

2023 AFA Research Report

TECHNOLOGY ADOPTION BY THE ACCOUNTANCY PROFESSION IN ASEAN COUNTRIES



A study by



ASEAN Accounting
Education Workgroup
(AAEW)

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(AFA)

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Foreword

The pace of technological change in the 21st century has been astonishing. It has transformed industries, redefined economies, and rewritten the rules of doing business. The accountancy profession is no exception to this sweeping tide of innovation. As we navigate the digital revolution, it becomes clear that embracing technology is not merely an option – it is imperative for the accountancy profession to remain relevant and effective.

This publication, titled “*Technology Adoption by the Accountancy Profession in ASEAN Countries*” builds on our 2020 AFA Research Report: *ASEAN SMPs – A Report on Technological Competency Skills*¹ and offers a comprehensive exploration of the critical role that technology plays in reshaping the landscape of accounting within the dynamic and diverse ASEAN region. It underscores the urgency for accountants and financial professionals to adapt, adopt, and harness the power of technology in their daily practices.

The ASEAN region, known for its vibrant diversity and economic dynamism, is a microcosm of the global shift towards a technologically driven future. The accountancy profession, deeply intertwined with businesses, organizations, and governments, finds itself at a crossroads where traditional practices must coexist with, and eventually yield to, the powerful tools and innovations offered by technology.

This publication brings together the wisdom and insights of leading experts, scholars, and practitioners who have not only recognized the transformational potential of technology but also have actively harnessed it to bring greater efficiency, accuracy, and transparency to the financial world. Their experiences and expertise demonstrate that technology is not merely a disruption but it is also an enabler, empowering accountants to provide more strategic and value-added services to their clients and organizations.

The digital revolution is not a future vision but an ongoing reality. Accountants in ASEAN and beyond must adapt to this changing landscape, incorporating data analytics, automation, and blockchain technologies into their practices to remain relevant. The accountancy profession must evolve to become a forward-thinking and technology-driven force in the business world.

I extend my sincere appreciation to the ASEAN Accounting Education Workgroup (AAEW) and the entire team behind this publication, whose dedicated efforts have resulted in this invaluable resource. I trust that this publication will serve as a guiding beacon for accountants, educators, regulators, and all stakeholders interested in the intersection of technology and accounting in the ASEAN region.

As we venture further into this transformative era, let this publication inspire us to embrace technology, not as a challenge, but as a catalyst for a brighter and more relevant future for the accountancy profession in ASEAN countries.

Voravit Janthanakul

President

ASEAN Federation of Accountants (AFA)

1 2020 AFA Research Report, <https://bit.ly/AFARESEARCH2020>

Preface

We acknowledge the confidence and trust of the ASEAN Federation of Accountants (AFA) in commissioning the ASEAN Accounting Education Workgroup (AAEW) to conduct a study entitled ‘Emerging Technologies Adoption by the Accountancy Profession in ASEAN Countries’.

In this era of significant changes to the accounting profession, our researchers have stepped up to provide insights from accountancy educators, practitioners and professional accountancy organizations in each of their jurisdictions in ASEAN, relating to the level of knowledge, familiarity, competency and adoption of various technologies.

The global shift towards a technology-driven future in the accountancy profession, where traditional practices will coexist, is paving the way for utilizing more powerful tools and innovations that technology offers. This report consolidates the views and insights of leading experts, scholars, and practitioners.

Over the past couple of years, we saw a shift in the way we work, learning new tools to enhance the speed and quality of work as we were driven by the inevitable changes in the environment. As such, the emerging technologies have somewhat influenced the practices, training and education of accountants and would-be accountants, whilst driving innovation and transformation.

We now find ourselves in the midst of digitisation and digitalisation, data science, big data, AI, ChatGPT, et cetera, as the accountancy fraternity strives to stay relevant and important. Educating and upskilling ourselves with the latest technology is a perennial quest that we must pursue unflaggingly.

This timely and much-needed study offers meaningful findings towards reshaping the accountancy landscape within the dynamic and diverse ASEAN region. A living reality, our research calls for the various stakeholders to be more prepared in this ever-evolving landscape. We posit that the accountancy profession must evolve into a progressive, multi-skilled and multi-knowledge entity within the business world, tapping the benefits of emerging technologies.

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Industry Report:

Technology Adoption by the Accountancy Profession in ASEAN Countries

The World Economic Forum (WEF)¹ in 2023 emphasized the significant job creation and destruction effects driven by environmental, technological, and economic trends. Key points highlighted include:

- a. Technology adoption will continue to drive business transformation.
- b. Big data, cloud computing, and artificial intelligence (AI) play crucial roles in technology adoption.
- c. Fastest-growing roles are driven by technology, digitalization, and sustainability.

The accountancy profession² is not immune to these impacts.

The WEF's 2020 report ranked accountants and auditors fourth among jobs on a declining trend. The 2023 report predicts more accountancy jobs will be displaced³ than created due to technological advancements.

Computers, spreadsheets, and now cloud computing have transformed accounting and auditing practices. Advancements in data mining and AI enhance forensic accountants' abilities, increasing efficiency and effectiveness, reshaping traditional practices.

Accountants face the challenge of understanding technology's impact in terms of enhancing client services, work efficiency, and profitability.

Robotic processing, automation, and artificial intelligence streamline labour-intensive tasks, demanding accountants adopt new skills in data analytics, modelling, visualization, and predictive analysis.

Accountants must embrace these innovations to remain competitive, as technology becomes integral to their profession.

Take the example of ChatGPT and its impact on knowledge acquisition and field audits. Box 1 shows an example of a response from ChatGPT to a query on internal auditing.

1 World Economic Forum 2023 "Future of Jobs Report", page 5.

Box 1: Example of response from ChatGPT

QN

Imagine you are an internal auditor and you are auditing a university, list one of the most important internal controls you would examine in the handling of cash.



As an internal auditor auditing a university's handling of cash, one of the most important internal controls I would examine is the segregation of duties. Segregation of duties ensures that no single individual has complete control over the entire cash handling process, reducing the risk of fraud, errors, and misappropriation of funds. It involves dividing cash handling responsibilities among different individuals to create a system of checks and balances.

Here are some key elements I would review regarding the segregation of duties in cash handling:

- **Cash Receipts:** I would ensure that the process of receiving cash is separated from the recording and depositing of funds. This means that the individuals responsible for collecting cash should not have access to the accounting systems or the authority to make deposits. This segregation prevents the potential for individuals to manipulate records or misappropriate cash.
- **Cash Disbursements:** I would examine the process of authorizing and making cash payments. There should be a clear segregation between the individuals authorized to approve payments and those responsible for physically disbursing the cash. This segregation minimizes the risk of unauthorized payments or personal use of funds.
- **Cash Reconciliation:** I would review the reconciliation process to ensure that someone independent of the cash handling process verifies and reconciles cash transactions regularly. This individual should compare the recorded cash transactions with the actual cash on hand and investigate any discrepancies. This segregation helps identify errors or fraudulent activities and promotes accountability.
- **Physical Controls:** I would assess the physical controls in place for cash handling, such as locked cash boxes, secure storage areas, and restricted access to cash handling areas. Adequate physical controls reduce the risk of theft or unauthorized access to cash.

For financial reporting, ChatGPT is also able to provide preliminary responses to a query on the effects of a change in interest rates on accounting (See Box 2).

Box 2: Change in interest rates and accounting for leases

QN

Imagine you are an accountant, articulate the effects of a change in interest rate on accounting for leases in your books.



As an accountant, a change in interest rates can have several effects on the accounting for leases in your books, specifically those classified as finance leases. Here are some key considerations:

- **Interest expense:** A change in interest rates will directly impact the interest expense recognized over the lease term. If interest rates increase, the interest expense will also rise, resulting in higher lease costs for the lessee. Conversely, if interest rates decrease, the interest expense will decrease, reducing the overall lease costs.
- **Lease liability:** The lease liability represents the present value of future lease payments. A change in interest rates will affect the calculation of this liability. If interest rates increase, the present value of future cash flows will decrease, resulting in a lower lease liability. Conversely, if interest rates decrease, the present value of future cash flows will increase, leading to a higher lease liability.
- **Lease asset:** The lease asset represents the right to use the asset over the lease term. A change in interest rates does not directly impact the recognition or measurement of the lease asset. However, any change in lease liability (as mentioned above) will have an indirect effect on the leased asset. For example, a decrease in the lease liability due to lower interest rates may result in a decrease in the value of the lease asset as well.
- **Interest income (Lessor):** If you are accounting for leases from the lessor's perspective, a change in interest rates will affect the interest income recognized over the lease term. Higher interest rates will lead to higher interest income, while lower interest rates will result in lower interest income.
- **Discount rate:** The discount rate used to calculate the present value of lease payments may be influenced by changes in interest rates. If interest rates increase, the discount rate used to determine the present value of lease payments may also increase. Conversely, if interest rates decrease, the discount rate will decrease. This change in the discount rate will impact the measurement of the lease liability and lease asset.

Given the insightful responses from ChatGPT, a generative AI, how should future accountants be prepared to face this technology and others entering their profession? Despite the ongoing improvement of generative AI, it's just one of the many technologies shaping the accountancy field.

Specific technology for the accountancy profession

The World Economic Forum (WEF 2020) surveyed industry experts, revealing the top technologies to be adopted by 2025.

These include cloud computing (98%), encryption and cybersecurity (95%), big data analytics (91%), artificial intelligence (90%), and e-commerce and digital trade (90%). distributed ledger technology (blockchain) stands at 8th place with 73% adoption.

Table 1: Technology likely to be adopted by 2025, by share of companies surveyed, from the financial services sector⁴

Position	Technology	Financial services (%)
1	Cloud computing	98
2	Encryption and cybersecurity	95
3	Big data analytics	91
4	Artificial intelligence (e.g., machine learning, neural networks, NLP)	90
5	E-commerce and digital trade	90
8	Distributed ledger technology (e.g., blockchain)	73

Table 1 highlights the necessity for the accountancy profession to adapt to technologies adopted by industry players to remain relevant. Specific technologies directly impacting the industry include artificial intelligence, automated repetitive processing, big data analytics, cloud computing, cybersecurity, data visualization, machine learning, and methods for structured and unstructured data, among others. A glossary of these technologies is provided at the report’s end.

Given the array of technologies and limited resources, the challenge lies in identifying key digital skills for accountancy professionals and students in the short-, mid-, and long-term. To excel in the future workforce, accountants must:

- a. Understand relevant technologies and their potential impact on their work.
- b. Recognize how these technologies enhance productivity.
- c. Learn and effectively deploy these new technologies.

This study emphasizes six pivotal technologies crucial for the accounting profession, termed “A²B²C²”: **A**utomation (robotic processing), **A**rtificial intelligence, **B**ig data, **B**lockchain, **C**loud computing, and **C**ybersecurity. The following briefly describes these essential digital skills and their significance.

Automation (Robotic processing)

The introduction of software robots in robotic process automation (RPA) represents a natural evolution, taking charge of routine tasks defined by structured rules or protocols. This domain relies on algorithms capturing these structured pathways, akin to an automated production line in a factory. As computer technology, computational power, and storage advance, software is expected not only to handle routine processes but also to offer support for non-routine tasks involving complex decisions and flexibility.

Artificial intelligence

AI has the potential to significantly transform professional occupations and tasks⁵.

⁴ WEF (2020, Figure 19 - abstract)

⁵ Neely, M. P., and Cook, J. S. (2011). Fifteen years of data and information quality literature: Developing a research agenda for accounting. *Journal of Information Systems* vol. 25 (1), p. 79-108.

In the accounting realm, auditors were exploring “expert systems” as early as the 1980s, assisting or replacing decision makers for auditing purposes.

While AI technology is gradually infiltrating the accountancy profession, there are expectations that AI-based software robots can handle intricate tasks like fraud detection and liquidity planning.

AI is a crucial step toward a Fully Autonomous Accounting System (FAAS), described as a “*firm-wide, fully autonomous, self-aware and self-improving accounting system. The centre of an FAAS is a state-based, multi-functional, deep-learning network as artificial intelligence (AI) that is able to holistically simulate and potentially outpace human-cognition and decision-making processes. This AI manages structured and unstructured data and regulations from various sources and delivers timely and apt information to the right audience in the right format*”⁶.

Accountancy professionals must understand the opportunities, risks, and limitations of AI, including ethical considerations, to stay competitive. Embracing AI, rather than avoiding it, is essential. The emergence of ChatGPT and generative AI has heightened the need for proactive responses within the accountancy profession, urging professionals to be proactive rather than defensive or reactive.

Big data / Data analytics

Big data⁷, characterized by high volume, velocity, variety, and now, veracity, demands innovative information processing for enhanced insights, decision making, and automation. Accountants must grasp the nuances of big data.

The prevalence of big data in accounting⁸ is due to advances in computing power, diverse data sources (social media, mobile tech, open-source data, internet of things), and collaborative IT infrastructure. Accountancy professionals need digital skills to manage, analyze, and integrate data from these varied sources effectively, especially in ESG or sustainability reporting.

Big data offers opportunities for data analytics, visualization, data-driven decision making, and thorough audit processes. Auditors, armed with digital data, can conduct comprehensive checks without limited sampling, ensuring precise audit opinions. Adaptability to big data is essential for providing valuable information-based services.

Blockchain

Blockchain, a digital representation of a traditional accounting ledger, is designed to be immutable, akin to physical ledgers. It operates as a digital ledger technology where peer-approved transactions are globally distributed across computer networks, ensuring real-time verification. Traditionally, accounting relied on printed hardcopies as immutable

6 Lehner, O.M, Forstenlechner, C., Leitner-Hanetseder, S., and Eisl, C. (2020). The dynamics of artificial intelligence in accounting organizations: a structuration perspective. Working Paper Series, Hanken School of Economics, Helsinki.

7 Gartner. (2012). What is big data? - Gartner IT glossary - Big data. available on the internet at <https://www.gartner.com/it-glossary/big-data/>. (Accessed 31 October 2023).

8 ICAEW. (2019). Big data and analytics: the impact on the accountancy profession.

proof of transactions. Blockchain, as a digitalized ledger, is transforming accounting into a digital realm, aligning with its core functions of recording, processing, and communicating past transaction information.

Deloitte's 2019 survey⁹ showcased blockchain's increasing maturity and adoption in various sectors, including fintech, technology, healthcare, and government. Many view blockchain as a transformative technology with the potential to revolutionize accounting and auditing¹⁰. Some even consider it as revolutionary as the Internet. Blockchain's application in auditing is particularly promising, providing a virtual environment for verifying accounting transactions efficiently.

Blockchain's attributes, such as distributed recording and immutability, address fundamental trust and transparency concerns. It could introduce a third entry¹¹ in the traditional double-entry accounting system, potentially simplifying or replacing traditional audit procedures. For instance, audit confirmations of account balances might become obsolete, as auditors can directly verify balances on the blockchain, eliminating the need for client account confirmations. Consequently, it's crucial for accountancy students to receive training in blockchain technology.

Cloud computing

The Covid-19 pandemic highlighted the significance of cloud-based solutions for accountancy professionals. It showed that tasks like analytics, compliance control, monitoring, reporting, and data governance can be effectively managed in the cloud, minimizing the need for physical presence in the office. Accountancy professionals must acquire the skills to operate efficiently in this evolving cloud environment.

Cybersecurity

In the virtual landscape, where information transfer, storage, and work occur, accountancy professionals face increased cybersecurity risks. Relying solely on cloud solutions can be compromised in a single cyber breach. Professionals engaged in audit and risk management advisory services must be well-versed in cybersecurity to evaluate their clients' systems effectively.

Assumed familiarity with IT for spreadsheet and ERP tasks may not suffice. A technology shift could render current IT knowledge inadequate, necessitating a redefinition of skilled accountancy professionals.

The key questions to address will include:

- a. What are the roles of the professional accountancy body in promoting and equipping accountancy professionals to keep up the quality of the accountancy profession?
- b. What do the accountancy professionals need to keep themselves relevant?

9 Deloitte. (2019). Deloitte's 2019 global blockchain survey. Available at: https://www2.deloitte.com/content/dam/insights/us/articles/2019-global-blockchain-survey/DI_2019-global-blockchain-survey.pdf.

10 Felski, E. A., and Empey, T. B. (2020). Should Blockchain be added to the Accounting Curriculum? Evidence from a Survey of Students, Professionals and Academics." *The Accounting Educators' Journal* vol. XXX, 201-218.

11 Cai, C. W. (2021). Triple-entry accounting with blockchain: How far have we come? *Accounting and Finance* vol. 1, 71-93.

c. What must the accountancy schools do to ensure that their graduates are conversant with the new technology?

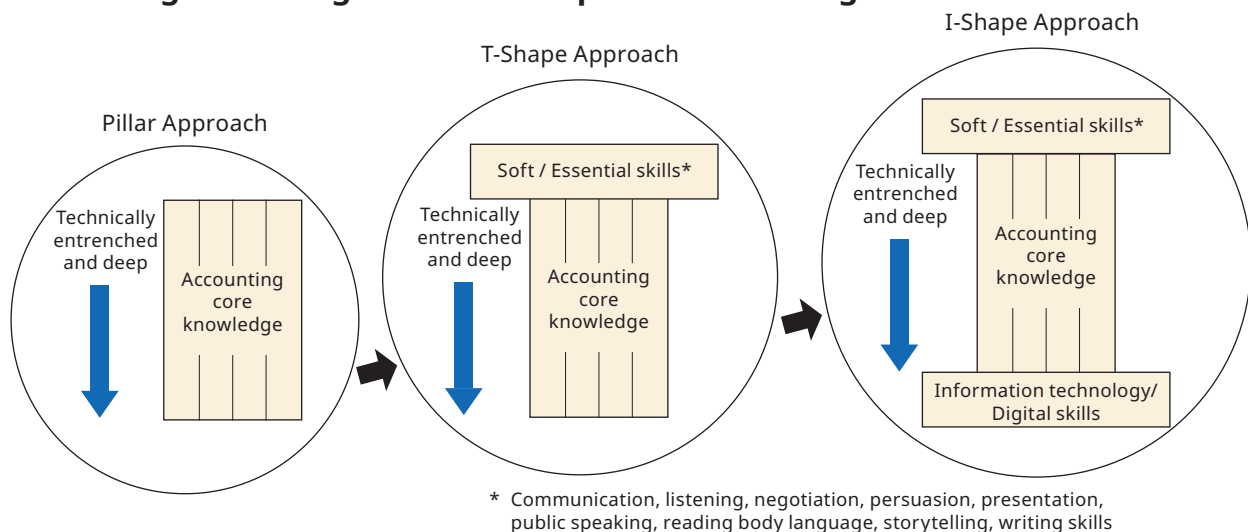
Technology education in accountancy curriculum

The accountancy profession faces crucial questions regarding the depth of digital skills needed, effective methods of imparting these skills given time constraints, and the challenges faced by professional accounting organizations (PAOs), professionals, and schools in addressing this digital need.

One perspective suggests that introducing technology and fostering an aptitude for learning is sufficient. Accountants can delve deeper into specific skills as needed, outsourcing complex tasks to technologists. Another viewpoint emphasizes early exposure to practical technology applications.

As technology continues to evolve, accountancy professionals must embrace lifelong learning. Adapting to emerging technologies becomes essential, requiring constant skill development to stay relevant. Equipping accountancy students with knowledge of emerging technology is imperative for their future. Figure 1 illustrates the evolving training approach for accountancy students over time.

Figure 1: Progressive development of training for accountants



The evolving landscape of accountancy education presents critical challenges. Traditional emphasis on core accounting skills has expanded to include essential soft and digital skills. The “Pillar Approach” underscores core accounting knowledge, while the “T-Shape Approach”¹² integrates essential soft skills¹³. The emergence of digital technology introduces the “I-Shape Approach,” necessitating proficiency in digital skills.

However, incorporating digital skills into the curriculum poses dilemmas. The “silo

12 David Epstein in his book “Range: Why generalists triumph in a specialized world” used the T-shape concept to represent someone who is technically deep and yet has breadth which incorporates general skills. This is very different from the concept in this study as the “T-shape Approach” requires the accountant to have both technical skills and soft skills. The impartation of both technical and soft skills is the imperative of accountancy schools.

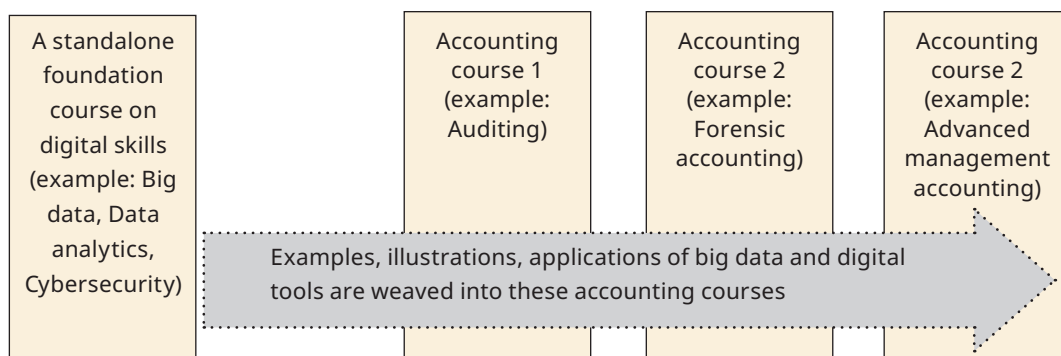
13 Some may label “soft skills” as “essential skills”. These skills are essential for a professional to communicate and sell their professional services.

approach” isolates digital skill courses, offering in-depth knowledge but struggles with relevance. The “integrated approach” embeds digital skills within core accounting courses, ensuring relevance but requiring significant restructuring and expert instruction. A potential hybrid approach suggests foundational digital skill courses followed by integration into advanced accounting topics, facilitating a gradual transition¹⁴.

However, the duration of an accountancy programme has not increased despite the significant enlargement of the content space. This creates significant challenges as more content is added to the accountancy curriculum (as shown by the enlarged circles) with a hard constrained duration.

Balancing these approaches is crucial to fostering skilled accountancy professionals equipped for the digital future. Figure 2 illustrates the proposed hybrid approach.

Figure 2: Hybrid approach in weaving standalone digital skills and knowledge courses into accountancy courses



The hybrid approach assumes digital skills acquired in standalone foundation courses, integrating them into accountancy classes through examples and assignments. This mirrors the existing model with Excel training, offering focused skill acquisition followed by practical application in accountancy contexts, aligning with a reinforced learning model.

Considering the diverse technologies in the accountancy field, this study aims to address how Professional Accountancy Organizations (PAOs), accountancy schools, and professionals can initiate their re-tooling process, answering these pivotal questions.

Technologies adoption by key stakeholders

The ASEAN Accounting Education Workgroup (AAEW)¹⁵ which was set up in 2015 was tasked to examine technology adoption by the accountancy profession in ASEAN countries. The current study seeks to:

- a. understand the views and perceptions of professional accountancy organizations (PAOs)

14 Lafond, C. A., McAleer, A. C., and Wentzel, K. (2016). Enhancing the link between technology and accounting in introductory courses: Evidence from students. *Journal of the Academy of Business Education* vol. 17, 95-108.

15 The objective of AAEW is to provide input to and empower higher education accounting programmes across ASEAN. Its vision is to foster the development of ASEAN higher education accounting programmes, honing them to produce graduates who can compete in the global accounting markets. It is to further support businesses and the development of the accountancy profession in ASEAN through advice on matters of relevance to accountancy education.

- in ASEAN about digital disruption to the accountancy profession.
- b. document the kind of digital technology which PAOs in ASEAN are most concerned with in the accountancy profession.
 - c. document the key concerns and types of digital skills required of future accountants.
 - d. understand what PAOs and accountancy schools will be doing to tackle the digital disruption in accounting.
 - e. propose a generic roadmap for technology adoption by PAOs and accountancy schools in ASEAN.

The methodology adopted by this study includes:

1. Interviews and surveys are used in this study to gather information about the current state of technology adoption in the accountancy profession from the perspective of PAOs, accountancy schools and accountancy professionals for each ASEAN country.
2. Representatives of the PAOs in ASEAN are surveyed and interviewed to get their views and inputs on the questions stated above.
3. Accountancy professionals and firms in ASEAN were surveyed and/or interviewed to obtain their perceptions and views.
4. Accountancy professionals from SMEs or SMPs in ASEAN were also surveyed and/or interviewed to obtain their perceptions and views.

The study covered all the 10 ASEAN countries as shown in Table 2.

Table 2: List of countries which participated in the study

Brunei	Laos
Cambodia	Philippines
Indonesia	Singapore
Malaysia	Thailand
Myanmar	Vietnam

Local Professional Accounting Organizations (PAOs)

The 10 ASEAN countries are at varying stages of technological development, influencing their Professional Accountancy Organizations (PAOs). PAOs typically align their strategies with their countries' technology roadmaps. In rapidly advancing countries, PAOs are ahead, investing significantly in technology adoption. Across all 10 member states, PAOs recognize technology's challenge to the accountancy profession, displaying intermediate to advanced awareness of selected technologies. PAOs generally believe in technology's importance, yet actual utilization in accounting lags behind awareness and belief levels.

Regarding technology adoption intentions, views vary widely. Some PAOs allocate funds and develop AI, creating technology roadmaps, while others are in early stages, focusing on awareness. Certain PAOs engage stakeholders like professionals and schools, fostering joint technology journeys. Initiatives like Malaysia's studies reflect this proactive approach. PAOs can benefit from networking and sharing knowledge, eliminating the need to reinvent strategies.

Accountancy schools

There were altogether 169 accountancy schools which responded to the study. Figure 3 shows their distribution among the 10 ASEAN countries.

Figure 3: Distribution of the 169 accountancy schools among ASEAN countries

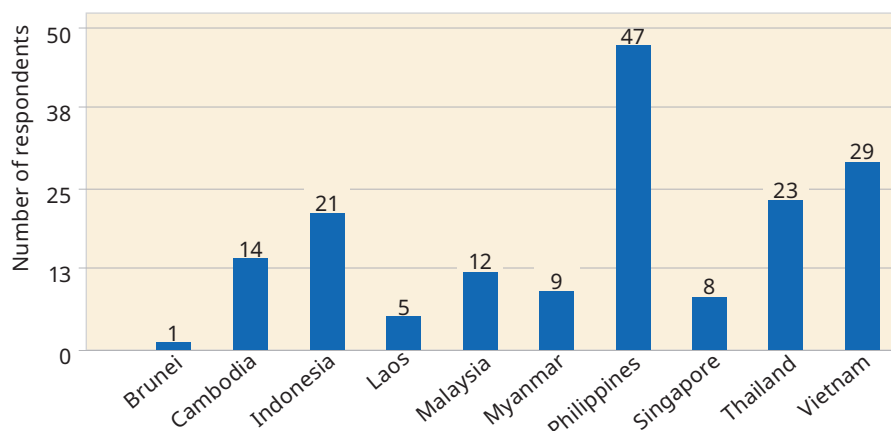


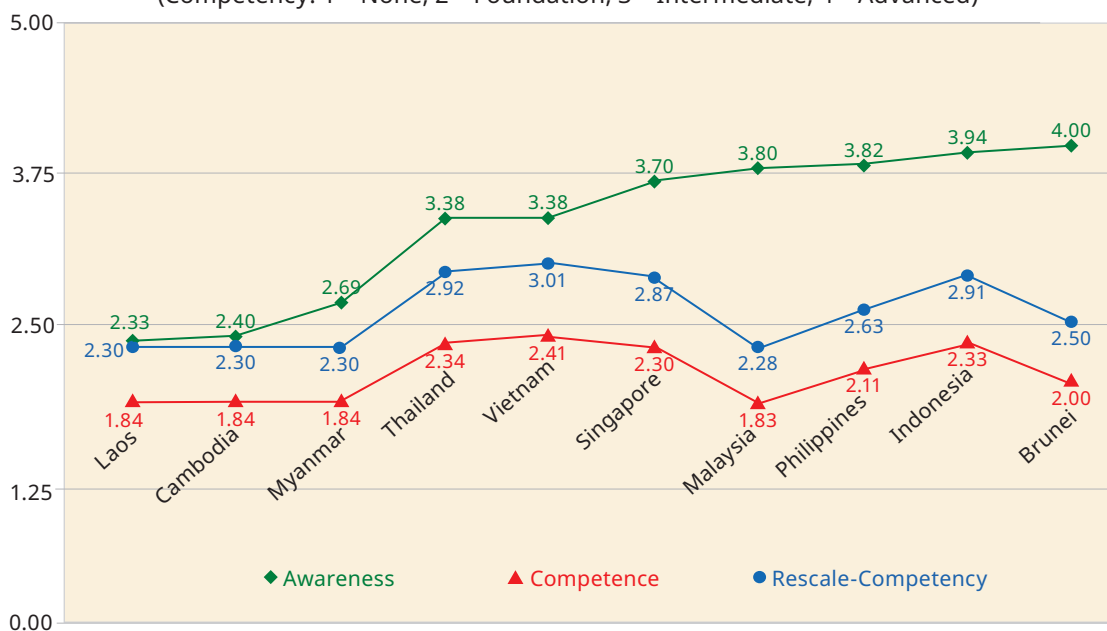
Figure 4 illustrates varying levels of awareness among Institutes of Higher Learning (IHLs) in different ASEAN countries. Three countries – Laos (2.33), Cambodia (2.40), and Myanmar (2.69) – have below-average awareness scores. However, most countries exhibit intermediate to advanced levels (scores of 3.0 to 5.0) of awareness regarding the six technologies (“A²B²C²”) discussed in this study.

The figure also depicts the competency levels in emerging technology across ASEAN countries. The overall average for each country is below 3.0, significantly lower than their awareness levels. This indicates that IHLs in ASEAN have substantial room for improvement to enhance their competency in identified emerging technologies.

Figure 4: Levels of awareness of and competency in emerging technologies¹⁶

(Awareness: 1 – Not at all and 5 – Fully aware)

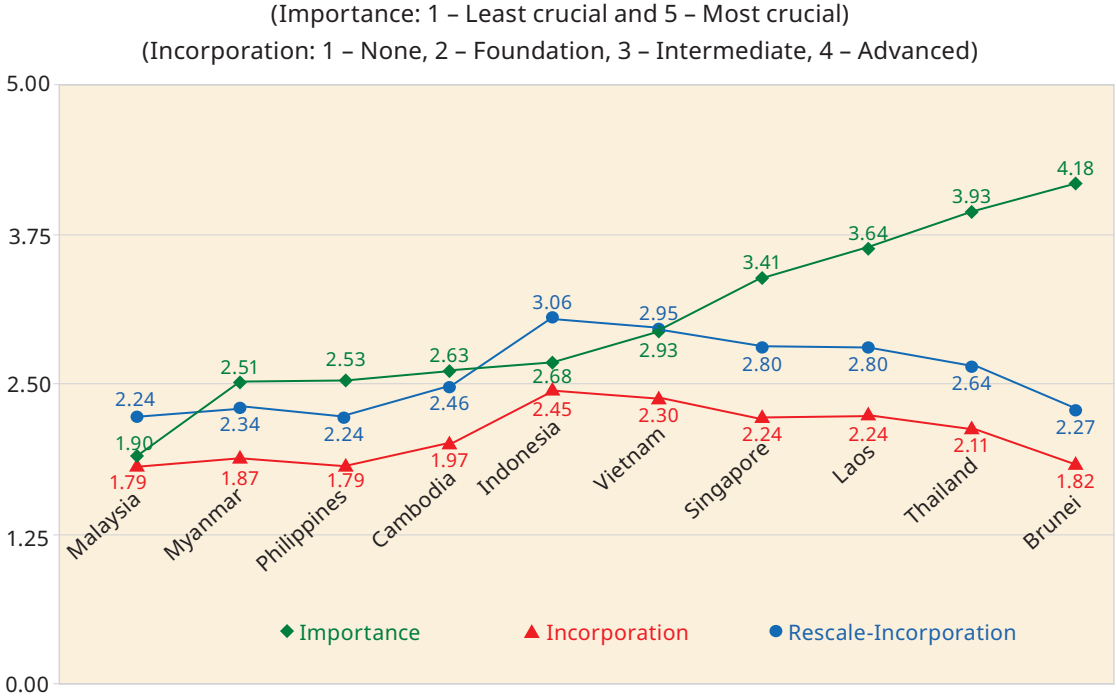
(Competency: 1 – None, 2 – Foundation, 3 – Intermediate, 4 – Advanced)



¹⁶ This is after taking into consideration that the response scale for awareness is 1.0 to 5.0 while competency is measured from 1.0 to 4.0, namely, after re-scaling, the divergence remains.

Figure 5 illustrates the level of importance and incorporation of emerging technologies in the accountancy curriculum by IHLs. The level of incorporation varies widely, ranging from low (1.79) to intermediate (2.45). Indonesia exhibits the highest level of incorporation (2.45), falling between the foundation and intermediate levels. Notably, the level of incorporation consistently falls short of the perceived importance for every country with the exception of Indonesia, Malaysia and Vietnam. While emerging technologies are recognized as significant, accountancy schools may face challenges in integrating them into their curricula.

Figure 5: Levels of importance and incorporation of emerging technologies in the accountancy curriculum¹⁷



The adoption of accounting and auditing software varies across ASEAN countries, with some countries employing a comprehensive technology suite and others focusing on Microsoft and statistical software for research purposes (e.g., SPSS, EViews, STATA). Nevertheless, respondents consistently reported significant efforts to enhance technology integration into their accountancy curricula.

The primary obstacle to incorporating more technology courses is the lack of expertise in emerging technologies, a challenge documented in nearly all ASEAN countries. Table 3 summarizes the average responses from ASEAN countries.

¹⁷ This is after taking into consideration that the response scale for importance is 1.0 to 5.0 while incorporation is measured from 1.0 to 4.0, namely, after re-scaling, the divergence remains.

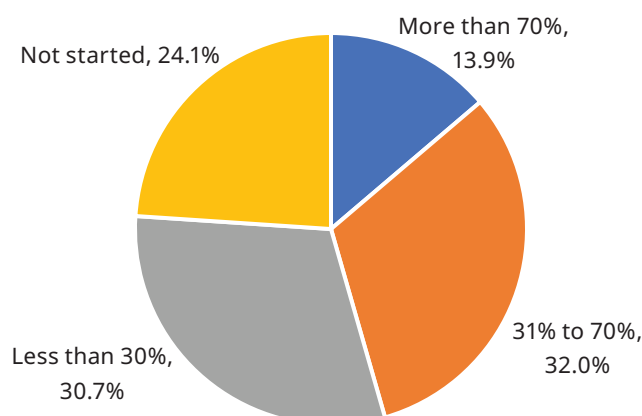
Table 3: Key barriers to the inclusion of technology in the accountancy curriculum

Key barriers	Average response rate
Lack of experts in the emerging technologies	86.8%
Lack of funding for the establishment of facilities in the emerging technology areas	60.3%
Lack of understanding of the emerging technologies	53.3%
Lack of flexibility in accounting programme standards	41.9%
Lack of support from top management	22.3%
Tedious process for the approval of changes	21.5%
Lack of clear business case to justify investment	19.3%

Table 3 highlights the critical shortage of experts in emerging technologies as the primary challenge facing accountancy schools in ASEAN. Proactive measures are essential to expand the pool of technology experts within accountancy schools to enhance technology education. Without such efforts, accountancy graduates may struggle to keep pace with technological advancements. ASEAN accountancy schools can leverage networking opportunities to share their technology expertise and collaborate with industry partners to attract technology experts. Concerted efforts are crucial to bridge the gap between technological evolution and the adoption of emerging technologies by the accountancy profession in each ASEAN country. A secondary concern is the lack of funding for emerging technology adoption, voiced by 60.3% of respondents.

Encouragingly, some accountancy schools have demonstrated significant progress in integrating technology into their curricula over the past three years, with some respondents indicating that over 70% of technology adoption occurred during the most recent curriculum revision. A notable example is the Singapore Institute of Technology, which incorporated a comprehensive range of data analytics skills and knowledge into its accountancy courses during the latest curriculum revamp. However, it is concerning that 24.1% of respondents reported no progress in incorporating technology into their accountancy curricula over the past three years. These respondents typically represent ASEAN countries with lower levels of technology awareness, competency, and adoption.

Figure 6: Distribution of the state of incorporation of technology into the accountancy curriculum in the past 3 years



The study revealed various approaches to teaching technology skills and knowledge, ranging from standalone technology courses to integrating technology into the core accountancy curriculum. Additionally, a slight preference emerged for combining accountancy and IT lecturers or practitioners for technology training. Encouragingly, respondents are actively enhancing their lecturers’ capabilities through upskilling, professional involvement, and industry attachments. Table 4 summarizes the findings for ASEAN countries.

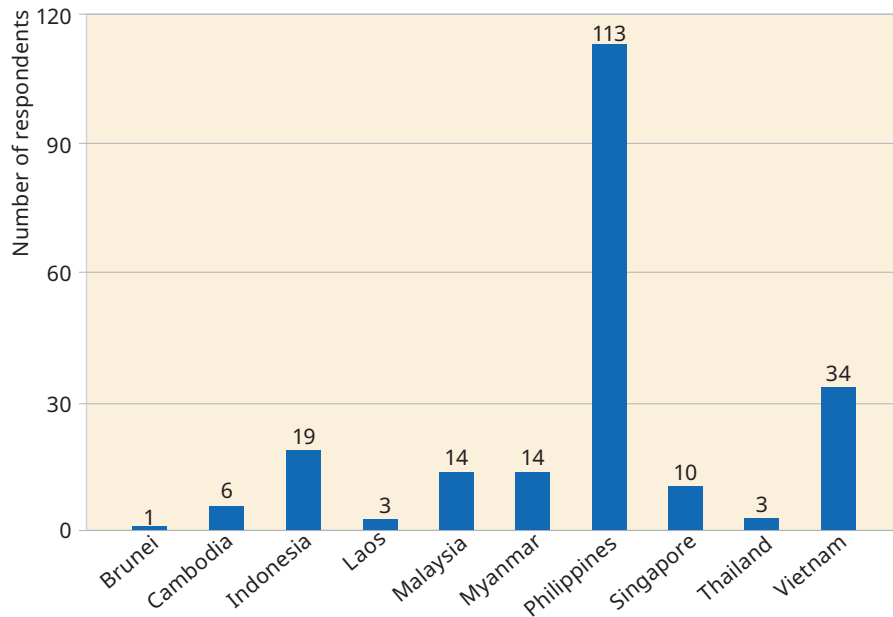
Table 4: Summary of the IHLs’ responses on modes of incorporating technology in the accountancy curriculum and the kind of help needed

Who should teach the technology courses?	Responses
Hybrid: Accounting and IT lecturers/Practitioners	67.8%
Accounting lecturers	30.0%
IT lecturers	24.1%
Industry experts	17.3%
How are the technology courses to be taught?	
Embedded into the existing accounting course/module	60.6%
Taught separately as a course/module	47.7%
Where to incorporate the technology?	
Include emerging technology components into various subjects in the accounting curriculum	57.0%
Include specific emerging technology courses as core subjects	35.3%
Include specific emerging technology courses as elective subjects	17.3%
What kind of help is needed	
Training in emerging technologies	79.9%
Training in curriculum design and integration	73.6%
Opportunities for industrial attachment	64.9%

Accountancy professionals

The survey encompasses 217 professionals and their firms from across the 10 ASEAN countries. The largest contingent of respondents, numbering 113, hails from the Philippines. The sample includes representatives from Big 4, mid-sized, and small-scale practitioners. Figure 7 illustrates the distribution of respondents from the different ASEAN countries.

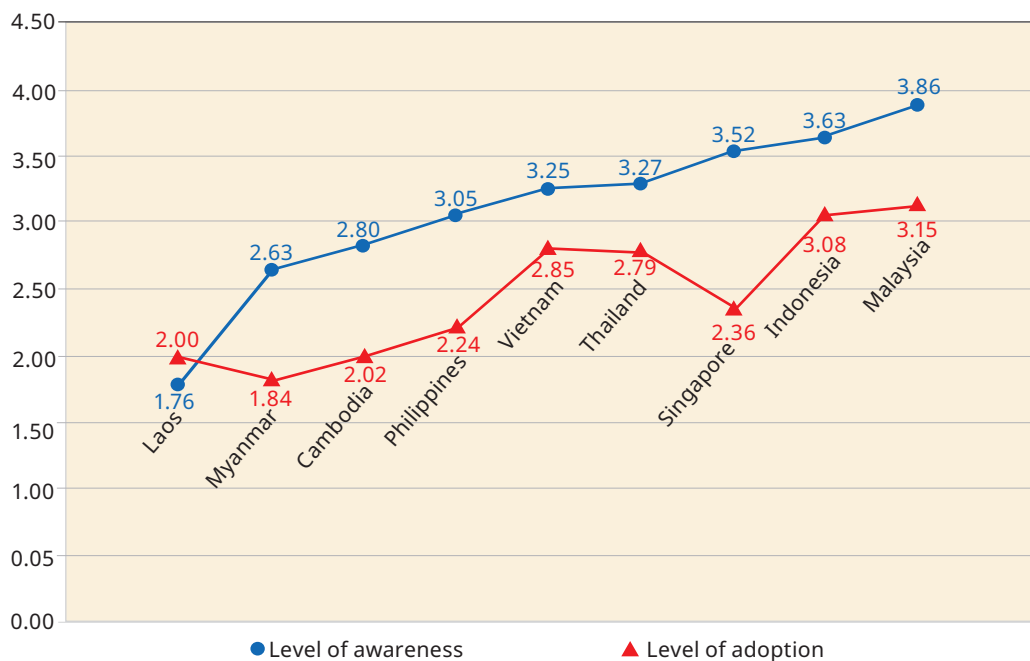
Figure 7: Distribution of accountancy professionals from ASEAN countries who responded to the study



A consistent pattern emerges across ASEAN countries, with the level of technology adoption lagging behind the level of awareness, except for Laos. Figure 8 illustrates this divergence.

Figure 8: Summary of levels of awareness and adoption of the emerging technology¹⁸

(Awareness: 1 – Not at all and 5 – Fully aware; Adoption: 1 – Not at all and 5 – Advanced)



The survey revealed that accountancy professionals are well aware of the six technologies (A²B²C²). Software systems and accounting and auditing software are widely used among respondents.

Table 5 summarizes the attitudes towards technology across ASEAN countries. It

¹⁸ There was no response from Brunei for this attribute.

indicates a generally positive and optimistic outlook (3.73). Interestingly, the level of optimism regarding technology investment is consistently high (exceeding 3.0 in most cases and reaching 4.3 out of 5.0), resulting in an average value of 3.55. However, there is less optimism about the technological capabilities and attitudes of human resources.

Regarding planned behaviour towards technology adoption, a positive correlation emerged between positive attitudes and belief in technology and plans to adopt it. This is encouraging as it suggests that accountancy professionals have a positive attitude towards technology adoption and are motivated to take action to implement it.

Table 5: Summary for each attitude for ASEAN countries in general¹⁹
(1 – Pessimistic response, 3 – Neutral response and 5 – Optimistic response)

Attribute	Score
Subjective belief about technology	4.08
Plan for technology adoption	4.05
Approach to technology	3.73
Intention to engage technology	3.71
Investment in technology	3.55
Manpower skills and knowledge	3.48
Attitude towards technology	3.42

Table 6 highlights the anticipated benefits of technology adoption in ASEAN countries. Respondents strongly endorsed the listed benefits. A key benefit consistently emphasized by respondents is enhanced productivity and efficiency. This advantage is crucial for practitioners to maintain competitiveness and ultimately determine their sustainability and profitability. Accountancy professionals recognize technology adoption as essential for their survival and competitiveness.

Table 6: Expected benefits of technology adoption for ASEAN countries in general²⁰
(1 – Fully disagree and 5 – Fully agree)

Expected benefits of technology adoption	Min	Max	Average
Productivity and efficiency	3.00	4.50	4.05
Faster turnaround / response time	3.33	4.40	3.98
Human skills enhancement	3.00	4.40	3.85
Better planning and controlling increases	3.00	4.21	3.85
Greater agility (changes in business strategy & investment in systems)	3.00	4.33	3.84
Greater flexibility	3.00	4.40	3.84
Higher customer satisfaction	3.33	4.30	3.81
Encourage a desired culture (do right thing right)	3.00	4.30	3.77

19 Scores were not available from Brunei and Philippines.

20 Scores were not available from Brunei and Philippines.

Table 7 outlines the challenges to technology adoption in ASEAN countries. High investment costs consistently ranked as the top or second most significant challenge among respondents. Notably, respondents also expressed concerns about the cultural readiness of their staff to embrace technology adoption.

Table 7: Challenges to adoption of technology in ASEAN countries in general²¹

(1 – Fully disagree and 5 – Fully agree)

Challenges to adoption of technology	Min	Max	Average
High investment costs	2.67	4.20	3.55
Cultural readiness	3.00	4.20	3.54
Lack of standards, regulations or certifications and unclear economic benefits	2.50	3.79	3.11
Unclear legal situation concerning the use of external data	1.67	3.70	3.09
Unresolved questions concerning data security	1.67	4.00	3.05
Insufficiently skilled employees	1.67	4.10	3.01
Lack of support from government	1.67	3.86	2.91
Insufficient knowledge of employees	1.67	3.60	2.89

By synthesizing the responses from PAOs, accounting schools, and accounting professionals, it becomes clear that the importance of technology is widely recognized. However, there are significant challenges that hinder technology adoption, including the shortage of skilled manpower, particularly in accounting schools, the high costs associated with technology adoption, and the lack of a comprehensive technology roadmap for the accounting profession.

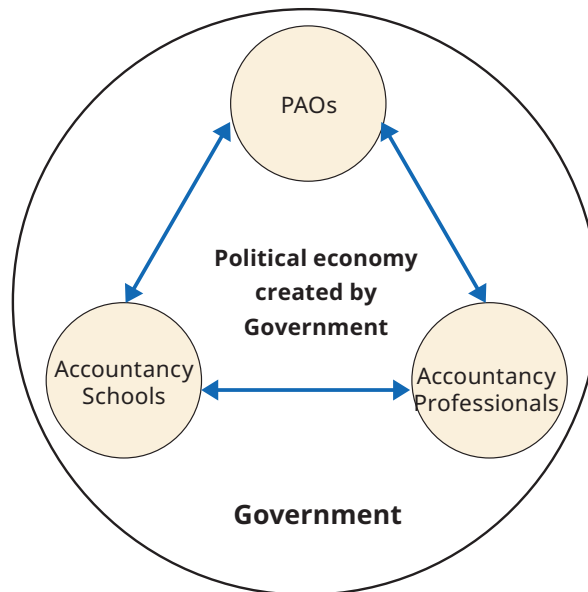
Generic technology roadmap

This concluding section consolidates the findings and proposes a generic technology roadmap tailored to the needs of the accountancy profession in ASEAN. In developing this roadmap, it is crucial to establish a foundational framework and underlying assumptions.

Foremost, it is essential to acknowledge the collaborative effort required among the three key stakeholders – PAOs, accountancy schools, and accountancy professionals – to facilitate an effective and accelerated deployment of technology within the accountancy profession. Figure 9 illustrates the symbiotic relationship among these stakeholders, existing within the political economy framework provided by the government.

²¹ Scores were not available from Brunei and Philippines.

Figure 9: Symbiotic relationship between the key stakeholders



Governments have a vested interest in fostering highly stable and prosperous economies. They recognize technology as a critical enabler and driver of economic growth. To achieve the shared goal of economic prosperity, PAOs, accountancy schools, and accountancy professionals must collaborate effectively.

The government plays a crucial role in providing an overarching vision for technology deployment and utilization at the national level. PAOs are responsible for translating the government’s vision into actionable plans for the accountancy profession.

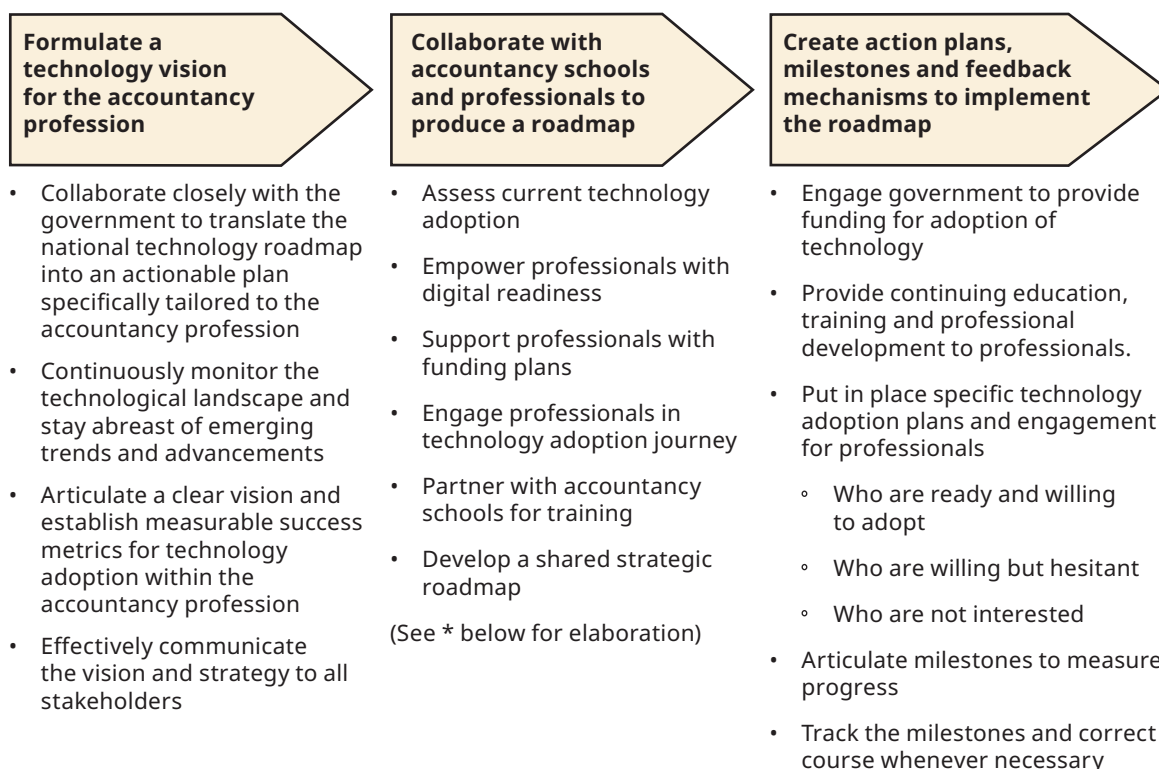
Accountancy schools must adapt their curricula to equip graduates with the necessary technological skills for employment as accountancy professionals. Accountancy professionals, along with PAOs, should provide continuous feedback on the evolving technological skill requirements for graduates.

This collaborative approach forms the foundation of a technology roadmap involving these three key stakeholders, with the government serving as the overarching sponsor.

Figure 10 illustrates a generic roadmap for technology adoption, with PAOs, in collaboration with the government, accountancy schools, and accountancy professionals, serving as the primary driving force.

Figure 10: Generic roadmap for technology adoption by PAO

Government provides an overarching vision of the technology roadmap for the nation and serves as a sponsor of technology adoption in the accountancy sector



* Collaboratation with accountancy schools and professionals to produce a roadmap

Proposed action	Details
Assess current technology adoption	Establish a baseline model to grasp the current level of technology adoption among accounting professionals.
Empower professionals with digital readiness	Conduct digital-readiness self-assessments to guide professionals in identifying areas for improvement and embracing relevant technologies.
Support professionals with funding plans	Formulate funding plans to provide financial assistance to professionals seeking support in adopting and integrating new technologies into their practices.
Engage professionals in technology adoption journey	Actively engage accounting professionals throughout their technology adoption journey, addressing their plans, execution strategies, and pain points.
Partner with accountancy schools for training	Collaborate with accountancy schools to integrate technology adoption training into their curricula, ensuring that future accountants possess the necessary skills.
Develop a shared strategic roadmap	Create a shared strategic technology adoption roadmap that aligns the efforts of various stakeholders in the accounting profession, fostering a coordinated approach to technology integration.

Begin the technology adoption roadmap by thoroughly comprehending the needs and priorities of all stakeholders within the accountancy profession’s ecosystem, including government bodies, professional accounting organizations (PAOs), accountancy schools, and individual professionals.

Thereafter, clearly outline the roles and responsibilities of each stakeholder, with PAOs acting as the unifying force that connects them. Each party plays a distinct role in driving this technology-driven transformation. Tables 8 to 10 provide action checklists for PAOs, accountancy schools, and professionals, respectively.

Table 8: Checklist of actions to implement technology adoption (Professional Accounting Organizations (PAOs))

	Yes	No	In-Progress
1. Technology adoption roadmap: Has a comprehensive technology adoption roadmap been formulated to guide the profession’s transition to new technologies?			
2. Engagement mechanism: Is there an established mechanism and strategy to engage accountancy schools, professionals, and firms through discussions and feedback on technology innovations and needs?			
3. Emerging technology search: Is there a systematic approach to identify and explore emerging technologies with potential applications in the accounting profession?			
4. Technology curating and inventory: Is there a mechanism and strategy to curate and inventory useful accounting technology applications, making them easily accessible to professionals?			
5. Accounting technology education and training: Is there a comprehensive education, training, and professional development program on accounting technology specifically tailored for accountancy professionals?			
6. Collaborative technology platforms: Is there a mechanism and strategy to facilitate or create collaborative technology platforms for accountancy entities, particularly smaller firms, to enhance their efficiency and effectiveness?			
7. Strategic technology adoption guidance: Is there a scheme or programme to provide assistance and advice to accountancy entities in developing strategic technology adoption roadmaps for their firms?			
8. Government engagement for capacity building and funding: Are there strategic and intentional efforts to engage the government in capacity building and funding initiatives to support accounting technology adoption?			
9. Accountancy education transformation: Is there a mechanism or strategy to engage accountancy schools to transform accountancy education and produce technology-savvy accountancy graduates through revisions in accreditation requirements?			
10. Progress tracking and success stories: Is there a process in place to track the progress of technology adoption and showcase success stories to inspire and motivate others?			

**Table 9: Checklist of actions to implement technology adoption
(Accountancy schools)**

	Yes	No	In-Progress
1. Engagement mechanism for paos and professionals: Is there an effective mechanism and strategy to engage professional accounting organizations (PAOs) and accountancy professionals/firms through discussions and feedback on technology innovations and adoption?			
2. Industry expert collaboration: Is there a mechanism to collaborate with industry experts to incorporate curated technology into the accountancy curriculum, ensuring the curriculum remains relevant and up-to-date?			
3. Technology-inclined instructors: Is there a mechanism and strategy to train and produce technology-inclined accounting instructors who can effectively transfer knowledge of the latest technologies to students?			
4. Industry-academia reciprocity: Is there a mechanism and strategy to establish close relationships with the industry by having reciprocal exchanges of accounting instructors and accountancy professionals, fostering mutual learning and continuous improvement?			
5. Feedback to PAOs on accreditation requirements: Is there a mechanism and strategy to provide feedback to PAOs on the accreditation requirements for making them more relevant and dynamic to meet the evolving needs of the accountancy sector?			
6. Tracking progress and success stories: Is there a process in place to track the progress and success stories in educating and training accountancy students in technology adoption, demonstrating the effectiveness of the implemented initiatives?			

Table 10: Checklist of actions to implement technology adoption (Professionals)

	Yes	No	In-Progress
1. Technology adoption roadmap: Has a comprehensive technology adoption roadmap been formulated to guide the profession's transition to new technologies?			
2. Collaborative technology needs articulation: Are there mechanisms and strategies in place to work closely with professional accounting organizations (PAOs) and accountancy schools to create a collaborative and informative articulation of the technology needs of accounting professionals?			
3. Continuous staff training: Is there a mechanism and strategy to collaborate with PAOs and accountancy schools to ensure the continuous training of staff to be technologically equipped and adapt to the evolving technological landscape?			
4. Seeking guidance and support: Is there a mechanism and strategy to seek help and advice from PAOs, government agencies, or accountancy schools to effectively implement technology adoption roadmaps?			
5. Influencing accounting training: Is there a mechanism and strategy to work closely with accountancy schools to influence the training of accountants, ensuring they are equipped with the necessary technology skills to meet industry demands?			
6. Accountancy professional exchange programme: Is there a mechanism and strategy to partner with accountancy schools to facilitate the exchange of accounting instructors and accountancy professionals, promoting knowledge sharing and mutual learning?			
7. Progress tracking and success stories: Is there a process in place to track the progress of technology adoption and collect success stories, highlighting the positive impact of implemented initiatives?			

Conclusion

This study explores the perspectives and experiences of professional accounting organizations (PAOs), accountancy schools, and professionals in the 10 ASEAN countries regarding technology adoption in the accountancy profession. The study highlights that ASEAN countries are at varying stages of technology adoption at the national level, significantly influencing technology adoption within their respective national accountancy professions.

PAOs play a pivotal role in driving technology adoption by promulgating technology adoption roadmaps and collaborating with accountancy schools and professionals to promote technology integration. However, the study reveals that a limited number of PAOs have formal technology adoption roadmaps, with most relying on their government's technology roadmap.

The study identifies key emerging technologies perceived as most popular among PAOs, accountancy schools, and professionals, including A²B²C² (automation, robotic processing, artificial intelligence, big data, blockchain, cloud computing, and cybersecurity). The study also documents the barriers to adoption and the key benefits associated with technology adoption. The lack of experts in the technology space is identified as a primary barrier, particularly for countries at the early stages of their technology journey.

Finally, the study presents a generic technology roadmap for technology adoption, emphasizing the need for symbiotic collaboration among key stakeholders – PAOs, accountancy schools, professionals, and the government – to achieve the common good of their respective countries.●

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Glossary of technology (from ChatGPT)

Artificial intelligence	Artificial intelligence (AI) refers to the simulation of human intelligence in machines, enabling them to perform tasks that typically require human cognitive abilities. These tasks include learning, reasoning, problem-solving, understanding natural language, perception, and decision-making. The goal of AI is to create intelligent systems that can mimic or surpass human capabilities in specific domains.
Artificial intelligence - Generative	Generative artificial intelligence refers to a class of artificial intelligence techniques and models that are designed to generate new content that is similar to existing data. These techniques rely on various machine learning algorithms to create new data instances, such as text, images, audio, and more, by learning patterns and structures from a given dataset.
Artificial intelligence - Re-Generative	Re-generative AI refers to a concept in artificial intelligence where an AI system is designed not only to generate outputs based on given inputs but also to actively learn and improve its own internal algorithms and processes over time. In essence, it involves an AI system that can iteratively regenerate or update its own architecture and behavior in response to new data and experiences.
Artificial human assistants	Artificial human assistants, also known as virtual assistants or AI assistants, are advanced computer programmes or AI systems designed to interact with users and perform tasks in a manner that simulates human-like conversation and behavior. These assistants are developed to provide a more natural and intuitive user experience, making them accessible through voice commands or text-based interactions.
Blockchain	Blockchain is a decentralized and distributed digital ledger technology that enables secure and transparent record-keeping of transactions across multiple parties in a network.
Big data	Big data refers to vast and complex sets of data that exceed the capacity of traditional data processing applications to manage, process, and analyze within a reasonable timeframe. These datasets are characterized by their volume, velocity, variety, and sometimes variability, often collectively referred to as the "Four Vs".
Cloud computing	Cloud computing is a paradigm for delivering computing services over the internet. It enables users to access and utilize various computing resources, such as servers, storage, databases, networking, software, and more, without the need to own or manage the physical infrastructure. Instead of maintaining their own servers and data centres, users can leverage the power of remote data centers operated by third-party providers.
Cybersecurity	Cybersecurity, also known as computer security or information technology security, refers to the practice of protecting computer systems, networks, programmes, and data from unauthorized access, damage, theft, or any other form of disruption. It involves a set of measures, technology, and practices designed to safeguard digital assets and ensure the confidentiality, integrity, and availability of information and resources in the digital world.
Data analytics	Data analytics is the process of examining, transforming, and interpreting raw data to uncover valuable insights, patterns, and trends that can be used to make informed business decisions and drive strategic actions. It involves the application of various techniques, statistical methods, and algorithms to extract meaningful information from vast amounts of data.

Data visualization	Data visualization is the graphical representation of information and data to help people understand, analyze, and interpret complex datasets more easily and effectively. It involves using visual elements such as charts, graphs, maps, and other interactive tools to present data in a visually appealing and intuitive manner.
Extended reality	Extended reality (XR) is an umbrella term that encompasses all forms of immersive technology that merge the physical world with digital content, creating an interactive and enhanced experience for users. XR blends the real world with computer-generated elements, providing users with a seamless and integrated environment.
Machine learning / Intelligence	Machine learning/intelligence is a subset of artificial intelligence (AI) that focuses on the development of algorithms and statistical models which allow computers to learn and improve their performance on a specific task without being explicitly programmed. The primary objective of machine learning is to enable computers to make predictions or decisions based on patterns and insights derived from data, rather than following explicit instructions.
Predictive analytics	Predictive analytics is a branch of data analytics that uses historical and current data, statistical algorithms, machine learning techniques, and other computational methods to make predictions about future events or outcomes. The goal of predictive analytics is to identify patterns, trends, and relationships within the data that can be used to forecast future behavior or events with a reasonable degree of accuracy.
Robotic process automation	Robotic process automation (RPA) is a technology that enables the automation of repetitive and rule-based tasks within business processes using software robots or "bots." These bots mimic human interactions with digital systems and applications to perform tasks, just like a human operator would, but in a faster and more efficient manner.
Virtual Internet of Things	The virtual Internet of Things (IoT) is a network of physical objects or "things" embedded with sensors, software, and connectivity, enabling them to collect and exchange data over the internet. These interconnected devices communicate with each other, analyze the data they gather, and make decisions based on the information received.

