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ORIGINAL
Research article

Characteristics of professional accounting practice tasks that may be affected by process automation: validation of methodology and analysis in a case of managerial activity*

Características de las tareas de la práctica profesional contable que pueden ser afectadas por la automatización de procesos: validación de metodología y análisis en un caso de actividad gerencial

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Abstract
The paper shows the first stage of an investigation into the characteristics of the tasks carried out by the accounting profession that are most likely to be replaced by the incorporation of Robotic Process Automation within the framework of digital transformation. The hypothesis, in accordance with the main doctrinal position, is that the use of technologies for robotization and automation of processes has a strong impact on the profession, since multiple tasks will be disrupted, displaced, or deconstructed, with the basic skills required being replaceable. and there are significant changes in the way value is delivered. The results of the first case study whose main objective was the validation of the methodology to be applied are shown. The tasks carried out by a managerial position of the Uruguayan subsidiary of an international company are surveyed through an interview, classifying them as manual or cognitive, routine and non-routine. Tasks were then coded according to the type of value offered and the skills required. The results validate the methodology and show that, as expected for a managerial

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position, almost two thirds of the tasks are of the non-routine cognitive type, that the skills required to carry out most of the associated tasks are not significantly affected, and that for half of the tasks there is no change in the way the value is generated. Likewise, it is clear that there is a need for more training on the potential of robotic process automation technologies, as well as their costs, in order to correctly evaluate the associated benefits and carry out adequate planning for their use. Finally, the authors point out the importance of determining how automation is linked to objectives, policies and strategies associated with the digital transformation of organizations.
Keywords: Automation, Process, RPA, Accounting, Digital Skills

Resumen
El trabajo muestra la primera etapa de una investigación sobre las características de las tareas que realiza la profesión contable más factibles de ser sustituidas por la incorporación de la Automatización de Robotización de Procesos en el marco de la transformación digital. La hipótesis, en concordancia con la posición doctrinaria principal, es que el uso de tecnologías para la robotización y automatización de procesos tiene un fuerte impacto en la profesión, ya que múltiples tareas se verán interrumpidas, desplazadas o deconstruidas, siendo las habilidades básicas requeridas reemplazables y existiendo cambios significativos de la forma en que se entrega el valor. Se muestran los resultados del primer estudio de caso cuyo objetivo principal fue la validación de la metodología a aplicar. Se releva mediante entrevista las tareas realizadas por un cargo gerencial de la filial uruguaya de una empresa internacional clasificándolas en manuales o cognitivas, rutinarias y no rutinarias. Luego las tareas se codifican de acuerdo con el tipo de valor que se ofrece y las habilidades requeridas. Los resultados validan la metodología y muestran que, acorde a lo esperado para un cargo gerencial, casi dos tercios de las tareas son del tipo cognitivo no rutinario, que las habilidades requeridas para llevar adelante la mayoría de las tareas asociadas no se ven afectadas significativamente, y que para la mitad de las tareas no hay cambios en la forma en que se genera el valor. Asimismo, queda de manifiesto, la necesidad de mayor formación sobre el potencial de las tecnologías de automatización robótica de procesos, así como de sus costos, para evaluar correctamente los beneficios asociados y realizar una adecuada planificación de su utilización. Finalmente, los autores señalan la importancia de determinar cómo la automatización se vincula a objetivos, políticas y estrategias asociadas a la transformación digital de las organizaciones.
Palabras clave: Automatización, Procesos, RPA, Contabilidad, Competencias Digitales

SUMMARY

Introduction

In the last decade, automation has been highlighted as an important technology to simplify accounting processes in companies, and research has been carried out to determine its advantages, classify the different available technologies and evaluate their harmonization in the context of software incorporation in organizations (Elizalde, 2018). A large amount of data available, manually processed with many hours of work, makes timely and efficient decision-making very difficult, so special emphasis is placed on simplifying and optimizing

processes and reducing costs through automation (Deloitte, 2017).

Robotic Process Automation (RPA) has the potential to predict that accountants will be replaced by robots in certain tasks (Deloitte, 2018). Consequently, accounting jobs may disappear, shifting to other roles beyond traditional accounting, such as business consulting and digital transformation (Jędrzejka, 2019). For this, the need to develop professionals' soft and digital skills has been pointed out (Andiola, Masters & Norman, 2020).

This work is part of a line of research whose general objective is to analyze the impacts of technological changes on accounting practices, especially the incorporation of Robotic Process Automation within the framework of the digital transformation of organizations. As part of this line of research, this study tries to identify the characteristics of the tasks of the accounting profession that are most likely to be automated and the perception of professionals on this topic. Automation implies profound changes, not only in terms of the use of technologies but also in culture and operations. How value is delivered, so its approach must consider the human, physical, and digital aspects (Hewlett Packard Enterprise, 2020).

Robotic process automation seeks to optimize task execution times and minimize errors through interaction with different systems imitating human work (Aguirre & Rodríguez, 2017). The combination of RPA technologies with the use of artificial intelligence allows decisions based on contextual information, which provides efficiency and cost reduction and allows us to visualize significant changes in the role of people concerning processes (Rai, Siddiqui & Pawar, 2019).

Resolution Scheme

1. Research Problem

What are the characteristics of the professional accounting practice tasks that can be affected by process automation?

2. Methodology

Exploratory qualitative research is proposed, using case analysis techniques that allow the revealing of the characteristics of the tasks performed by accountants and the relevance of their robotization.

The methodology proposed by Arntz, Gregory & Zierahn (2016) was applied to identify the tasks associated with the different ways of exercising accounting practice, based on the analysis of a case study, under the hypothesis that the use of technologies for robotization and automation of processes has a strong impact on the accounting profession since a significant number of tasks are disrupted, displaced or deconstructed, the basic skills required being replaceable and there being significant changes in the way in which value is delivered.

In this sense, accounting tasks were classified as manual or cognitive, routine, and non-routine to assess what kind of threat robotization represents for the accounting profession. Subsequently, the tasks were coded according to the type of value offered and required skills: disrupted, displaced, deconstructed, and durable (Latham & Humberd, 2018).

The characteristics of the tasks are then approached from both conceptual frameworks, so they must be interpreted both from the indicated typologies (manual or cognitive, routine, and non-routine) as well as from the skills required and the type of value delivered.

Likewise, an open question was included (Do you think that robotic automation tools for accounting processes will have a relevant impact on your work?) to know the perception of the interviewees on the subject in question and their predisposition to change.

3. Writing plan

3.1 State of the art of accounting process automation

Among the possible approaches to the problem posed, Gotthardt, Koivulaakso, Paksoy & Saramo (2020) present a summary overview of the transforming RPA ecosystem and indicate which challenges are critical to face a successful implementation of such systems in accounting and auditing. These authors reviewed the relevant literature regarding the current state and the challenges in the implementation of RPA systems to summarize the key factors in practice, analyzing two use cases, along with an extensive interview on the subject.

Arntz, Gregory & Zierahn (2016) opted for a task-based approach to estimate how automatable jobs are, considering the heterogeneity of worker tasks within jobs. They carry out a case study to quantitatively determine the degree of influence that the tasks of a job have on their level of automation. Thus, the relationship between the tasks of the workers and the degree of automation of the jobs was estimated, considering the automation indicator of Frey & Osborne (2013) and the occupational codes of the Program for the International Assessment of Adult Competencies (PIAAC).

For their part, Apella & Zunino (2017) studied employment profile trends in Argentina and Uruguay according to the relative importance of the type of tasks performed by workers in their occupations to approximate the impact of technological change on The work market. They conduct a case study to analyze the evolution of the relative importance of using the different types of tasks: cognitive/manual and routine/non-routine. In this regard, following Acemoglu & Autor (2011) and Górka, Hardy, Keister & Lewandowski (2017), five measures of content or intensity of the tasks were constructed:

- "Routine manuals" are easily automatable.
- "Non-routine manuals" require adapting to the situation, language, visual recognition, and social interaction.
- "Routine cognitive" requires a series of repeated activities that can be standardized.
- "Non-routine cognitive" fall into two major subcategories: analytical and interpersonal. Both require abstract thinking, creativity, problem-solving, and communication skills.

Latham & Humberd (2018) analyzed what type of threat automation represents for different professions, for which they made their comparison through the analysis of case studies, coding 50 professions according to the type of value that workers offered and the skills they used to deliver it. This way, they created a framework that helps workers assess what kind of threat automation represents, identifying four evolution paths (jobs will be disrupted, displaced, deconstructed, or durable). They discovered that it is the value that predicts better change.

3.2 Context of RPA knowledge

Since the 70s of the last century, organizations have begun to use computer tools in different registration, processing, and reporting activities. However, after the generalization of enterprise resource planning systems (in English, enterprise resource planning, ERP) and decision-making support (especially Data Warehousing), the vast majority of processes in organizations came to be supported by computerized systems, networks, and centralized databases (Iacub, 2015).

In the last decade, this has been enhanced by access to the Internet, with software as a service (SaaS) model, cloud computing, the *Internet* of Things (in English *Internet of Things,* IoT), artificial intelligence and analytical information systems (Huerta & Jensen, 2017), highlighting the role of the finance and accounting professional in data science and analytics (Gould, 2019).

The Information and Communication Technology (ICT) skills required in the accounting profession have been repeatedly raised in numerous publications from prestigious professional associations such as the *American Institute of Certified Public Accountants* (AICPA), the *International Federation of Accountants* (IFAC), the *Institute of Management Accountants* (IMA), the *Association of Chartered Certified Accountants* (ACCA) or the *Institute of Chartered Accountants in England and Wales* (ICAEW).

From academia, in 2004, the American Accounting Association (AAA) launched the Journal of Emerging Technologies in Accounting; and in 2012, the Journal of Accounting Education dedicated a special issue to Big Data. Likewise, in September 2015, the AAA organized the first Accounting IS Big Data Conference. It started in 2021, and the Journal of the Association for Information Systems (JAIS) published a special edition on artificial intelligence in organizations.

The academic interest in the incorporation of ICT in the professional practice of the accountant has grown systematically, as can be observed in publications such as the *Journal of Information Systems, International Journal of Accounting Information Systems, Journal of Emerging Technologies in Accounting, International Journal of Digital Accounting Research* or *the Intelligent Systems in Accounting, Finance, and Management.*

Concomitantly, in the academic literature, there are numerous publications related to the impact, both in accounting, auditing, and finance as well as in professional practice, of automation through the robotization of processes (see, for example, Zhang, Dai & Vasarhelyi, 2018; Rozario & Vasarhelyi, 2018; Fernández & Arman, 2018; Huang & Vasarhelyi, 2019; Kaya, Türkyılmaz & Birol, 2019; Cohen & Rozario, 2019; Tietz, Cainas & Miller-Nobles, 2020; Qiu & Xiao, 2020; Bakarich & O'Brien, 2020; Gotthardt et al 2020; Cooper, Holderness Jr., Sorensen & Wood, 2019 and 2021; Ribeiro, Lima, Eckhardt & Paiva 2021; among others).

Likewise, concern about unemployment that technology can cause arises something that dates back to the industrial revolution. In recent decades, the world has faced a technological revolution that finds various points in common with the one that occurred in the second half of the 17th century. Both revolutions have caused economic and social transformations as well as technological ones. At first, the economy was based on a rural and manual economy, giving way to an urban and industrialized economy. In contrast, the second transforms these concepts into a global, digital, and information-based society and economy

The incorporation of process automation technologies requires to be oriented efficiently and effectively to contribute to achieving its goals. In this sense, it is necessary to provide

elements of government in the decisions and related actions tending to add value to the business (Reinhard, 2012). Beyond the structural and procedural practices concerning governance, which tend to apply transformation, it is necessary to focus on relational practices that improve transformation capacity.

According to Acemoglu & Autor (2011) the interactions between worker skills, tasks, evolving technologies, and changing business opportunities have determined changes in employment. Thus, the estimated proportion of "jobs at risk" should not be equated with actual or expected job losses due to technological advances, and automation and digitization are unlikely to destroy large numbers of jobs. Low-skilled workers will bear most of the adjustment costs since the possibilities of automating their jobs are higher compared to highly-skilled workers (Arntz, Gregory & Zierahn, 2016).

Organizations incorporate the robotization of processes to be more efficient, simplify management and free up resources for more complex activities such as information analysis and innovation (Provasnik, Rubio & Salgado, 2019) is especially relevant for accounting, auditing, and finance, so it is interesting to understand what the impact of process automation will be on the professional practice of accountants and public accountants.

Automation brought about by technological changes does not only refer to manual work but also extends to cognitive and non-routine jobs, especially those that were once considered beyond the scope of mechanization, eliminating various activities that involve routines and even work. cognitive (Brynjolfsson & McFee, 2014; Frey & Osborne, 2017; Manyika, 2017; Benbya, Pachidi & Jarvenpaa, 2021).

The robotization of processes has a great accumulated experience at the level of industrial production, although it is a less mature technology in administrative and accounting processes. As with other emerging technologies, they go through a process that is reflected in the Gartner *Hype Cycle (Dedehayir & Steinert, 2016), which shows the degree of maturity: some are just beginning to spread, others are going through a peak* of exaggeration of expectations, then they fall into the abyss of disappointment, to finally go through the ramp of consolidation and reach the plateau of productivity.

Currently, the automation of processes, particularly the use of specific robotization software (RPA), is in the phase after their peak of expectations, and the time will soon come to find efficient uses (Johnson, 2019). It should be noted that the problem is not in recording data but in converting that data into useful information for decision-making (Rikhardsson & Yigitbasioglu, 2018). Arnold (2018) points out that it is necessary to explain the probable effects of emerging changes in the decision-making of users of accounting information and analyze the impact that technological changes have on financial information, external auditing, and accounting. Managerial.

Cooper *et al.* (2021) argue that process automation is implemented in all areas of the company. However, it has done so with greater traction in tax services, followed by advisory and insurance services. They also point out that the quality and efficiency of tasks have increased. In this sense, it is necessary to educate users about the potential of these technologies and their costs to evaluate the associated benefits correctly. However, also the education of IT personnel concerning the needs of users and how automation is linked to objectives, policies, and strategies associated with the digital transformation of organizations, the elimination of routine tasks, and the focus on an analysis of the data.

4. Research results

To start the process of validation of the methodology, the tasks carried out by an accounting professional with the position of Accounting and Tax Manager in the Uruguayan subsidiary of a multinational company in the fashion industry were analyzed as a case study is a 32-year-old woman, trained at the University of the Republic, Uruguay, with a degree in Public Accounting and a Master's in Administration (MBA), who has held the position since 2014.

As a result of a directed interview in November 2021, 38 tasks were identified, expressed through descriptive phrases with a verb. Each was classified as manual or cognitive, routine, and non-routine, further opening the non-routine cognitive ones into analytical and interpersonal subclasses. The total task in each class is shown in Tables 1 and 2.

Table 1. ***General classification of tasks***

ITEM	ROUTINES	NON ROUTINE
Manuals	4	2
Cognitive	7	25

Source: own elaboration.

Table 2. ***Detailed classification of tasks***

CLASSIFICATION			AMOUNT
Manuals	routines		4
	non routine		2
Cognitive	routines		7
	non routine	Analytics	13
		interpersonal	12

Source: own elaboration.

To ensure the classification's consistency, it was verified that the verbs always gave rise to a single class. The verbs included in each class are detailed in Table 3.

Table 3. ***Verbs by Class***

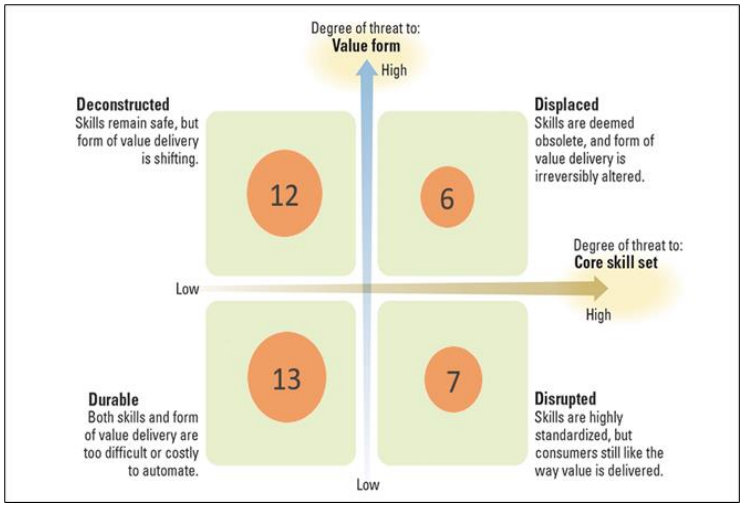
CLASSIFICATION	VERB
Routine Manuals	Load
	Enter
	Verify
Non-routine Manuals	Close
	Report
Routine Cognitive	Adjust
	Calculate
	Control
	Elaborate
Cognitive Interpersonal	Articulate
	Attend
	Provide
	Consult
	Teach
	Participate
	Perform
	Respond
	Request
	Supervise

Cognitive Analytical	Analyze
	Evaluate
	Identify
	Review

Source: own elaboration.

According to the bibliography analyzed, it was evidenced that robotization mainly threatens routine tasks (manual and cognitive) since the basic skills required are easily replaceable (adjust, calculate, load, control, elaborate, enter, verify). Regarding the type of value that workers offer, the analytical cognitive ones are the ones that change the least (analyze, evaluate, identify, review), something that also happens with the routine cognitive ones (adjust, calculate, control, elaborate), and with the manual ones—non-routine (close, report). However, the interpersonal cognitive skills (articulate, attend, provide, consult, teach, participate, perform, respond, request, supervise) have seen how the task is carried out modified, for example, by the mediation of communication technology. Figure 1 shows the total number of tasks that correspond to each of the four categories analyzed: disrupted (7), displaced (6), deconstructed (12), and durable (13).

Figure 1. ***Task chart***



Source: Own elaboration based on Latham & Humberd (2018).

The results were as expected for a managerial position since they show that almost two-thirds of the tasks are of the non-routine cognitive type, that the skills required to carry out most of the associated tasks are not significantly affected, and that for half of the tasks, there is no change in the way value is generated.

Regarding the open question (Do you think that robotic automation tools for accounting processes will have a significant impact on your work?), the interviewee pointed out that, although the company where she practices her profession has not yet started incorporation projects of RPA tools, you have a general understanding of your potential application. Recognize that many of the tasks you currently perform could be automated. He emphasizes that, for better use of this type of technology, you should have more information on associated costs and benefits, better training on the subject, and a way of ordering which tasks should be selected when defining your automation.

Conclusions

According to the proposed objectives, the methodology could be validated, and it establishes a framework to establish a comparative model between different accounting profession roles in various activity sectors.

The classification carried out according to the proposed model allows us to conclude that, according to the position performed, a significant impact of process automation in the professional practice of this particular case is not detected since most of the tasks are of the non-cognitive type routine.

In the open question, no resistance to change is observed a priori. However, the need for training on the potential of robotic process automation technologies is evident, as well as their costs, to correctly assess the associated benefits and adequately plan its use.

As a final reflection, and considering that this research is part of a line of research whose general objective is to analyze the impacts that technological changes have on accounting practices, and especially the incorporation of the Automation of Process Robotization in the framework of digital transformation of organizations, it seems reasonable to consider determining how automation is linked to objectives, policies, and strategies associated with the digital transformation of organizations as a new challenge.

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