (2020) stated that technology often does not meet expectations because people do not have knowledge or guidance concerning an activity. Consequently, the developer ultimately fails to reproduce criteria, metrics, and the way a human accomplishes a task.

In practice, some cooperatives face challenges related to manual and technological materials. Some pointed out that much of the material found was not in Portuguese, which impacted adoption, since it is not a prerequisite for collaborators to know other languages. The programming interface, pointed out by some interviewees as a motivator for the adoption of technology in cooperatives, was also commented on in the study conducted by Kokina *et al.* (2021), where technology is presented as easy to control because it does not involve code creation. As a low code tool, it is considered a technology ready for use so that tasks can be automated quickly.

Eulerich *et al.* (2021) state that guidance is necessary for the adoption of technologies, and that without it, such initiatives tend to fail and fall short of the expectations raised. Corroborating the findings of authors mentioned previously, it was observed that some cooperatives sought training in RPA, and some interviewees reported that it was fundamental for them to automate complex processes. Other interviewees reported that no pre-training in technology was achieved through their daily experience of using RPA at the cooperative. Other interviewees reported operational problems and exposure to the risks that were generated because they were not given technological training.

Figure 3. Systematization of the technological context



Source: Elaborated by authors.

Figure 3 presents a summary of the technological context presented by Tornatzky and Fleischer (1990), the first categories generated through a systematic literature review, and the subcategories created through observations, documentation, and interviews in the case study.

Figure 3 presents the aspects found in the systematic literature review, with some subcategories created through the case studies in the technological context of cooperatives. The categories have at least a tenuous relation to what was observed in practice at some cooperatives, although the subcategories that do not have aspects of the systematic review (white rectangles presented in the case study part) may be linked to the difficulties of knowledge and training by the cooperatives on RPA adoptions.

4.2.2 Environmental Context Category

The environmental context refers to the setting in which companies conduct their business, including the behaviour of their direct competitors and the availability of third-party suppliers. For Tornatzky and Fleischer (1990) the life cycle of a company is pertinent because it is a trend that fast-growing companies tend to innovate more quickly while in more mature companies their innovation practices are not necessarily clear.

The case study of the cooperatives corroborates the description of the framework given by Tornatzky and Fleischer (1990) because it was observed through the interviewees' reports that some cooperatives have been directly influenced by the external environment regarding their decision on whether to adopt the technology. Market acceleration in relation to technologies, new tools, and company behaviour outside the Cooperative Credit system is a motivating factor.

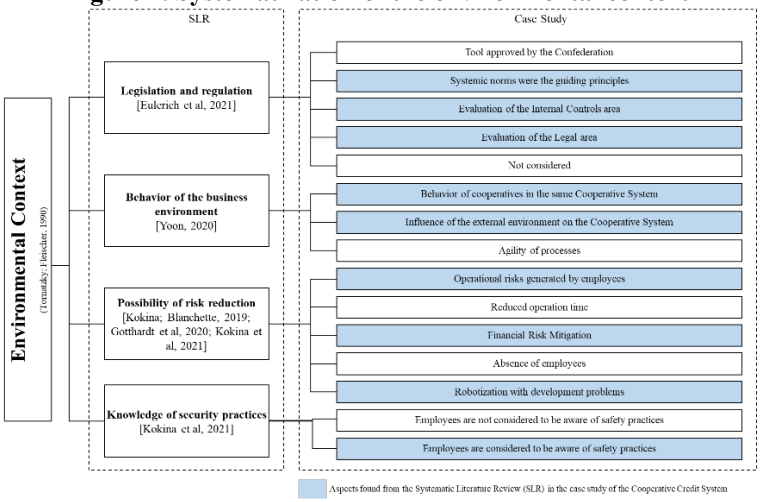
Eulerich *et al.* (2021) pointed out that, with regard to procedures, it is essential to look at which processes are robotic, whether the processes are considered in legal and regulatory considerations, and whether they have data restrictions. In this respect, in the case study, some cooperatives can be perceived as concerned with following systemic norms and assessing areas of internal and legal controls. On the other hand, some did not show this initial concern, but voiced it later, adjusting the processes according to the rules.

Understanding the behaviour of the business environment, which technologies are being used, as well as the structuring of these adoptions, is crucial to the survival of a company (Yoon, 2020). It can be observed in the case study that cooperatives seek to understand the behaviour of the other cooperatives in the system itself, as well as their behaviour outside the system. In line with the framework and Yoon (2020), in practice, the behaviour of the business environment is important for deciding the use of RPA technology in cooperatives.

According to Kokina and Blanchette (2019), Gotthardt *et al*. (2020), and Kokina *et al.* (2021), concerns have been raised regarding the protection of business processes and the risks that can occur and generate losses for the company. Corroborating the findings of these authors, in the case study, some interviewees reported that the mitigation of operational errors was an important factor in deciding to adopt RPA, because these errors could also generate financial losses.

Knowledge and safety practices are considered fundamental aspects (Kokina *et al.*, 2021), who pointed out the importance of internal controls in an RPA environment, where reliable reports, compliance with regulations, and safety controls should be guaranteed. The authors noted that, in the absence of such controls, RPA technology-related performance may be compromised. As in the work of Kokina *et al.* (2021), in the case study, some cooperatives demonstrated concern over conformities and safety controls, as was observed in the document of norms of the Cooperative Credit System, with good practices and procedural guidelines. However, some interviewees reported that safety practices were not considered at the beginning regarding the technology in some cooperatives and that there were no reports of their negative impacts.

Figure 4. Systematization of the environmental context



Source: Elaborated by authors.

Figure 4 presents a summary of the technological context presented by Tornatzky and Fleischer (1990), the first categories generated through a systematic literature review, and the subcategories created through observations, documentation, and interviews in the case study.

Figure 4 presents the aspects found in the systematic literature review with some subcategories created through the case study. Every category has at least one relationship with the practices of some cooperatives. However, the subcategories that are not directly derived from the systematic review (white rectangles presented in the case study part) may be related to the maturity of the cooperatives in terms of technology adoption and development, as they are part of a system in which each cooperative has decision-making autonomy.

4.2.3 Organizational Context Category

Tornatzky and Fleischer (1990) described how the organizational context contemplates the size and scope of a company, its managerial structure, and the quality of its employees. Some authors have complemented the framework, pointing out that the organizational context directly affects the decision to adopt or not adopt technologies, and how these mechanisms can be used to break barriers and promote innovation (Galbraith, 1973; Tushman & Nadler, 1986).

In the case study, it was observed that, in compliance with the framework, technology adoption generates changes in organizational structures. The interviewees reported that although the technology provides process improvements, operational gains, and fewer repetitive and manual tasks for employees, it is still necessary to break down barriers regarding people's resistance to RPA. In practice, a constant drive for innovation by cooperatives is observed through the adherence of technologies that add to the efficiency of administrative processes and the digital transformation of the segment. In most cases, resistance is linked to a lack of sharing of objectives and expected results with the adoption of technology, such as increasing the focus of collaborators on analytical and strategic activities.

Eulerich *et al.* (2021) comment in their study that when employees were asked how they decided which tasks to automate, they reported that the decisions were based on experience and individual judgment. In the case study, the interviewees pointed out that in the vast majority of cases, the definition of activities is based on criteria that are analysed by areas with knowledge of processes, business, and technology. According to Kokina and Blanchette (2019), some criteria for using RPA are to look at mundane, routine tasks that have rules and few exceptions in their processes. The authors also commented in their studies that it is essential to analyze these activities to verify their robotic potential.

The benefits of adopting RPA technology in cooperatives include improved efficiency and agility, reduction of employees' operational activities, time and lower costs, fewer errors and risks. Kokina and Blanchette (2019) identified various

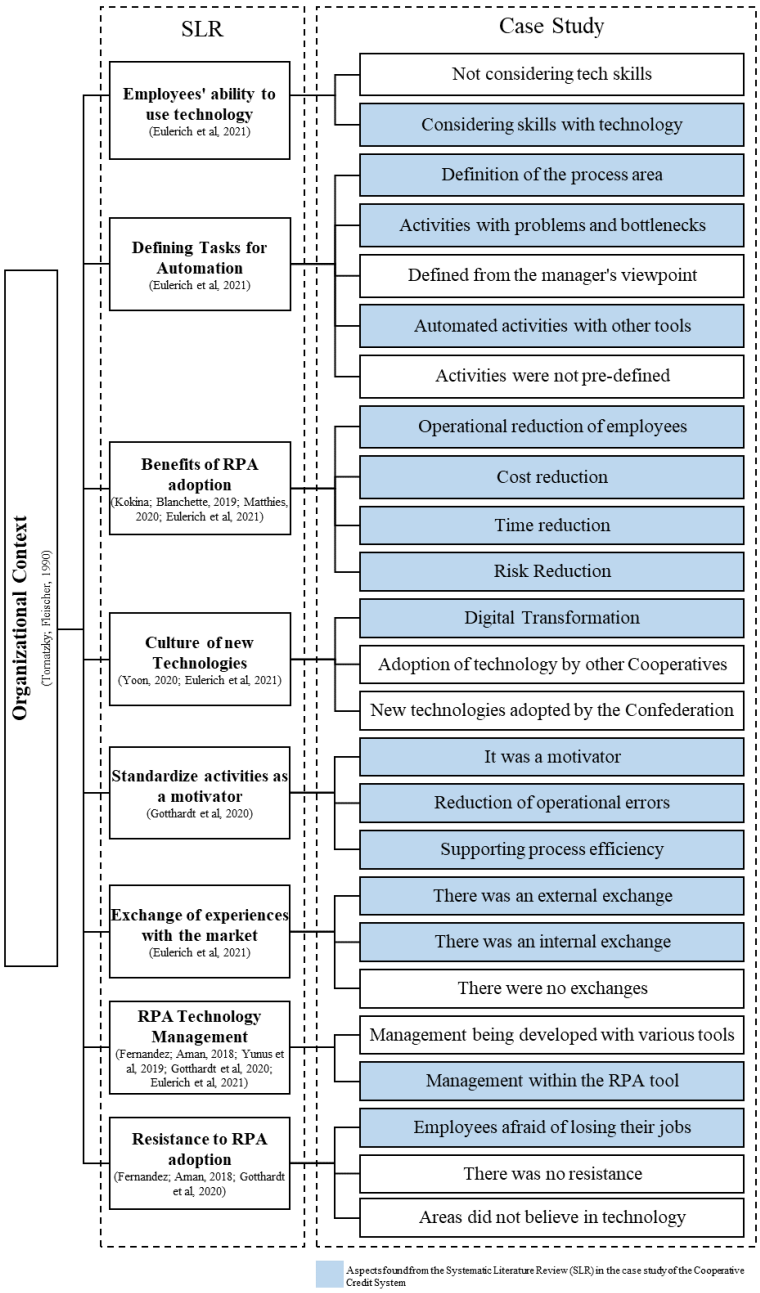
measures for understanding the benefits of RPA technology, such reduced error rates and robot efficiency. Matthies (2020) commented that RPA can increase process compliance and reduce risks, because machines, unlike humans, do not skip the process steps and tiers involved in examining transactions.

According to Gotthardt *et al.* (2020), the governance of RPA technology is critical because any tool can present errors that can become systematic because it processes a considerable volume of data. The authors also recalled that robots do not understand the changes in business environments as humans would understand them, and therefore, it is important to monitor these technologies. In practice, some respondents commented that there is no established governance of technology, whereas others commented that there is established governance and that technological control is important for cooperatives.

Resistance to technology was addressed by Gotthardt *et al.* (2020). To these authors, companies see a negative impact on the position of their employees as they are afraid of being replaced by robots. The authors also emphasized that if the technology focuses heavily on information technology, it risks the objective of adoption being forgotten, such as improved operations, process efficiency, and risk reduction. Corroborating the work of these authors, in the case study, we observed the initial expectations of the collaborators regarding the adoption of the technology because they thought they would lose their place at work to the RPA. Several interviewees reported that after a while, resistance faded and the technology was accepted and requested by employees.

Figure 5 summarizes Tornatzky and Fleischer's (1990) organizational context. The first category was generated through a systematic literature review and subcategories were created through observation, documentation, and interviews in the case study.

Figure 5. Systematization of the organizational context



Source: Elaborated by authors.

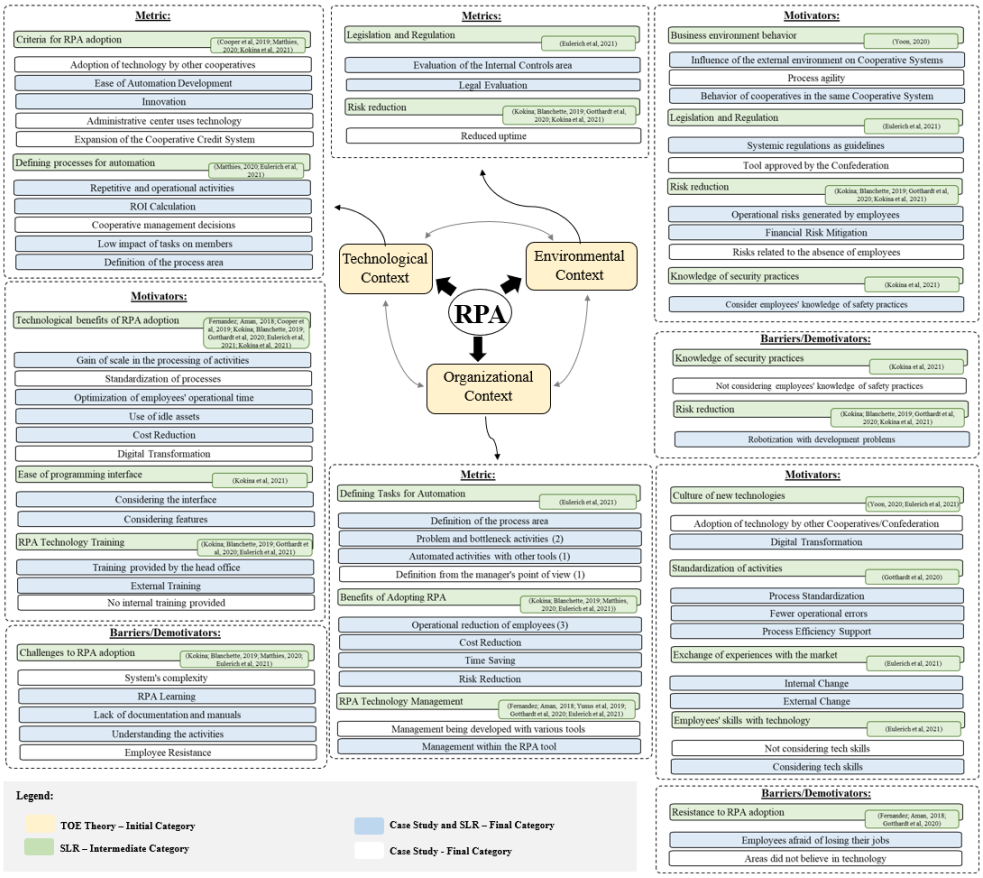
Figure 5 presents the aspects found in the systematic literature review with some subcategories created through the case study. Every category has at least one

relationship with the practices of some cooperatives. However, the subcategories that do not show aspects stemming from the systematic review (white rectangles presented in the case study part), which may be linked to the differences in the business model in relation to other companies, also consider cooperatives as a system where each has the autonomy to make its own decisions regarding tools.

4.3 RPA and TOE

This subsection presents the results of the case study and systematic literature review from the perspective of TOE framework. Figure 6 shows the framework generated after the two stages of the study, presenting the metrics and motivators considered by the cooperative credit system for the adoption of RPA technology.

Figure 6. Framework of metrics and motivators for RPA adoption



Source: Elaborated by authors.

The *technological context* characterized in the framework considers that, for the adoption of a technology, it is necessary to look at the characteristics and availability of the chosen technology. In the literature review, when examining RPA technology, five new categories were identified, based on the premises of TOE. The literature indicates that for the adoption of a technology, it is important to have knowledge of what tasks can be automated and the expected effects of the adoption of the technology, such as benefits, problems, challenges, and seeking guidance on the technology for implementation, use, and development.

This case study presents the variables considered by cooperatives when adopting RPA, with 24 motivators and metrics linked to the technological context being cited. Drivers and metrics include expected technological benefits, adherence of other cooperatives to RPA technology, a drive for innovation, and fewer operational activities. The new categories are related to the five categories discovered in the systematic review and can be considered practical details on how to relate the authors' studies to the reality of cooperatives. The motivators and metrics used by cooperatives to decide on the adoption of RPA technology also represent an evolution of the TOE framework created by Tornatzky and Fleischer (1990) from the perspective of the use of a specific technology, RPA in this case, bringing its characteristics and availability into a practical context.

In the framework, the *organizational context* relates to the structure of the company, its size, bonds, and communication, as well as more internal characteristics. In the systematic literature review, four categories were created for the adoption of technology from an organizational perspective: communication between areas, importance of multidisciplinary teams, management structure of companies, and human resources. In practice, when analyzing the case study, 20 new categories were formed that aided cooperatives in the decision on technology adoption in the organizational context, considering improvements in the employees' lives, lower risks, costs, and greater process efficiency. The metrics and motivators perceived in the case study reinforce the fundamental characteristics to the adoption of technologies in TOE framework. Specifically, a correspondence between framework and practice was observed.

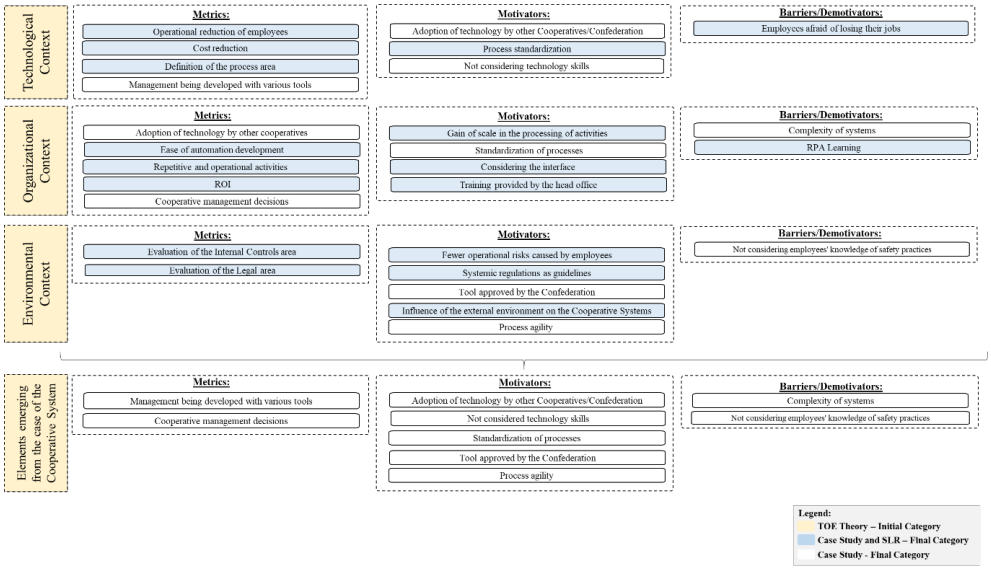
The *environmental context* is a more external view of the organization, such as market structure, government regulation, and technological infrastructure (Tornatzky & Fleischer, 1990). When looking at the studies presented in the systematic review, a slightly greater scope is seen from the aspects brought about in the framework: the sharing of knowledge regarding RPA technology, technology suppliers, internal policies, and the procedures of companies and regulations. The case study presents 13 new categories that show the motivators for the adoption of

technology since the adoption of other cooperatives in the same system and other external institutions, the behaviour of market innovation, and concern over risk reduction and mitigation without financial regulations for cooperatives.

The three elements addressed by Tornatzky and Fleischer (1990) that influence an organization in the process of adopting and implementing technological innovations were noted in the systematic review, with a focus on RPA technology. Some relevant points regarding the split of elements were identified in the studies, such as the need to spread knowledge about RPA, the possibility of making processes more efficient, resulting in financial and operational risk mitigation, and the importance of structured governance of technology, mainly because RPA is considered a new technology in the accounting environment.

Based on the findings of the systematic review, the case study provides greater detail regarding the cooperatives' perspectives on the metrics and motivators used to decide the adoption of RPA. The categories highlighted in the interviewees' responses are shown in Figure 7.

Figure 7. Framework of the most highlighted metrics and motivators for RPA adoption



Source: Elaborated by authors.

Thus, the case study contains elements that illustrate the TOE framework of Tornatzky and Fleischer (1990), shedding light on a relatively new technology that values software agents called robots, which automate the execution of repetitive and

manual tasks. Figure 6 presents the framework created to address to the research gaps identified by Cooper *et al.* (2019), Kokina and Blanchette (2019), Syed *et al.* (2019), and Kokina and Langmann (2022), who discussed the lack of studies on motivations for RPA adoption in accounting environments.

Figure 7 presents the results in greater detail for the specific context of credit cooperatives, highlighting the metrics, motivators, and barriers to the adoption of this technology, as shown in the case study. Among these topics, the importance of process management and the influence of the internal ecosystem of the cooperative system are significant motivators for the adoption of RPA. However, the complex structure of these systems serves as a deterrent. This reinforces the importance of support from the central structure of the cooperative system in influencing the adoption of RPA, which is reflected in the metrics that emerged from the case study, where there is a central role in management decisions and the potential to integrate RPA management with the cooperative system.

5. Conclusion

This study aims to develop a framework of metrics and motivators for the adoption of RPA in the accounting area of a Cooperative Credit System, based on TOE framework. To achieve this objective, this study was conducted in two stages. The first stage was carried out through a systematic literature review (SLR) to present the motivators used to adopt RPA technology in accounting, in light of TOE framework. The methodology and results are presented in Section 3.1 and 4.1.

In addition, a case study was conducted through semi-structured interviews with 17 interviewees, document collection, and observation to map the metrics and motivators that guide the decision to adopt RPA in a Cooperative Credit System from the perspective of TOE framework. It was possible to describe the procedures for the adoption of RPA in the different organizational components of TOE, outlining the challenges in the decision-making process and the adoption of RPA in the different organizational components of the Cooperative Credit System, and relating the results obtained from the systematic literature review with the results obtained from the case study through the organizational components of TOE.

As pointed out by Syed *et al.* (2019), there is a need for studies describing metrics to guide the decision-making process regarding the adoption of the RPA. Kokina and Langmann (2022) also commented that, although RPA is used to automate financial and countable activities, there is still a lack of studies that examine its adoption. The results of the case study aimed to present the metrics and motivators that Credit Cooperatives consider for the adoption of RPA technology in an attempt to bridge the research gaps.

This work contributes to the field by detailing the motivators and metrics considered in the practice of adopting new technologies. In this study, RPA returns to the TOE framework proposed by Tornatzky and Fleischer (1990), taking a closer look at the starting point in practice with Credit Cooperatives. This study presents 61 motivators and metrics distributed according to the organizational elements that influenced the adoption of innovation in RPA technology in the 17 cooperatives examined. As a practical contribution, this study presents, in the final categories, the metrics and motivators that can serve as a basis for other institutions to make decisions on adopting RPA technology as well as to attend to points that need to be matured before adoption, such as training, security controls, regulations, and communication.

As limitations of the study, since it is a study case in a Cooperative Credit System, it is emphasized that there are limits to generalization due to the adopted methodology. Additionally, the adoption of RPA technology is asymmetrical, due to the organizational and technological structure of each business area. Despite this limitation, the study presents metrics that can be observed and adapted to other business contexts based on the methodological approach described in the study.

A suggestion for future research is to continue the study in other segments and compare the motivators and metrics found, as well as the reasons for the differences that are identified. Another suggestion is to analyse the impacts of technology adoption on institutions following implementation, and the positive and negative aspects of technology in the organizational environment.

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