

# The Impact of Automation on the Accounting Profession - The Perspective of Indonesian Accountants

Christopher Jonathan Adrianto<sup>1\*</sup>, Valentina Tohang<sup>1</sup>, and Rosaline Tandiono<sup>1</sup>

<sup>1</sup>International Accounting & Finance Program, Accounting Department, Faculty of Economics & Communication, Bina Nusantara University, Jakarta, Indonesia 11480

**Abstract.** The purpose of this study is to examine the effect of automation on accountants and accountants' work in Indonesia. In Indonesia, automation starts to be significant. Many companies have gradually integrated their operation with automated technology. Nevertheless, the overall implementation of automation in Indonesia is considered one of the lowest compared to other countries in the ASEAN region. Several accountants from across companies and industries were interviewed to get their insights. This study found that accountants in Indonesia are very aware of the emergence of technology, including automation in their jobs. They realized automation affects the required skills of accountants. Nevertheless, automation also creates the opportunity for a job promotion. This study shed some light on the effect of technology, particularly automation on accountants' work in Indonesia.

## 1. Introduction

Accounting has evolved since it was first developed in the 1400s by Benedetto Cotrugli and Luca Bartolomes Pacioli. Accounting was seen as manual bookkeeping by using physical paperwork and pencil handwriting. Nowadays, the accounting profession is still evolving periodically for the past few decades, and the evolution of technology is already affecting accounting practices in many ways possible. What used to be manual bookkeeping using physical paperwork has now changed into computerization with the development and adoption of various accounting software. Corresponding to this issue, there has been a big debate about the impact of these technological advancements in the future. Will accounting automation fully replace the work of accountants, or will it somehow benefit the accounting process and works of accountants?

Nevertheless, the development of technology is getting more advanced beyond the usage of computers and software. It has impacted the accounting reporting environment as well as accountants' work. For instance, the preceding decade has seen the emergence of big data in the accounting field. [1] argued that these days accountants need to deal with a big volume of data and simultaneously keep their job relevant to the changes. Likewise, the existence of blockchain enables business transactions to be seamlessly operated with minimum involvement of the third party using the accounting ledger distribution [2].

The rise of this technology has nonetheless affected accountants in various ways. According to Drew & Tysiac [3] technological innovations, such as artificial intelligence and blockchain, will transform Certified Professional Accountant (CPA) dramatically. This transformation also created fear of the possible loss of certain jobs [4].

The above issues have led several scholars to investigate the effect of advanced technology on accountants and accountants' work. [5] claimed that the implementation of Robotic Process Automation (RPA) software in public accounting decreased the hour of the accountant's work. Such a decline in work hours might adversely affect the client's expectation of the public accountant's service fees. Likewise, the availability of blockchain and big data supported by cloud-based analytics tools and AI will allow the emergence of perpetual and timely accounting reporting. Consequently, much of the decision-making will be automated [6].

Furthermore, [7] predicted that the accounting profession is in danger because of the possibility that accountants' work will be replaced by technologies and automation as well. It is predicted that automation that involves computerized machines will wipe out roughly 6% of the professions in the United States over the next five years. Among those professions, the accounting profession is one of them [8], [9].

This study offers at least two contributions. First, it contributes to the current discussion on technology transformation and accounting which currently is scarce. Second, it provides empirical evidence from the Indonesian context where it is still under-examined.

\* Corresponding author: [christopheradrianto97@gmail.com](mailto:christopheradrianto97@gmail.com)

The next section reviews the relevant literature on the development of technology and accountants' work. Then, it moves to the methodology employed by this study. The findings and discussions are presented next, followed by a conclusion and implications of this study.

## 1.1 Objectives

In line with the above arguments and concerns, this study aims to examine the effect of the emergence of advanced technology, such as automation on accountants in Indonesia. In Indonesia, automation starts to be significant. Many companies have gradually integrated their operation with automated technology. Nevertheless, the overall implementation of automation in Indonesia is considered one of the lowest compared to other countries in the ASEAN region. Regardless of this, automation is perceived to create more jobs by 2030 [10]. Therefore, it is fair to conclude that the effect of the implementation of automation on accountants and accountants' work in Indonesia is not yet fully understood. Therefore, this study focuses on accountants in Indonesia to gain their insights on the impact of automation on their work. Specifically, this study's purpose is to answer the following research questions:

*"What are the significant changes that automation will bring to the works of Indonesian accountants?"*

*"How do the accountants in Indonesia perceive the effect of automation on their jobs?"*

To answer the above research question, this study employs a semi-structured interview with several accountants in Indonesia. The overall findings indicate that accountants in Indonesia are very aware of the emergence of automation and its related technology. While there is a concern about the loss of lower-level accountants due to automation, in general, accountants in Indonesia are confident that their profession will sustain. Nevertheless, they need to adapt and learn rapidly to keep up with the advancement of technology.

## 2. Literature Review

### 2.1. The technologies that enable automation in the accounting field

In recent years, automation has radically changed the business process in dramatic ways. It adds more value and has become the foundation of shaping the business. Automation of a business process is defined as a technological adoption by the various process that was previously controlled manually by humans. According to [11] automation reduces operational costs and increases productivity and efficiency significantly. It is because automation significantly reduces human factors in the management of a business process, both on staff and organization levels [9]. Consequently, the waiting time in-between tasks of a firm's organizational level are reduced. Thus, automation nowadays is very widely used in various industries with diverse extensive business

processes and workforce. Industries that rely heavily on automation include information technology, manufacturing, automotive, utilities, and facility operations [11]. Two technologies are widely discussed that enable automation in the accounting field are Robotics Process Automation (RPA) and Artificial Intelligence (AI) [12]

The automation process includes Robotic process automation or RPA. RPA is a form of business process automation that utilizes computer software, or a "bot" to imitate and incorporate the activities of a person interacting with digital systems to perform a business process [5] [9]. [13] explained that RPA improves the company's internal operations. A survey on one of the Big 4 firms regarding the use of RPA reveals that 10% to 30% of the general accounting processes could be automated. The result is the reduction of expenses incurred on internal control processes and allows employees to dedicate their skills and time to tasks that increase the firm value.

Another enabling automation technology is Artificial Intelligence (AI). AI is a combination of big data application and machine learning that enables us to understand the past and predict the future [14]. Accordingly, AI has been used in the accounting field since the 1980s [15]. The most studied area of AI in the accounting field is the use of the expert system [16]. Expert Systems are software that tries to replicate human behavior and expertise, store knowledge and experience and transform them into rules to solve accounting and perform accounting tasks [17]. While expert system brings some benefits, some scholars criticized their accuracy. For example [18] argued that an expert system is too logical, based on rules and decision trees, far beyond the flexibility that human has. Additionally, the expert system has the potential to make mistakes over and over again [19]. Nevertheless, instead of examining the flaws of technology, this study focuses on how accountants can benefit from technology such as AI and how it affects the accounting profession.

### 2.2. The technologies that enable automation in the accounting field

The existence of the discussed technology affects accountants' work considerably. According to [5] since RPA has automated many of the tasks, employees focused more on the individual tasks. Accordingly, accounting firms have the desire to restructure their internal processes to include RPA. It is expected by using RPA will provide profits increment, since it is also perceived to be beneficial to the accountants as they learn more about the automation [20]. Interestingly, not only the big four firms that recognize the need for automation of their tasks, but their clients, specifically in the area of tax and advisory, also express interest in adopting the technology for their benefit as well.

From the accounting side, the implementation of RPA means the need to improve their skill sets. Many of the accountants recognized that they need to focus more on subjective and value-adding tasks [20]. The

existence of technology, such as RPA is also predicted to provide lower attrition levels and higher job satisfaction in the workplace. Consequently, accountants believe that there will be a rapid progression in their career prospects. This also means accountants are more likely to consider their long-term careers within public accounting firms.

Nevertheless, some accountant still has anxiety about having their jobs replaced by bots. They claim that they are not capable of shifting their skillsets to a higher level which requires more critical thinking and logic. While some accountants express their anxiety about RPA replacing their job in public accounting firms, most still support the implementation of RPA [5].

Reflecting on how accountant work has evolved over the past ten years, people argued how difficult it is to predict what can happen in the next ten years, especially in the evolution of the accounting profession. The disruption of technology has fostered more innovations to substantially change the way things will be done. One thing that is undoubtedly going to happen over the next ten years, however, is the new technologies that will bring vast alterations to the accounting industry. The same study highlights how accountants in the United States were not as proficient in their accounting skills due to differences in the accounting standards that they used to adhere to as well as the technology setbacks in the early 2010s [3]. While automation mainly aims to automate repetitive and monotonous tasks, the technology itself is far from perfect because it still has its flaws, and some people are still doubting the long-term impact of adapting to this approach.

A field base study conducted in the automation lab of a consulting company by [5] provides evidence on how RPA automation is emerged and triggered an end-to-end business process automation that will also affect accountant’s profession, as illustrated in Table 1.

**Table 1.** Potential Automation by Business Function

Function	Sub-process	Process automation potential (%)	Potential time savings	Quick win
General accounting	<ul style="list-style-type: none"> <li>▶ Fixed assets / FMM / closing and reporting</li> <li>▶ Local tax accounting</li> </ul>	25%–30% 10%–15%	10%–15%	Yes No
Controlling	<ul style="list-style-type: none"> <li>▶ Costing</li> <li>▶ CO operation/reporting</li> <li>▶ Business controlling support</li> <li>▶ BI and systems</li> </ul>	5%–10% 10%–15% 5%–10% 10%–15% 5%–10%	15%–20%	No

	▶ Group financial controlling			
Finance (other)	<ul style="list-style-type: none"> <li>▶ Intercompany</li> <li>▶ Account and bank reconciliations</li> <li>▶ Financial planning and analysis</li> <li>▶ Tax</li> </ul>	25%–30% 15%–20% 25%–50% 40%–60%	30%–50%	Yes No No Yes
Human resources	<ul style="list-style-type: none"> <li>▶ HR general services</li> <li>▶ Expatriate management</li> </ul>	25%–30% 10%–15%	60%–80%	Yes No
Supply chain	<ul style="list-style-type: none"> <li>▶ Supply chain planning</li> <li>▶ Transport planning</li> <li>▶ Supply planning</li> <li>▶ Project management</li> <li>▶ General supply chain service</li> </ul>	10%–15% 10%–15% 10%–15% 10%–15% 10%–15%	10%–15%	No No No No

Source: L. A. Cooper, D. K. Holderness Jr, T. L. Sorensen, and D. A. Wood, “Robotic process automation in public accounting,” *Account. Horiz.*, vol. 33, no. 4, pp. 15–35, 2019.

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This table shows that most of the RPA projects involve accounting, finance, and supply chain areas, thus it is crucial to explore how the business process automation affects the accountants and accountants’ work. Many works of literature discussed the benefit, opportunities, and challenges of the technology to the accounting profession worldwide, however, there is still few discussing from accountant’s perspectives in Indonesia. In Indonesia, the number of automations is expected to be adopted by more firms in the future since it still has the lowest rates of automation in comparison to other countries in the ASEAN region, at just 28% on par with Laos [21]. Accordingly, McKinsey argues that automation may create more jobs by 2030 as opposed to some pessimistic statements related to the accountant’s work [10]. It is fair to say that the implementation of automation in a profession possesses its advantages and disadvantages. Hence, the objective of this paper is to synthesize the automation’s impact from the perspective of an Indonesian accountant.

### 3. Methods

Drawings upon the objective of this paper, a qualitative research approach was chosen. Qualitative research is focusing on discovering patterns within words, activities, and records and presenting those patterns for inspection by others while also remaining within the boundaries of the world that has been structured when the correspondents experienced it first at that time [22].

This paper also relies on primary data, i.e., interviews. In selecting the respondents, this study applies two categories of respondents – the main and the supporting. The former was those who have an educational background in accountancy, and a working experience in that profession in Indonesia for at least ten years. The latter group is those who have an educational background in any technology-related majors and have robust experience in operating automation in their works. Several respondents were contacted by the researchers. However, during the study, Indonesia was impacted by the unforeseen Covid-19 pandemic. Subsequently, only five respondents agreed to take part in this study. While the number of respondents does not represent a large sample pool, they represent the key players in the accounting field. Each of the respondents holds a significant position in their workplace, such as holding an executive director of the standard-setter, assurance senior manager in an auditing firm, the head of accounting and finance operation in a corporation, financial controller in a corporation. Furthermore, to complement the view of the impact of automation on the accounting profession, this study also includes a configuration process analyst to provide a coherent perspective on the issue being discussed. Moreover, some scholars agree on small sample size, such as five respondents as long as the data collected is qualified, there is high usefulness of the data, and the topic of the research is unique or new [23].

Due to the COVID-19 pandemic, three interviews were conducted face-to-face (where there was no social restriction imposed by the government yet), and after the government imposed social restriction, the test was carried out by skype. Each interview was transcribed verbatim. Immediately after all interviews were transcribed, the researchers started the dive into the data. Data analysis was taken in several steps and individually. However, each research follows the same phases as recommended by [24]. First, each researcher read the transcription repeatedly to immerse in the data. Second, the researchers took notes on any important points and impressions perceived by the researchers. Third, each of the researchers made the thematic analysis based on themes derived from the data. At this stage, each researcher did not communicate with each other regarding the themes to allow a more truthful induction process. After each researcher had finished with the thematic analysis, all researchers discussed and made consensus on the perceived most important points concerning the research objective and research questions.

### 4. Findings and Discussion

#### 4.1. The Perception on the Emergence of Technology in the Current Accounting Field in Indonesia

Respondents indicate that the influence of technology on accountants' work is new in Indonesia. However, they also acknowledged that it is an unavoidable phenomenon. Several factors drive the need for the inclusion of technology in the accounting field, such as:

*"The main drivers that push automation are the markets themselves. In the case where a company investigates industries, and they see that people are starting to pick up automation, especially RPA [...] the company will feel obliged to adopt the technology as well. The market has a growing need for us, and institutions need to be more efficient and need to adopt this technology."*  
(Supporting respondent, E)

Respondents also indicate that the emergence of technology reduces the time in conducting their work:

*"[...] doing calls for the financial statements, previously associate do it for three or four hours. But now we are introducing a robot that they can do only by five minutes."*  
(Main respondent, A)

The growth of technology is also perceived to be unstoppable. Therefore, the need to embrace technology become compulsory:

*"Besides, from the technology itself, I think if we do not adopt technology, we would be left behind, and it would be much harder for certain companies to catch up on the growing trends of technology."*  
(Main respondent, C)

However, the level of adoption depends on, first, the stakeholders' demand and knowledge:

*"We need to understand the environment first, as in what is available to you, so say, for example, if you mention things such as Big Data, in an environment where most of the stakeholders are not familiar with such thing, then it would be impossible for you to even introduce or speak about such thing."*  
(Main respondent, B)

Second, the infrastructure of the country:

*"If we don't have Internet service, then Black Line won't work. We can't do anything; we must have internet."*  
(Supporting respondent, E)

According to [25] development in technology and the digital world establish important changes, adaption, as well as a dilemma for many industries. Companies should be more sensitive when deciding to adopt those technologies to balance the complexities and potentials that might be occurred. In some cases, it will also

compel the change in the company's culture and skills of the existing employees that significantly require coordination across various business functions [26]. Hence, this is not an effortless task and process.

#### **4.2. The Effect of Technology and Automation on Accountant's Work and Profession**

The rise of technology is perceived to bring benefits to accountant's work, especially when it involves heavy calculation and accounting standards:

*"There are so many regulations such as IFRS 15 and 16 regarding leases and they have to compute the lease liability and write-off used asset; using Excel on these makes it more prone to human error and the amount of time using the manual labor is much higher than the automated part. If it is automated, then it will reduce the time, cost, and make it efficient for the accounting, especially in the consolidation method."*  
(Main respondent, A)

However, there is also concern from respondents that the rise of technology might put their profession in danger. Particularly, when the organization decides to streamline its management and employees due to technology adoption:

*"If let's say it [technology] will replace accountants, it is because automation is more cost-efficient, and it will affect the lower-level accountants."*  
(Main respondent, C)

Another respondent also expressed his anxiousness about the thought of being replaced by technology. This respondent relates such replacement with the issues of ethics:

*"Instead of replacing accountants with automation, it is best for companies to reconsider it because I think it is unethical for them to replace a certain number of employees in a department with automation."*  
(Supporting respondent, E)

However, not all respondents agreed that technology will make the termination of the lower-level accountants. One of the respondents remarked that it is also possible, that instead of being replaced by the technology, the junior accountant's work is shifted elsewhere:

*"If there is a heavy adoption of automation, and we will be having more virtual locations of work, and then the system is all automated, then the role of the clerical accounting staff which does the manual journalizing each day can be shifted into the analysis; how to maintain the system, acting as their support system to maintain the automation to prevent the system from malfunctioning."*  
(Main respondent, B)

Nonetheless, all respondents are also confident that accountants will always be needed although there is a heavy adoption of technology. First, it is due to the unique skill of judgment that accountants have:

*"No matter how advanced a technology is, you still need the role of the human being to make the key judgments that currently cannot be replicated by machines, or even by AI."*  
(Main respondent, A)

Additionally, the decision-making skill also contributes to the respondents' confidence in their future career:

*"[...]such as when making decisions, I have not seen any technologies that can make a decision [...]. There is still a need for someone to make the decision."*  
(Main respondent, C)

Furthermore, respondents believed that the interpersonal skill, intuition, and emotion that each human has will always be beneficial and needed in the workplace, including in the accounting field:

*"...there is something that differentiates us from robots and that is intuition and emotion, such as managing people. I doubt AI can understand and empathize with people, so one of the strongest factors that AI couldn't do is interpersonal communication in-between employees and their managers and bosses because what they can learn is limited."*  
(Main respondent, A)

Nonetheless, accountants need to continuously transform and adapt to the new technology, and they need to learn it fast:

*"...the most important skill that they [organizations] need is to adapt fast to changes, so you need to be able to adapt to anything fast. That is the most important thing."*  
(Main respondent, A)

The main and supporting respondents show belief that it is not simple to replace the accountants' tasks, especially when related to decision-making skills and key judgments [12]. Previous studies in the United States [27] characterized the accountant roles as strategic business advisors rather than information processors that are now replaced by technology. [20] also emphasized a surge of IT skills for the accountants since technologies such as RPA have significant impacts in a swift of accountants' roles [13]. A recent study of [28] also confirmed the main and supporting respondents' beliefs that accountants possess strategic roles with RPA replacing the repetitive activities of recording and reporting. These facts are summarized in the next table:

**Table 2.** Accounting Task Automation by Area

Example area/task	Description of procedures
Journal entries	
Data entry	Utilizing email correspondence and predefined parameters, the robot enters account entry information into the accounting system. The robot will send a confirmation email to the initiator.
Data entry	The robot accesses Excel files that contain information needed to record journal entries. The robot enters the journal entries into the accounting system.
Data entry and account classification	Utilizing bank statements, credit card activity, and the previous transaction posting history, the robot records journal entries in the accounting system. If the robot identifies transactions for which there is no recorded past history, an exception report is generated and the robot sends an email to the necessary parties.
Standard journal entries	The robot prepares standard journal entries based upon completing or accessing predefined templates. The robot enters the journal entries into the accounting system.
<b>Reconciliation preparation and analysis</b>	
Extract account movements from bank website	Based upon predefined parameters, the robot accesses online banking information to download selected activity for reporting. This information can be uploaded to a shared folder and used as part of the reconciliation process.
Upload and validation of bank statement activity	The robot obtains bank statements and downloads information daily. The robot compares information from bank statements to the accounting system to compare to prior periods and validate balances. The robot will export an Excel file, upload the information to a shared folder and send emails to appropriate individuals for follow-up.
Account analysis	
Accruals creation	Based upon pre-established templates, the robot updates the inputs to revise the calculations of selected accruals. The robot will perform a comparative analysis of the current calculations to past calculations

	based upon predefined parameters/thresholds. If an exception is identified, the robot will forward the information to the necessary parties to resolve the matter.
Warranty calculation	Based upon predefined parameters, the robot updates the Excel file for warranty claim information based upon individual claim data. The robot saves and uploads the excel file that can be further analysed as part of the reconciliation process. Intercompany payment requests related to the warranty are also initiated by the robot.
Commissions calculation	The robot calculates and processes payments for commissions based upon sales data and predetermined commission plans.
Rebate calculation	The robot calculates and processes payments for rebates based upon a predefined parameter.
<b>Closing/reconciliation process</b>	
Export and data consolidation	The robot exports and downloads information from the accounting system and then uploads the information to a shared site that can be used as part of the reconciliation process.
Reconciliation process	The robot downloads predefined files from the accounting system and uses the information in these files to update an Excel file that can be used for further analysis or processing.
Foreign exchange rates	The robot updates the accounting system for foreign exchange rates based upon published information.

Source: Kokina and S. Blanchette, "Early evidence of digital labor in accounting: Innovation with Robotic Process Automation," *Int. J. Account. Inf. Syst.*, vol. 35, p. 100431, 2019.

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## 5. Conclusion

The development of advanced technology is not a surprise to the respondents. However, the level of technology adoption also depends on the country's infrastructure and the needs and knowledge of the stakeholders. The findings shed some light on the reason

for the low adoption of technology in Indonesia. The respondents acknowledged that technology-assisted in their work to some extent. Particularly, when the work involved heavy calculation, the automation is perceived to minimize errors and to increase accuracy. Automation may also transform the employment of accountant's work by shifting the existing jobs of the lower-level staff to higher thinking and decision-making required positions, therefore emphasizing the employee's communication skills and less on the repetitive work, such as data input.

In terms of the effect of technology on accountants' jobs, there is a mixed response on the sustainability of the lower-level accountants. Some perceived the lower-level accountants may be replaced by automated machines, while others believe their responsibility will be shifted elsewhere, and it is unethical to replace these accountants due to automation.

However, in general, all respondents agreed that technology cannot replace the accounting profession. There are three reasons for such confidence – judgment skill, decision-making skill, and interpersonal skill. Despite their belief that they will not be replaced, they also acknowledged that they need to adapt to the technology and learn swiftly. While previous studies including one in the US show a similar case with Indonesia, the overall findings showed that accountants in Indonesia in general, are more confident than prior studies illustrated [6]

## 6. Implications and Future Research

The overall discussion suggests that technology is nevertheless influenced accountants and their work. This study showed that even in a country where technology adoption is considered low, there are some effects of technology on the accountant's work and job. Therefore, there are several implications on existing accountants, future accountants, and accounting educators:

1. Existing accountants may work on their careers to ensure they are in a higher level of position. This study found that accountants in higher positions are less concerned and affected by the existence of technology and automation.
2. It is almost compulsory for the existing accountants to upgrade themselves in terms of technical knowledge and skills. As this study showed, the development and embracement of technology are almost certain, every accountant needs to be equipped with such knowledge and skills.
3. For both existing and future accountants, it is necessary to sharpen their soft skills. While this study found three soft skills are the most important skills that an accountant has, more soft skills will surely bring more advantages.
4. The overall findings also mean that accounting education where future accountants are molded, educated, and trained needs to transform and focus on the current trend. Accounting academia may revise the curriculum to include more technology in

their accounting education and emphasize the required skills that an accountant ought to have.

This study has extended the current debate on the effect of technology on accountants and accountants' work in Indonesia. It provided some insight into the effect of technology on accountants in a country where the adoption of technology is considered low. This is in contrast to existing literature where most of the discussion-oriented on developed countries where there is a higher adoption of technology. Nevertheless, this study has several limitations. These limitations may provide some recommendations for future research. First, the future study may extend the number of respondents. As explained in this study, due to the unforeseen Covid-19 pandemic, the researchers were only able to interview 5 respondents. A wider number of respondents may offer a broader view on the issue discussed. Second, this study focused on the effect of technology in general and automation in specific on accountants and their work. Future studies may focus on other technology such as blockchain on specific accountants' work. Lastly, to complement this study, when full adoption of technology occurs in Indonesia, the future study may explore the same issues to confirm or contrast the findings based on different levels of technology adoption.

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