

2023 AFA Research Report

TECHNOLOGY ADOPTION BY THE ACCOUNTANCY PROFESSION IN ASEAN COUNTRIES



A study by



ASEAN Accounting
Education Workgroup
(AAEW)

Commissioned by



ASEAN Federation of Accountants
(AFA)

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The Association of
Accountants and
Financial Professionals
in Business



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by the Accountancy Profession
in ASEAN Countries**

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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Introduction

How work is modelled in the world has been significantly disrupted by the accelerated advancement in technology¹.

The World Economic Forum [WEF] (2023) remarks, “The largest job creation and destruction effects come from environmental, **technology** and economic trends² (bold and italics emphasized)”.

In fact, it went on to emphasize the following key views:

- a. Technology adoption will remain a key driver of business transformation.
- b. Within technology adoption, big data, cloud computing and artificial intelligence (AI) feature highly on adoption.
- c. The fastest-growing roles relative to their size today are driven by **technology**, **digitalization** and sustainability.

The accountancy³ profession is not spared from the impact of the increasing use of technology as an earlier report by WEF (2020) commented that accountants and auditors ranked fourth in the top 20 jobs which were on a declining trend⁴.

This is also highlighted in the WEF (2023) report where the displacement of accountants and auditors in the next 5 years will number more than the new accountancy jobs created⁵.

A significant cause is the changing environment in which accountants and auditors work. The environment is significantly affected by the advances in technology⁶.

AAEW & objectives of this study

The ASEAN Accounting Education Workgroup (AAEW) was set up in 2015 with the objective of providing input to and empowering 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.

The AAEW was tasked to examine technology adoption by the accountancy profession in ASEAN countries. This has led to the current study.

1 Marrone and Hazelton (2019)

2 World Economic Forum 2023 “Future of Jobs Report”, page 5.

3 The word “accounting” and “accountancy” can be used interchangeably. However, “Accounting” can narrowly refer to “the process of recording, summarizing, analyzing, and reporting financial transactions and information related to a business or organization”. “Accountancy” on the other hand is a broader term which includes “the entire profession and practice of accounting”. (ChatHPT) Hence, for consistency, the word “accountancy” will be used unless the context requires the use of “accounting”.

4 WEF (2020), page 30.

5 WEF (2023), page 30.

6 Yu (2023), Goncalves, et. al., (2022), Kokina, et. al., (2021)

The objectives of the current study include:

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

Disruption by technology

Disruption to the accountancy profession by technology has been taking place with the advent of computers and their easy availability, much like calculators or spreadsheets had replaced the abacus, manual calculations and accounting ledger machines used for recording and performing calculations related to financial transactions.

There was steady progress as the intertwining of information technology and accounting practices and processes was taking place in tandem with the upgrading of computer hardware and software over the years.

However, in recent times, the speed and quantum leap in the capabilities of computer hardware and software have certainly redefined many accounting and auditing processes.

For example, the advent of cloud computing has allowed certain document verifications in auditing to be done remotely. The sample could be much larger than that selected for a physical audit.

The use of data mining, AI and fraud detection algorithms has increased the ability of forensic accountants to do a much more thorough and complete interrogation of the vast amount of data under examination.

This has resulted in greater efficiency and, likely, a higher level of effectiveness.

These gains in efficiency and effectiveness will substantially re-write best practices and change the way traditional accounting and finance are to be practised.

The challenge for the accountancy profession

The challenge before the accountancy profession is to be able to understand the significant impact and the revolution created by the deployment of technology, in terms of better client services, the effectiveness and efficiency of carrying out the work, and improved profitability and utilization of scarce manpower resources. This is especially the case with the use of robotic processing and automation to automate many labour-intensive processes.

In addition, there is the use of artificial intelligence through learning from real and large data sets to help decision making and boost efficiency in pattern recognition. All

these innovations have spawned a whole new vocabulary in the digital world of which accountants must be cognizant.

For example, in data analytics, the knowledge acquisition process would include the following abilities to handle data: collection and storage of data; processing of data (modelling and analytics), visualization (reporting and story-telling) and predictive analysis (forecasting). In years past, these were done in an ad hoc manner and to varying degrees.

However, with the development of technology, methods, processes and tools have become more sophisticated such that modern accountants will be handicapped if they are not conversant with the technology or tools.


The arming of accountants with technology is crucial for them to compete in providing services to their clients.

In fact, it could be an existential challenge to the accountancy 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.

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 very insightful responses from ChatGPT which uses a form of generative AI, how should future accountants be trained or equipped to do their job in the presence of such technology? This is notwithstanding the fact that generative AI will improve over time.

Generative AI is but one of the many technologies that are introduced into the sphere of the accountancy profession.

Given the vast array of technologies available to the accountancy profession, how should the PAOs, accountancy schools and accountancy professionals begin their re-tooling? This study seeks to answer some of these questions.

Literature review on technology disruption to the accountancy profession

This section reviews some of the literature on the use of technology in the accountancy profession and how it disrupts the profession.

In addition, it also covers how accountancy schools are addressing technology disruption in their accountancy curriculum.

The review provides the structure for the methodology and content of the survey and interview carried out.

Specific technology

The literature is filled with discussions on various disruptions caused by new kinds of technology available for deployment in the accountancy profession⁷.

The discussions have been vigorous as there is a key view that accountancy jobs can be severely reduced by the automation of processes pertaining to the more repetitive and rule-based tasks (Frey and Osborne, 2017).

However, there is also optimism that with new technology, there are new opportunities⁸ as the accountancy profession leverages the new possibilities to re-invent itself in the digital age.

The general conclusion from the literature is that for accountants to perform their role well in the future of works, they have to:

1. Understand the technologies which are relevant and that would potentially impact their work;
2. Be cognizant of how these technologies can be harnessed for greater productivity;
3. Learn these new technologies to deploy them effectively⁹.

The World Economic Forum (WEF 2020) surveyed industry players on the top technologies that will be adopted by 2025.

Table 1 shows the top 5 technologies which will be adopted by companies and they 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 (block chain – 73%) lies in 8th position.

7 Atanasovski and Tocev (2022), Soepriyanto, et. al., (2023)

8 Leitner-Hanetseder, et al. (2021b).

9 Seow, et al. (2021), Leitner-Hanetseder, et al. (2021a); Moll and Yigitbasioglu (2019), Tan and Laswad (2018), van Laar et al. (2017), Howcroft (2017).

Table 1: Technology likely to be adopted by 2025, by share of companies surveyed, from the financial services sector¹⁰

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 suggests that the accountancy profession will need to consider how to deal with the deployment of these technologies by industry players in order to be relevant.

There are also technologies which directly affect the accountancy industry and they include: artificial intelligence, automated repetitive processing capabilities, big data analytics, cloud computing, cybersecurity, data visualization, machine learning, methods to deal with structured and unstructured data, amongst others.

A glossary of the technologies mentioned in this study is included at the end of the report.

Given the plethora of technologies available and the constraint of limited resources, the challenge is to identify the key digital skills and knowledge which accountancy professionals and students must pay attention to and acquire in the current-, mid- and long-term.

The literature is filled with discussions and opinions on six key digital skills which accountancy professionals ought to have¹¹. This study labels them as the “A²B²C²” which stands for **A**utomation (robotic processing), **A**rtificial intelligence¹², **B**ig data^{13,14}, **B**lockchain¹⁵, **C**loud computing¹⁶ and **C**ybersecurity¹⁷.

The following section provides brief descriptions of these six digital skills and their importance.

10 WEF (2020, Figure 19 - abstract)

11 Santos et al. (2023), Cordos (2022), Moll and Yigitbasioglu (2019), Gulin, et al. (2019).

12 Hasan (2022), Holmes and Douglass (2022), Leitner-Hanetseder, et al., (2021b), Rane and Lahane (2020), Ukpong, et al. (2019), Kokina and Devenport (2017), Appelbaum and Nehmer (2017), Sutton, et al., (2016).

13 Cockcroft and Russell (2018), Appelbaum, et al. (2017), Arnaboldi, et al., (2017), Janvrin and Watson (2017), McKinney, et al. (2017), Enget, et al. (2017), Sledgianowski, et al. (2017), Alles (2015), Vasarhelyi, et al. (2015), Krahel and Titera (2015), Schneider, et al. (2015), Warren, et al. (2015), Wilder-James (2012).

14 In the area of Big data, it will include data analytics. Lawson and Street (2021), Andiola, et al. (2020), Oesterreich and Teuteberg (2019), Richardson and Shan (2019), Ballou, et al. (2018), Cunningham and Stein (2018), Dzurinin, et al. (2018), Appelbaum, et al. (2017), Kokina, et al. (2017), Tang, et al. (2017), Wang and Cuthertson (2015).

15 Dashora and Bhanawat (2023), Han, et al., (2023), Spano, et al., (2022), Cai (2021), Felski and Empey (2020), Dai and Vasarhelyi (2017).

16 Brandas, et al. (2015), Cambridge (2018).

17 Eaton, et al., (2019), Almomani, et al., (2021)

Table 2 provides a short list of articles written about each of the technologies in the accounting literature.

Table 2: Listing of articles on the six technologies (A²B²C²)

Technology	List of articles
Automation (Robotic processing)	<ul style="list-style-type: none"> • Leitner-Hanetseder, et al. (2021b) • Frey and Osborne, (2017) • Guthrie and Parker (2016) • Autor and Dorn (2013)
Artificial intelligence	<ul style="list-style-type: none"> • Holmes and Douglass (2022) • Leitner-Hanetseder (2021) • Lehner, et al. (2020) • Rane and Lahane (2020) • Ukpong, et al. (2019) • Skrbis and Jacqueline (2019) • Kokina and Devenport (2017) • Appelbaum and Nehmer (2017) • Sutton, et.al. (2016) • Brynjolfsson and McAfee (2014) • Neely and Cook (2011) • O’Leary (1986)
Big data/Data analytics	<ul style="list-style-type: none"> • Lawson and Street (2021) • Andiola, et al. (2020) • Oesterreich and Teuteberg (2019) • ICAEW (2019) • Richardson and Shan (2019) • Ballou, et al. (2018) • Cockcroft and Russell (2018) • Cunningham and Stein (2018) • Dzurani, et al. (2018) • Appelbaum, et al. (2017) • Arnaboldi, et. at., (2017) • Kokina, et al. (2017) • Janvrin and Watson (2017) • McKinney, et al. (2017) • Sledgianowski, et al. (2017) • Tang, et al. (2017) • Enget, et al. (2016) • Alles (2015) • Krahel and Titera (2015) • Schneider et al. (2015) • Vasarhelyi, et al. (2015) • Wang and Cuthertson (2015) • Warren, et al. (2015) • Wilder-James (2012)
Blockchain	<ul style="list-style-type: none"> • Han, et. al., (2023) • Spano, et. al., (2022) • Cai (2021) • Felski and Empey (2020) • Deloitte (2019) • Smith (2018) • Dai and Vasarhelyi (2017) • Janvrin and Watson (2017) • Psaila (2017)
Cloud computing	<ul style="list-style-type: none"> • Cambridge (2018) • Brandas, et al. (2015)
Cybersecurity	<ul style="list-style-type: none"> • Almomani, et. al., (2021) • Eaton, et. al., (2019)

Automation (Robotic processing)

The introduction of software robots in robotic process automation (RPA) is a natural progression in taking over the routine tasks which are defined by structured rules, processes or protocols.

This is an area where the structured solution pathways are coded and works are best done by algorithms which capture the structured pathways. This is a playing field for robotic processing which is much like the robotic or automated production line in a fully automated factory.

With the continuing improvement in computer technology, computational power and storage, it is expected that software is not only able to provide solutions for routine processes but they will also be able to provide *“more and more support in non-routine tasks that require decisions on complex and novel situations and flexibility”* (Leitner-Hanetseder, et al., 2021b; Frey and Osborne, 2017; Guthrie and Parker, 2016; Autor and Dorn, 2013).

Artificial intelligence

Neely and Cook (2011) commented on the major impact of new technology, particularly artificial intelligence (AI), on the accountancy profession. They said that AI has the *“potential to massively transform existing professional occupations and task profiles”*.

The use of AI in accounting is not new as back in the 1980s, auditors were already toying with “expert systems” in which the system *“assists decision maker, replace the decision maker or train the decision maker”* for auditing purposes (O’Leary, 1986).

Despite the fact that AI-based technology is making small but systematic inroads into the accountancy profession, there are high hopes that AI-based software robots can be deployed in highly complex tasks like fraud detection and liquidity planning (Brynjolfsson and McAfee, 2014; Skrbis and Jacqueline, 2019). Lehner, et al. (2020) advocate the possibility that AI will be a key link which will stepwise proceed towards a “Fully Autonomous Accounting System” (FAAS).

Letner, et. al. (2020) describe the FAAS 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”*.

Accountancy professionals need to be informed of the opportunities, risks and limitations of AI to stay ahead of their game.

This will include ethical considerations in the deployment of AI.

This is a better response as compared to fearing or avoiding AI altogether.

The advent of ChatGPT and generative AI has further increased pressure on the accountancy profession to be pro-active instead of being defensive or reactive.

Big data / Data analytics

Gartner (2012) defines big data as *“high-volume, high velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing*

that enable enhanced insight, decision making and process automation.” In recent times, a fourth “V” is attached to big data, namely, veracity.

There is a notion that large data sets may contain errors and would require a significant amount of verification and data cleansing. Accountants have to be schooled in the knowledge and understanding of big data.

ICAEW (2019) documents three key reasons why big data is a modern phenomenon that accountants need to pay attention to.

First, the advances in computing power allows the processing of large data sets which accountancy professionals have hitherto never been able to do.

For example, accountants primarily use Excel to process data for computation, summary, transformation and analysis. Excel 2003 has a maximum combination of 65,536 rows by 256 columns and this was significantly enhanced in Excel 2007 with its 1,048,576 rows by 16,384 columns (enlargement by 1,024 times the number of cells).

Nonetheless, as data sets get larger, the use of Excel as a key form of data manipulation tool may be found lacking. By today’s standards, Excel will not be a good tool for handling large data sets for reasons of efficiency and effectiveness, and notwithstanding the amount of storage capacity or computing power needed.

A second reason for the prevalence of big data is the variety of data sources and the ability to process all these sources concurrently much like one database.

In many articles on big data in accounting, there are advocates that accountancy professionals would need to consider the massive amount of data generated from social media, mobile technology and devices, open-source data, internet of things amongst others.

The data from these sources may have financial implications on companies which accountancy professionals cannot ignore in their work.

Big data allows for the bridging, amalgamation, triangulation, confirmation and management of data from these varied data sets. This is most critical as accountancy professionals venture into the ESG or sustainability space as auditors or preparers of ESG or sustainability reports.

Finally, IT infrastructure has allowed for the collaboration and sharing of the numerous data sets sitting in the cloud or offsite on a scale which has never been possible previously.

Given the presence of big data, accountancy professionals must have the necessary digital skills to manage, analyze and join the dots in big data to provide a valuable information-based service.

In addition, the availability of big data allows greater opportunities for data analytics, data visualization¹⁸, data-driven decision making, verification and fact finding (Warren, et al., 2015; Schneider et al., 2015).

For example, with big data, auditors may not need to do random or limited sampling for the purpose of audit tests. Technically, auditors can do a 100% check of the data to arrive at their audit opinions since the data are available in digital form.

Krahel and Titera (2015) argue that financial reporting and auditing standards may have to evolve in the face of big data and the processes that generate them. This is needed

18 Janvrin, et al. (2014).

to “*add value and relevance to the accounting profession, empower end users, and improve efficiency of the capital markets.*”

Alles (2015) warns that “*auditors cannot stray too far from the practices of their clients since their credibility with and respect of those clients are the basis of the value added that they provide*”.

Certainly, the accountancy professionals cannot lack this key digital skill and knowledge. Janvrin and Watson (2017) call the use of big data a “*new twist to accounting*”.

Blockchain

Blockchain is a digital representation of a traditional accounting ledger which is supposed to be immutable much as accounting ledgers were not meant to be changed once the transactions are recorded. Blockchain is a digital ledger technology where transactions that are approved by peers are distributed globally in networks of computers with the key attribute being that the transaction and hence the information can be verified real time (Smith, 2018).

Accounting has traditionally been carried out using printed hardcopies and the hardcopies are the immutable proof of the existence of the transactions.

One way to view blockchain is that it is a digitalised form of the accounting ledger.

This being the case, the concept of blockchain will be significant to accounting because a traditional view of accounting is that it involves the recording, processing and communication of information arising from past transactions. Blockchain henceforth becomes that digital technology in which accounting can be conducted digitally.

Deloitte (2019) published survey results showing increasing signs of blockchain’s maturity and its growing use in fintech, technology, media, telecommunications, life sciences, healthcare and government.

Therefore it is not surprising that individuals hail blockchain as one of the “*most promising emerging technologies that have the potential to vastly transform the accounting and auditing profession*” (Felski and Empey, 2020).

In fact, Dai and Vasarhelyi (2017) comment that “*blockchain has served as a potentially transformative information technology expected to be as revolutionary as the Internet*”.

Its vast potential could lie in auditing as blockchain can provide an important conduit to conduct the verification of accounting transactions in a virtual environment.

This hope is advanced by Cai (2021) who postulates that blockchain can be the third entry in the current double-entry accounting system outside the bounds of a company¹⁹.

This third entry in blockchain has the advantage that it can be verified in an efficient manner where fundamental trust and transparency are addressed by the attributes of blockchain (ie., distributed recording and immutable).

This could potentially usher in the simplification of audit or even the demise of traditional audit procedures and processes. The audit will be blockchain-focussed replacing the traditional checking of hardcopy records.

¹⁹ Psaila (2017) writing on Deloitte Malta article hailed blockchain as a game changer for the audit profession.

For example, audit confirmation of account balances may be a thing of the past if auditors have access to the blockchain to confirm the account balances directly rather than obtaining an account confirmation from the clients of the auditee.

Accountancy students will do well to be trained in blockchain.

Cloud computing

The Covid-19 pandemic has proven the relevance and importance of cloud-based solutions and services.

It was demonstrated during the Covid-19 pandemic that the work of accountancy professionals in analytics, compliance control and monitoring including reporting and data governance can all be done in the cloud with limited physical presence in the office.

Accountancy professionals need to be well versed with the skills and knowledge to navigate and perform their roles in this new cloud environment.

Cybersecurity

As information transfer and storage, processes and work take place in a virtual environment, accountancy professionals need to be highly sensitised to the increased risk of cybersecurity as putting all of one's eggs in the cloud basket can be compromised in a single cyber breach.

Accountancy professionals performing audit and risk management advisory services would need to be well versed in cybersecurity for them to perform their roles as auditors and evaluators of the system and processes of their clients.

Massive shift in technology

The existing IT knowledge for accounting work on spreadsheets and ERP and information systems is assumed.

There will be a regime change or a massive shift in technology which will render existing IT knowledge insufficient to define a capable and skilled accountancy professional.

The key questions to address will include:

- What are the roles of the professional accountancy body in promoting and equipping accountancy professionals to keep up the quality of the accountancy profession?
- What do the accountancy professionals need to keep themselves relevant?
- What must the accountancy schools do to ensure that their graduates are conversant with the new technology?

Technology education in accountancy curriculum

Given the need to incorporate these digital skills into the accountancy profession, there remain three critical questions that the accountancy profession needs to deal with.

First, how much depth does an accountancy professional need in each of these areas?

Second, what are the best ways to impart these digital skills to accountancy professionals given the scarcity of time?

Finally, what are the current challenges faced by PAOs, accountancy professionals and accountancy schools in addressing the need for these new digital skills?

With respect to the question of depth, it is important to note that accountancy professionals are not data or computer scientists.

Therefore, a reasonable functional knowledge of these technologies and their applications in accounting may suffice.

There is a discussion on whether accountancy professionals should know how to use programming languages like Python or R as these are the basic computer programming languages which are useful for machine learning and data analytics²⁰.

Different schools of thought

One school of thought is that it is good enough for accountancy professionals to have an aptitude to learn and a mere introduction to the programming language.

As and when the need arises, accountancy professionals can dedicate more time and effort to acquire these programming skills. Otherwise, acquiring the programming languages without regular application will not help the accountancy professional to be conversant or skillful in these programming languages.

The important thing is that accountancy professionals must be exposed early to the usefulness and practicality of these programming languages.

An alternative school of thought is that this is not necessary as accountants do not generally need programming skills in their daily work.

They just have to know what the programming language can do and how to outsource this to programmers.

The jury is still out as the world further evolves. In a world of emerging technology, accountancy professionals should be encouraged to adopt a lifelong learning approach as new technology will soon replace the current technology and accountancy professionals have to constantly retool themselves to cope with the new technology.

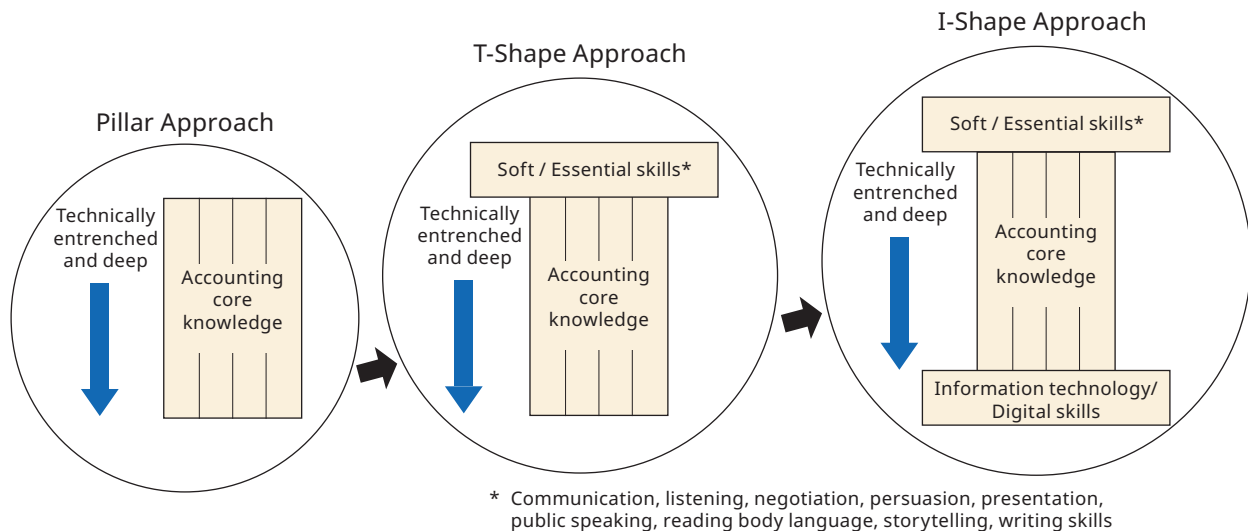
Therefore, arming accountancy students with knowledge of emerging technology becomes an existential requisite for the future of an accountancy professional²¹.

A way to conceptualize the development of the training of an accountancy student over time is summarized in Figure 1 below.

²⁰ Schoute (2019).

²¹ Salleh, et. al., (2023)

Figure 1: Progressive development of training for accountants



The “Pillar Approach” emphasises the accounting skills needed by an accountancy professional to discharge his professional responsibility. A deep knowledge of each of the core areas (pillars) of the accountancy domain is required. This has been the primary emphasis of accountancy schools since time memorial.

As accountancy professionals are more than just technicians, they serve the role of advisors and analysts. The requirement for soft²² skills that generally includes those skills which are typical of “humanity” like communication, listening, negotiation, critical thinking, amongst others, are crucial for the success of an accountancy professional. This results in the “T-Shape Approach”²³ to the training of accountancy students. These soft skills are required in addition to the accounting skills traditionally learnt by accountancy students.²⁴

With the advent of new digital technology, the traditional technical and soft skill knowledge and training of accountancy students will have to be undergirded by a foundation of digital skills. This is to ensure that accountancy students are able to compete and be competent in a digital world. This gives rise to the “I-Shape Approach” in the training of accountancy students.

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.

The above characterisation of the progressive development of training for accountancy students immediately results in two key challenges for accountancy schools.

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

23 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 the technical skills and soft skills. The impartation of both technical and soft skills is the imperative of accountancy schools.

24 Rebele and St. Pierre (2015).

First, the content space for each of the accountancy core knowledge continues to enlarge. For example, there were 23 International Accounting Standards (IASs) introduced from 1975 to 1985. By 2022, there were 24 IAS and 15 International Financial Reporting Standards (IFRS)²⁵ which represent an increase of almost 70%. This is notwithstanding the numerous interpretations from the International Financial Reporting Interpretations Committee (IFRICs).

The content space for financial accounting standards alone has more than doubled. The same can be said for auditing, taxation, valuation and many other existing and new topics in the accountancy domain.

Taking another example, the increased complexity of mathematical models used in financial reporting adds to the content space. Back in 1982, the most sophisticated mathematical model was the net present value calculation introduced in IAS 17: Accounting for Leases. Fast forward to 2022, the binomial and the Black-Scholes option pricing models have become choices available in the pricing of financial instruments for financial reporting purposes.

In addition, Monte Carlo simulations can be used in IFRS 13: Fair Value Measurement for the computation of credit valuation adjustment (CVA) and debit valuation adjustment (DVA).

Secondly, the introduction of soft skills and digital skills have further taken up more curriculum time.

In a world where more contents are introduced into the accountancy curriculum, it could result in under-coverage of some of the key contents or an information overload for students. This runs the risk of having “half-baked” accountancy professionals who are not adequately trained in the multi-content accountancy curriculum.

In the case of the “I-Shape Approach”, it is evident that the training of accountancy students must incorporate the needed digital skills that will drive the future of the accountancy profession.

Technology forms the foundation of the “I” and that is a reasonable representation of the role of technology in the new accountancy profession.

What should accountancy schools do?

As alluded to above, the current accountancy curriculum is already packed because of the continuous enlargement of the content space with no lengthening of the duration of the accountancy programme.

The duration of the accountancy programme is a hard constraint which forces every accountancy school to optimize the learning outcomes given the key imperatives (technical, soft and digital skills) in accountancy education (ie., the I-Shape Approach).

In carefully selecting the needed digital skills (for example, the six core digital skills [A²B²C²]: Automation (robotic processing), Artificial intelligence, Big data, Blockchain, Cloud computing and Cybersecurity, the key challenge will be how these digital skills should be imparted to the accountancy students²⁶.

25 International Accounting Standards (IASs) were first released in 1975 and new standards are called International Financial Reporting Standards (IFRSs) from 2003 onwards.

26 Tavares, et. al., (2023), Igou, et. al., (2023)

Approaches to impart digital skills in accountancy

In the literature on accountancy education, there are currently two key methods by which to impart digital skills to accountancy students²⁷.

One of the more popular approaches is the “silo approach” where each course on technology or digital skills stands on its own with very minimal linkages to the other key accountancy knowledge areas.

For example, a course in data visualization or big data where the knowledge and examples are general business related and scarcely cover any accountancy domain.

The assumption here is that the acquisition of deep big data skills and knowledge can be easily applied to the accountancy domain by accountancy students.

A second approach is the integrated or linked approach where digital skills are embedded in core accountancy courses. For example, big data is taught and applied in the audit or forensic accountancy course.

The choice of the approach has its own challenges. For the silo approach, the specific digital skills can be covered adequately by faculty who are experts in those digital skills. The digital skill courses may be taught by faculty from another discipline, for example, computer science or information technology. It could be in a course on Accounting Information Systems (AIS).²⁸

This approach has been used by some schools to teach quantitative methods for business (or statistics for business) by faculty who are not from the business or accountancy school. This method has the advantage of providing deep coverage of the domain expertise, be it quantitative methods or digital skills and knowledge.

However, digital skills and knowledge taught are not directly related to the accounting discipline and students may have difficulties in applying them to the accountancy domain. The learning is done in an unconnected silo approach.

The integrated or linked approach has the significant advantage of imparting digital skills in the learning of accountancy knowledge. This hastens the learning as the digital skills acquired are directly relevant to the context of accounting.

Lafond, et. al (2016) report that the integrated or link approach “*hold stronger perceptions about the role of technology in accounting than students in the stand-alone computer science courses*”.

The challenge in the integrated or linked approach is that the accounting instructor would have to significantly re-scope the accountancy courses to incorporate the digital skills to be taught. The accounting instructor must be capable of integrating or using digital skills in the accountancy courses without sacrificing the outcomes of learning accountancy knowledge.

The integrated or linked accountancy courses will require examples, illustrations, assignments or projects that include digital skills or knowledge. It is likely that such an approach will require significant redrafting of the accountancy course.

In addition, the accounting instructor must be able to teach the relevant technology

27 Lafond, et al. (2016).

28 Pan and Seow (2016).

in the accountancy course in an expert and knowledgeable manner.

The worst-case scenario is that neither the accountancy knowledge nor the digital skills will be taught and learnt well in this integrated approach.

Failing to get a technology-inclined accounting instructor, the accountancy course has to be co-taught by instructors from schools of accountancy or computer science or information technology.

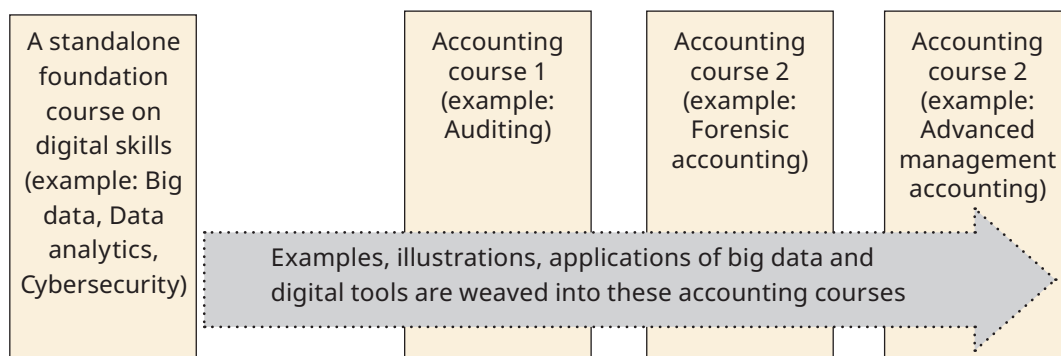
There is also a scarcity of highly technology-inclined accounting instructors.

A possible hybrid approach is to have silo courses on digital skills and knowledge at the foundation level for the accountancy students and thereafter, weave the advanced digital skills into the accountancy courses.

For example, there will be an introductory course on digital skills in accounting and the various digital skills on big data, data analytics, cybersecurity, etcetera, will be taught.

Thereafter, the digital skills on big data, data analytics and cybersecurity are applied in accountancy courses like auditing or forensic accounting or advanced management accounting. Figure 2 illustrates this approach.

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



The hybrid approach has the advantage in that the digital skills are assumed to have been acquired in standalone foundation courses on digital skills.

These digital skills are applied in the accountancy courses through examples, illustrations and assignments.

This is almost similar to the current approach where Excel or Advanced Excel is taught as a standalone course and the Excel knowledge is used in examples and applications in other accountancy courses like valuation or auditing.

This approach has the advantage of allotting time for purposeful acquisition of the digital skills with the subsequent application of those digital skills to the accountancy domain. It satisfies the notion of a reinforced learning model.

This study seeks to gather information from accountancy schools on how they are imparting technology skills and knowledge to the accountancy students and the possible barriers faced and possible help needed.

Methodology in the research

The methodology adopted by this study to address the questions above is stated as follows:

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. The generic survey questionnaire for PAOs, accountancy schools and professionals are contained in Appendices 1 to 3, respectively. Each country adapts the generic questionnaires accordingly to suit their local context but retaining the core questions pertaining to the objectives of this study.
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.
5. The key questions posed to the PAOs, accountancy schools and accountancy professionals include the following:
 - a. All: What are the perceptions and views on the disruption to the accountancy profession arising from new technology?
 - b. All: What would the accountancy profession need to do to address this technological challenge?
 - c. All: What are the new technologies needed for the future accountancy professions?
 - d. All: How should accountancy professionals be equipped with these new technologies?
 - e. All: How should the stakeholders work together to address this technological challenge?
 - f. PAO: Does the PAO have a technology skill roadmap for the profession? If yes, what does it look like?
 - g. Accountancy schools: Does the accountancy school have a plan or strategy to incorporate these new technologies into its current accountancy curriculum?
 - h. Accountancy schools: What are the challenges in incorporating these new technologies into the current accountancy curriculum?

6. Given the inputs from the PAOs, accountancy schools and professionals, a generalized generic roadmap for technology adoption by PAOs, Accountancy schools and professionals in ASEAN is proposed.
7. Case studies on selected accountancy schools in ASEAN will be undertaken to document their technology adoption journey in accountancy education.

Findings and discussions

The study covered all the 10 ASEAN countries with Thailand and Laos presented in a joint report. Table 3 shows the countries which participated in the study.

Table 3: List of countries which participated in the study

Countries	Report
Brunei	Appendix 4
Cambodia	Appendix 5
Indonesia	Appendix 6
Malaysia	Appendix 7
Myanmar	Appendix 8
Philippines	Appendix 9
Singapore	Appendix 10
Thailand and Laos	Appendix 11
Vietnam	Appendix 12

This section provides a general overview of the findings on a collective basis from the reports of the 10 countries from the perspectives of the three key stakeholder groups: PAOs, accountancy schools and accountancy professionals. The general findings from the ASEAN countries for each group in the study are summarized below.

Local Professional Accounting Organizations (PAOs)

The 10 ASEAN countries in this study are at different stages of development in technology at the national level and this has significant spillover into the PAOs. Generally, the PAOs take the lead from their countries' technology roadmap, priorities and investments.

In those countries where technology is on a fast track, the PAOs of those countries are generally ahead and have devoted more investment and attention to the adoption of technology.

Notwithstanding this, it is found that the PAOs in all 10 member states are conscious and aware of the significant challenge posed by technology to the accountancy profession.

We have also found intermediate to advanced levels of awareness of the various selected technologies by the PAOs. In fact, we can conclude that generally, the PAOs have a very positive subjective belief in the importance and relevance of technology to the accountancy profession.

However, the level of utilization of technology in accounting is generally much lower than the levels of awareness and subjective belief

With regard to the intention to engage technology in the accountancy profession, the

views are very dispersed.

On one hand, a PAO which has set aside funds for the development of AI and with a technology adoption map; and on the other hand, another PAO is only at the beginning stage of the technology journey, namely, trying to grapple with awareness and understanding of the usefulness of technology to the accountancy profession.

Some PAOs have significant engagement with their stakeholders, namely, professionals and accountancy schools, to ensure that all parties embark on the technology journey together.

Some have even conducted studies to sense the pulse of professionals concerning technology, for example, Malaysia.

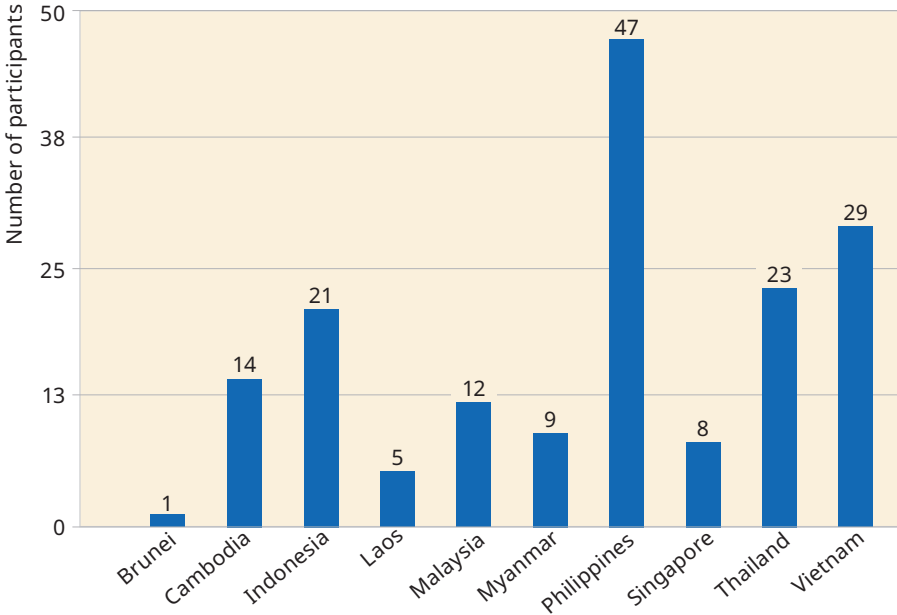
There is plenty of scope for PAOs to network and learn from each other without having the need to re-invent the wheel.

Accountancy schools

The coverage of the survey on accountancy schools in all the ASEAN countries is a general representation of the state of accountancy education in their respective countries.

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



This sample may be small in comparison to the total number of accountancy schools in ASEAN.

In some countries like Singapore, the survey covers the entire population of university-level accountancy schools.

In the other countries, the respondents are a good representation of the different types (public and private) and sizes of accountancy schools. The responses are generally provided by the dean or the head of the school or programmes, providing a certain level of assurance of the authenticity and accuracy of the responses.

The study found that institutes of higher learning (IHLs) in different ASEAN countries generally have differing levels of awareness. This is shown in Figure 4.

Three countries have a lower than average level of awareness (ie., lower than the average 3.34) and they are Laos (2.33), Cambodia (2.40) and Myanmar (2.69).

However, most countries generally have intermediate to advanced (ie., score of 3.0 to 5.0) levels of awareness of most of the six technologies (A²B²C²) discussed in this study. For other technologies, the levels of awareness span the whole spectrum, namely, from low to advanced.

Figure 4: Level of awareness of emerging technology

(1 – Not at all and 5 – Fully aware)

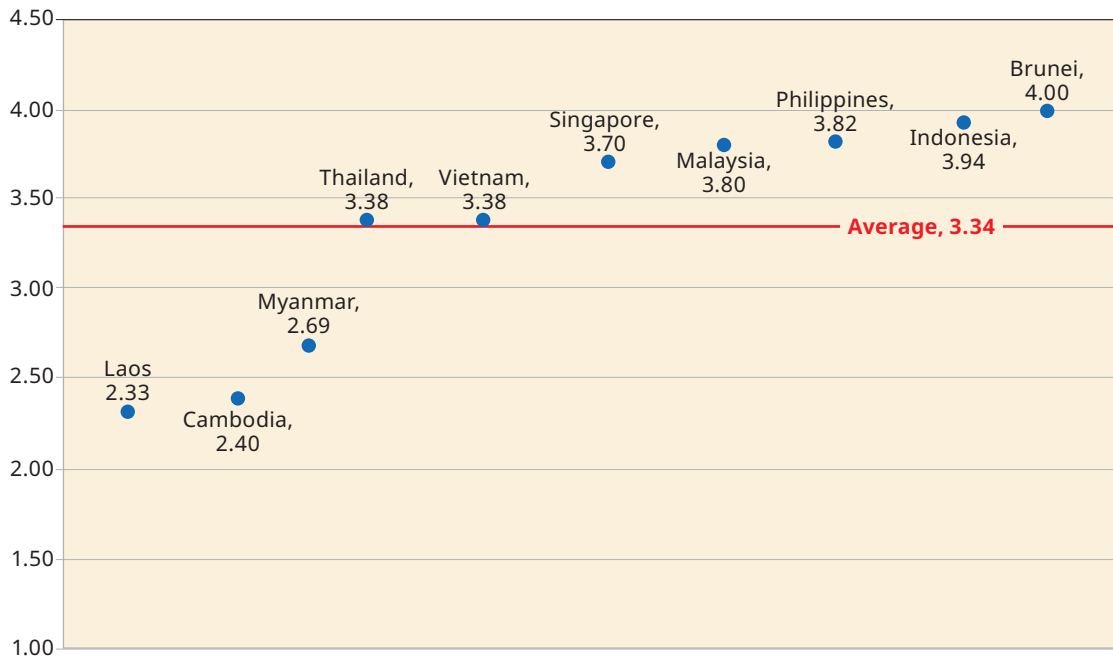


Figure 5 shows the level of competency in emerging technology in the ASEAN countries. However, it is documented that the level of competency is markedly lower than the awareness level.

The overall average for each country is below 3.0, standing at 2.08 which is much lower than the overall average level of awareness (3.34)*.

This is notwithstanding that the respondents stated that they are aware of the identified technology.

This suggests that the IHLs in ASEAN still have much work to do to enhance their competency in identified emerging technology.

* The scales for awareness (0 to 5) and competency (0 to 4) are different and even after adjusting for the scale difference, the score for awareness is still higher for all countries.

Figure 5: Level of competency in emerging technology

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

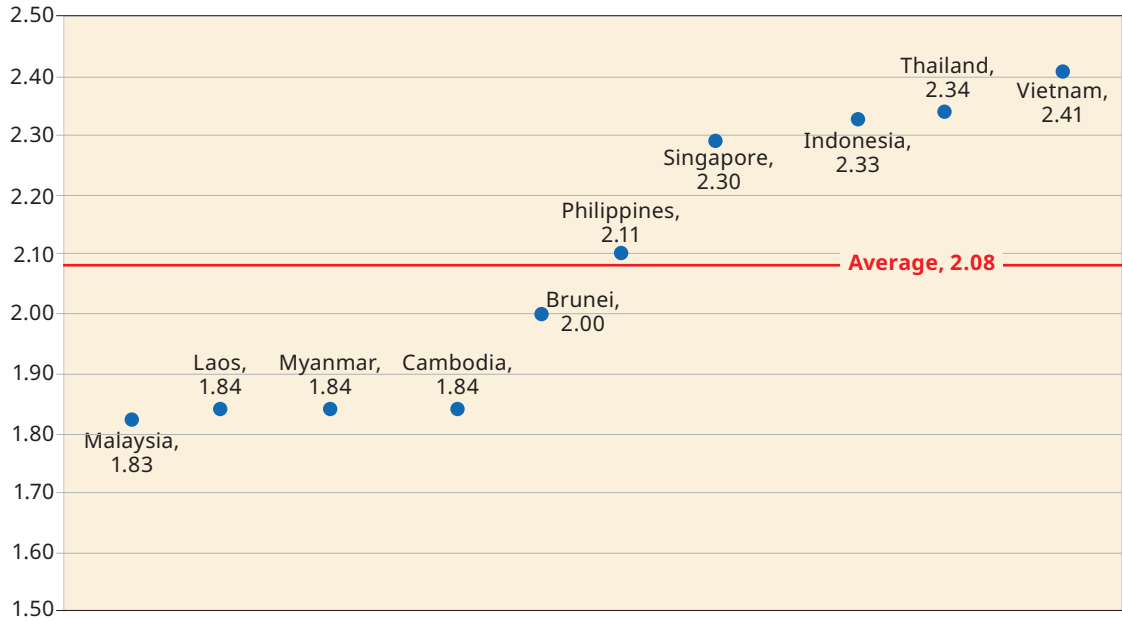
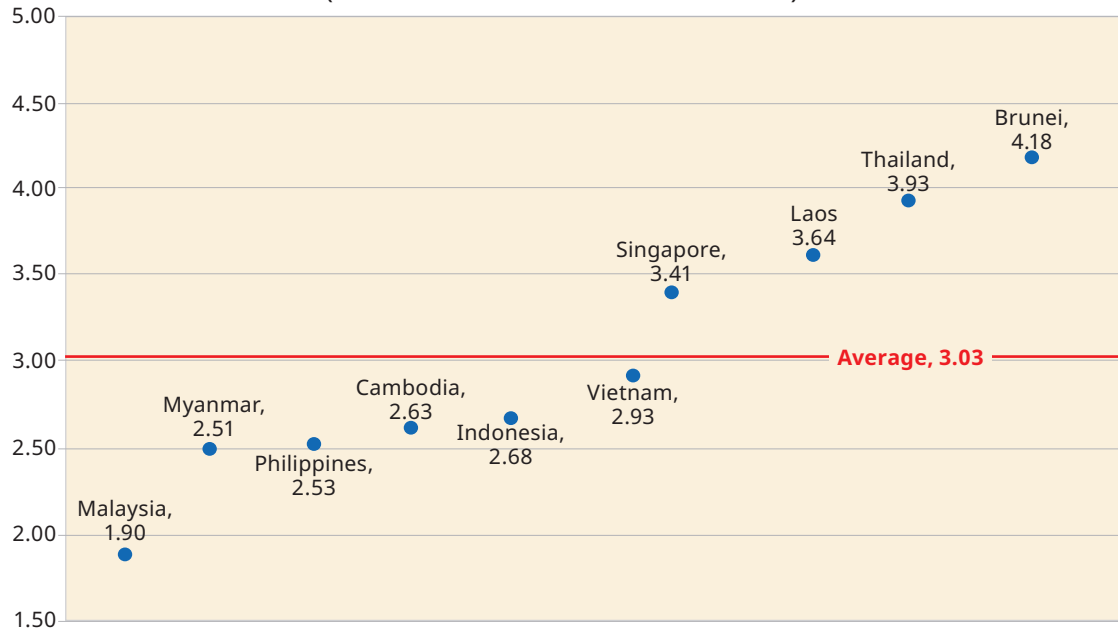


Figure 6 shows the level of importance of emerging technologies to be incorporated into the accountancy curriculum by the IHLs.

Figure 6: Level of importance of emerging technologies to be incorporated into the accountancy curriculum

(1 – Least crucial and 5 – Most crucial)



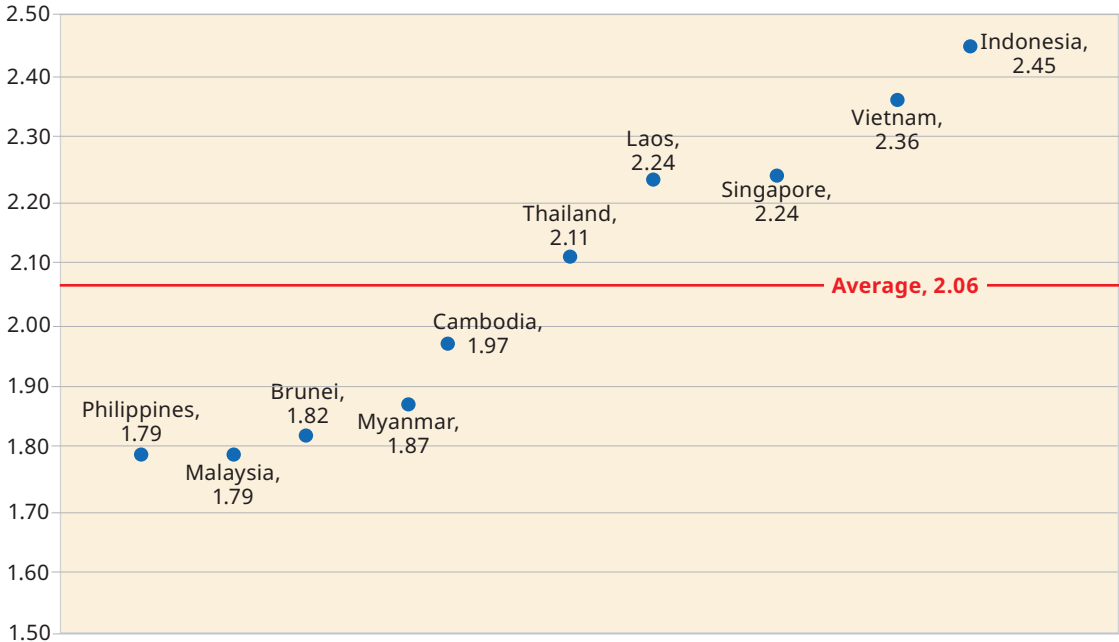
The level of incorporation of the identified technology into the curriculum is broad, ranging from low (1.79) to intermediate (2.45). This is shown in Figure 7.

The level of incorporation is low among all the ASEAN countries and the average of 2.06 is about the foundation level. The highest level is seen in Indonesia (2.45) and this is at most between the foundation and intermediate levels.

It is possible that the level of activities related to emerging technology for IHLs is generally driven by the state of the technology adoption in the respective country and the pro-activeness of PAOs in promoting and driving technology adoption.

Figure 7: Level of incorporation of emerging technology into the accounting curriculum

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



Accounting and auditing software adopted by IHLs in the ASEAN countries is also wide ranging with some countries possessing a full suite of technology while others concentrate non Microsoft, and the relevant statistical software for research purposes (i.e., SPSS, Eviews, STATA, etc).

Nonetheless, we documented significant efforts by the respondents to ramp up the adoption of technology in their accountancy curriculum.

The key barrier to the inclusion of more technology courses in the accountancy curriculum is the lack of experts in emerging technology and this was documented in almost all the countries.

The average responses of the ASEAN countries are shown in Table 4 below.

Table 4: Identification of the 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%

From Table 4, the unequivocal takeaway is the lack of experts in emerging technology and this is the most significant challenge facing accountancy schools in ASEAN.

Specific actions need to be taken to increase the technology expert bench of the accountancy schools in the teaching of technology. Otherwise, the accountancy graduates will languish in their technology skills and knowledge.

This can be a significant opportunity for the accountancy schools in ASEAN to network with each other to share their technology experts and also to work with industry to draw technology experts into the accountancy schools.

Concerted efforts will have to be made as otherwise, the natural state of evolution will not keep pace with the development of the accountancy profession in terms of technology adoption in each country.

A second key concern is the lack of funding for the adoption of emerging technology. This is expressed by 60.3% of the respondents.

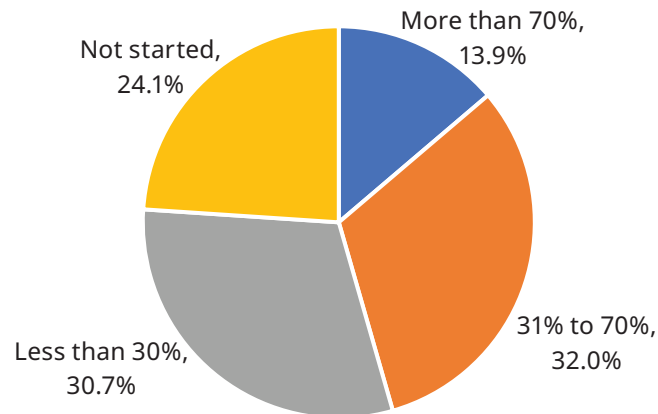
On an encouraging note, there are some positive responses that accountancy schools have ramped up technology adoption in their curriculum in the last 3 years with some respondents indicating that more than 70% or more of technology adoption took place in the last 3 years in curriculum revision.

This is shown in Figure 8 below. Take the case of the Singapore Institute of Technology which introduced a whole slew of data analytics skills and knowledge into accountancy courses in the most recent revamp of its accountancy curriculum.

However, it is worrying to document that 24.1% of respondents did not even start to incorporate technology in their accountancy curriculum in the last 3 years.

These respondents generally come from ASEAN countries with a lower state of technology awareness, competency and adoption.

Figure 8: Distribution of the state of incorporation of technology into the accountancy curriculum in the past 3 years



With respect to how the technology skills and knowledge are to be taught, the study found a range of methods from standalone technology courses to embedding technology into the accountancy core.

In addition, there seems to be a slight preference to have a combination of accountancy and IT lecturers/practitioners to conduct training for technology.

Finally, it is heartening to document that respondents are making significant efforts to better equip their lecturers through upskilling, the involvement of professionals and industry attachments.

The summary statistics of the ASEAN countries are shown in Table 5.

Table 5: 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%

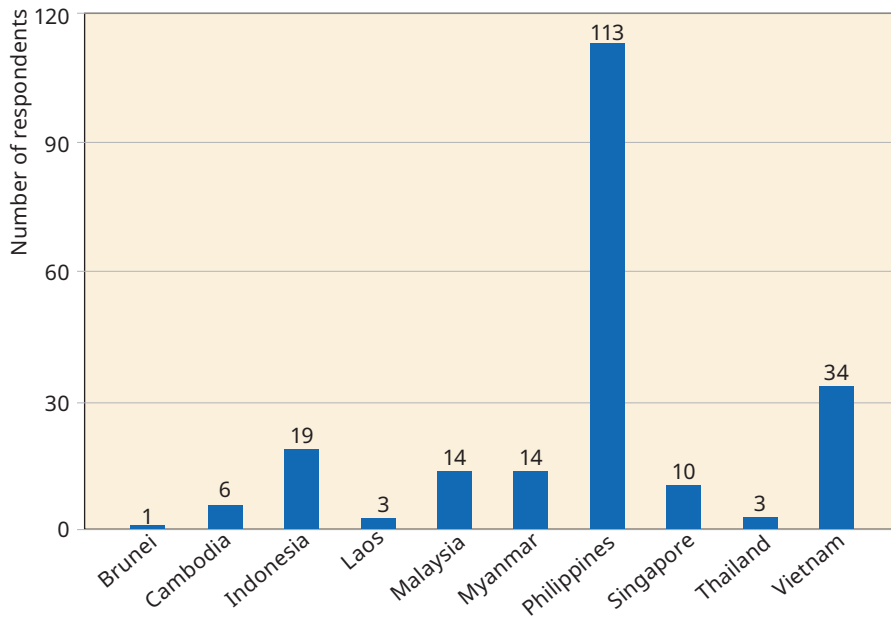
Accountancy professionals

The survey covers 217 professionals and their firms from the 10 ASEAN countries. The largest group of respondents hails from the Philippines, numbering 113.

The sample covers both Big 4, mid- and small-practitioners.

Figure 9 shows the distribution of respondents from the different ASEAN countries.

Figure 9: Distribution of accountancy professionals from ASEAN countries who responded to the study

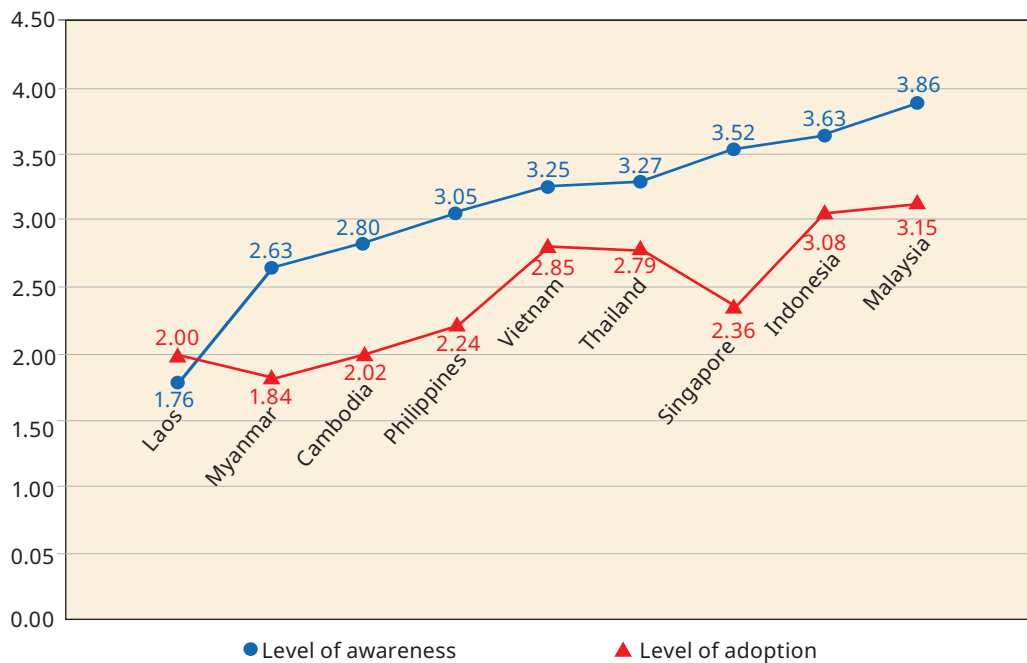


We document a relatively similar response where the level of awareness of technology is average to intermediate but the level of adoption is lower as compared to the level of awareness, except for Laos.

Figure 10 shows this divergence is consistent for every ASEAN country.

Figure 10: Summary of levels of awareness and adoption of the emerging technology²⁹

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



²⁹ There was no response from Brunei for this attribute.

The survey found reasonable evidence that the six technologies (A²B²C²) are well recognized by accountancy professionals. Software systems as well as accounting and auditing software are prevalent amongst all the respondents.

Table 6 provides a summary of each of the attributes in the ASEAN countries in general. The study documents a generally healthy and more than neutral level of optimism in the approach to technology (3.73).

Interestingly, the level of optimism in investment in technology is generally high among all the respondents (ie., greater than 3.0 in most cases and as high as 4.3 out of 5.0) resulting in an average value of 3.55.

However, there is less optimism about the skills and knowledge of human resources in handling technology and their attitude towards technology.

With regards to planned behaviour towards technology adoption, we found a general linkage between positive attitudes and belief in technology and plans and action to adopt technology. This is encouraging as the findings suggest that accountancy professionals do have a positive attitude towards, and belief in, technology adoption and this has motivated them to take action to adopt the identified technology.

Table 6: Summary for each attitude for ASEAN countries in general³⁰
(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 7 shows the expected benefits of technology adoption in the ASEAN countries in general.

It is documented that the respondents positively agreed with the listed benefits of the technology adoption.

One of the key benefits articulated by all the respondents is greater productivity and efficiency, which are essential for them to remain competitive and which will ultimately determine their sustainability and profitability.

Accountancy professionals view technology adoption as vital for their survival and competitiveness.

³⁰ Scores were not available from Brunei and Philippines.

Table 7: Expected benefits of technology adoption for ASEAN countries in general³¹

(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

Table 8 shows the challenges to the adoption of technology in the ASEAN countries in general. All the respondents cite high investment costs as the top or second top ranking challenge to technology adoption. Interestingly, respondents are also concerned about the cultural readiness of their staff in adopting technology.

Table 8: Challenges to adoption of technology in ASEAN countries in general³²

(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

31 Scores were not available from Brunei and Philippines.

32 Scores were not available from Brunei and Philippines.

Piecing together the responses of the PAOs, the accountancy schools and accountancy professionals gave a good understanding of the importance of technology. The importance is acknowledged by these stakeholders.

In addition, there are real challenges on the ground to the adoption of technology, be they the availability of skilled manpower especially in accountancy schools or technology adoption costs or the lack of a technology roadmap for the accountancy profession.

These are generally described in the above section and are elaborated in depth in each country report.

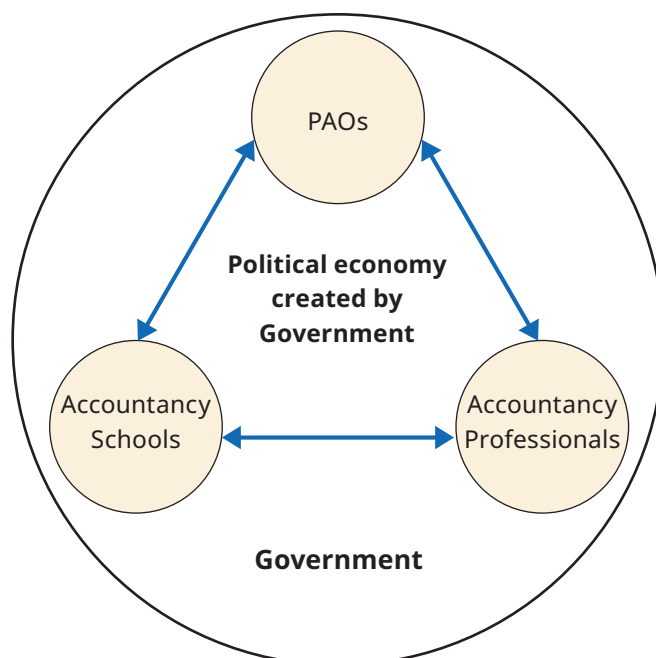
Generic technology roadmap

This final section seeks to pull together the findings of each country and to propose a generic technology roadmap which can benefit the accountancy profession in ASEAN. In building the generic roadmap, it is important to establish some base framework and assumptions.

First, it has to be recognized that the three stakeholders (PAOs, accountancy schools and accountancy professionals) must work closely with the government to enable an effective and accelerated deployment of technology in the accountancy profession.

Figure 11 shows the representation of this symbiotic relationship in the context of the political economy provided by the government.

Figure 11: Symbiotic relationship between the key stakeholders



The government has every interest to foster an economy which is highly stable and ever-prosperous.

The government knows that technology is a vital factor in enabling and empowering the economy to grow.

The PAOs, accountancy schools and accountancy professionals will have to work with each other and with the government to realize the common goal of economic prosperity.

In some ways, the government will have to provide the overall vision of how technology will be deployed and used in the nation.

The PAOs are responsible for helping translate the government's vision and superimpose it on the accountancy profession.

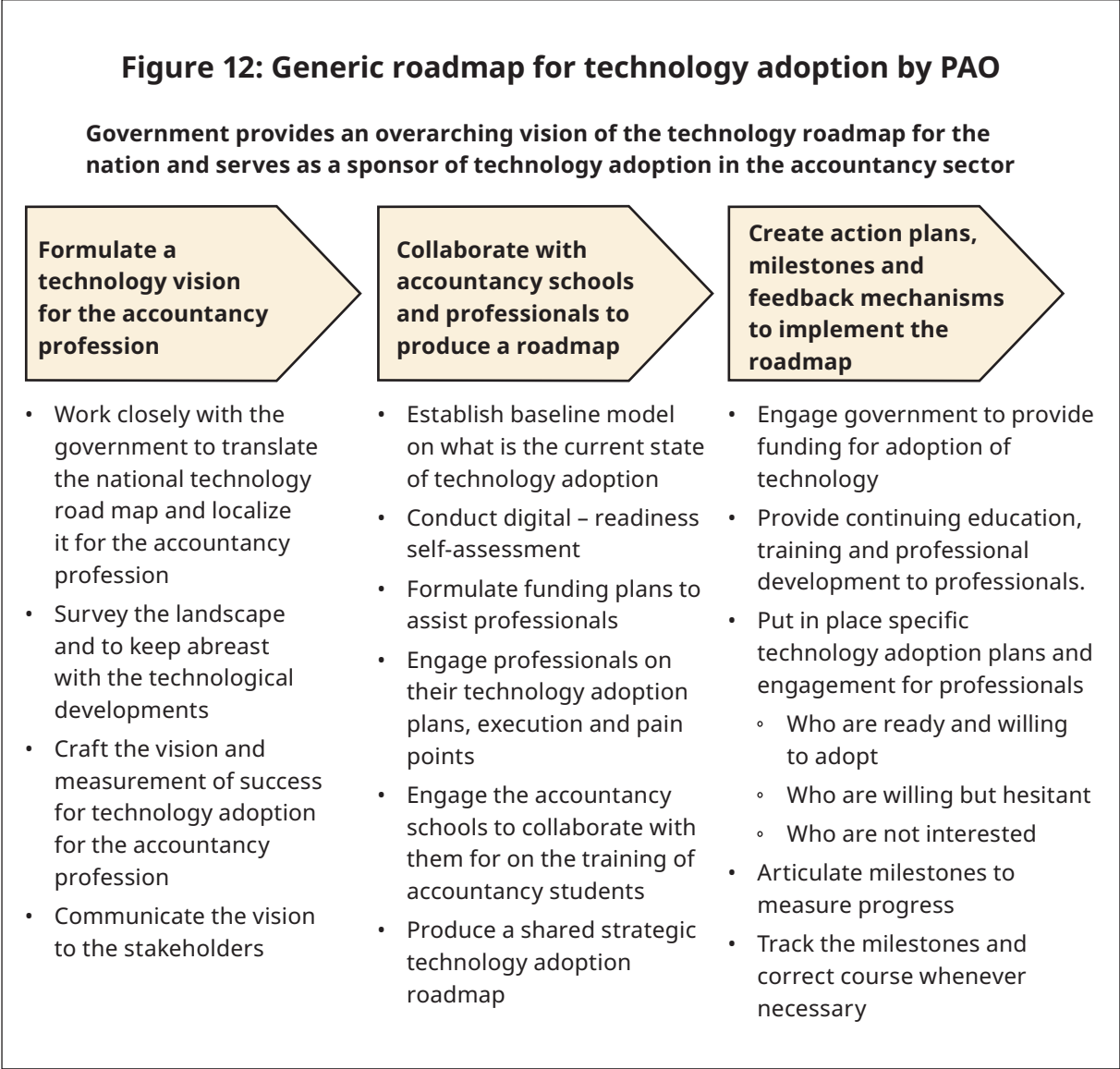
The PAOs will need the accountancy schools to train graduates skilled in technology for employment as accountancy professionals.

The accountancy professionals, together with the PAOs, will provide continuous

feedback on what is needed in the technological skill sets of graduates.

This is the basis for the technology roadmap which involves these three key stakeholders with the government always as the sponsor.

Figure 12 provides a generic roadmap for technology adoption with the key driver being the PAOs in collaboration with the Government, accountancy schools and accountancy professionals.



The roadmap for technology adoption begins with a clear understanding of the needs and importance of the various stakeholders in the ecosystem of the accountancy profession: Government, PAOs, accountancy schools and professionals.

The roles of each stakeholder can be defined and the PAO is the glue that binds the stakeholders together. Each party has specific actions and roles in this technology journey.

Tables 9 to 11 provide action checklists for the PAO, accountancy schools and professionals, respectively.

Table 9: Checklist of actions to implement technology adoption

Professional accounting organizations (PAOs)

Actions to implement technology adoption	Yes	No	In-Progress
1. Has a technology adoption roadmap been formulated?			
2. Is there a mechanism and strategy to engage the accountancy schools and the accountancy professionals/ firms through discussions and feedback on technology innovations and needs?			
3. Is there a mechanism for searching the technology space for emerging technology in accounting?			
4. Is there a mechanism and strategy to curate and inventorise useful accounting technology applications?			
5. Is there a mechanism and strategy to conduct education, training and professional development on accounting technology for accountancy professionals?			
6. Is there a mechanism and strategy to facilitate and/or create collaborative technology platforms for accountancy entities, especially the smaller accountancy entities?			
7. Is there any scheme to render help and advice for accountancy entities to have a strategic technology adoption roadmap for their firms?			
8. Are there strategic and intentional efforts to engage the government for capacity building and funding on accounting technology adoption?			
9. Is there a mechanism or strategy to engage accountancy schools to transform accountancy education to produce technology-savvy accountancy graduates through revision in the accreditation requirements?			
10. Is there a process in place to track the progress of technology adoption and success stories?			

Table 10: Checklist of actions to implement technology adoption

Accountancy schools

Actions to implement technology adoption	Yes	No	In-Progress
1. Is there a mechanism and strategy to engage PAOs and accountancy professionals/firms through discussion and feedback on technology innovations and adoption?			
2. Is there a mechanism to collaborate with experts in the industry to incorporate the curated technology into the accountancy curriculum?			
3. Is there a mechanism and strategy to train and produce technology-inclined accounting instructors who could transfer knowledge of the technology to students?			
4. Is there a mechanism and strategy to establish close relationships with the industry by having reciprocal exchanges of accounting instructors and accountancy professionals?			
5. Is there a mechanism and strategy to provide feedback to PAOs on the accreditation requirements for making it relevant and dynamic to meet the needs of the accountancy sector?			
6. Is there a process in place to track the progress and success stories in educating and training accountancy students in technology adoption?			

Table 11: Checklist of actions to implement technology adoption

Professionals

Actions to implement technology adoption	Yes	No	In-Progress
1. Has a technology adoption roadmap been formulated?			
2. Is there a mechanism and strategy to work closely with the PAO and the accountancy school to create a collaborative and informative articulation of the professional's technology needs?			
3. Is there a mechanism and strategy to collaborate with PAO and the accountancy school for the continuous training of staff to be technologically equipped?			
4. Is there a mechanism and strategy to seek help and advice from PAO or government or accountancy schools to implement their technology adoption roadmap?			
5. Is there a mechanism and strategy to work closely with the accountancy schools to influence the training of accountants?			
6. Is there a mechanism and strategy to partner the accountancy schools for exchange of accounting instructors and accountancy professionals?			
7. Is there a process in place to track the progress of technology adoption and success stories?			

Conclusion

This study presents the views and experiences of PAOs, accountancy schools and professionals in the 10 ASEAN countries with respect to the adoption of technology in the accountancy profession.

All the ASEAN countries are in different stages of technology adoption at the national level and this has significantly influenced technology adoption in the respective national accountancy profession.

PAOs are the prime movers for the adoption of technology as they have a significant role to promulgate a technology adoption roadmap and to work with accountancy schools and professionals to promote technology adoption.

It is documented in this study that few PAOs have a technology adoption roadmap. Most of them would rely on their government's technology roadmap.

This study documented the key emerging technologies which are perceived to be most popular amongst PAOs, accountancy schools and professionals, namely, A²B²C² (Automation – robotic processing, Artificial intelligence, Big data, Blockchain, Cloud computing and Cybersecurity).

The barriers to adoption were also documented alongside the key benefits, with the key barrier being the lack of experts in the technology space. Much work needs to be done especially for countries which are at the beginning of the technology journey.

Finally, a generic technology roadmap is created for technology adoption.

The roadmap requires the key stakeholders, namely, PAOs, accountancy schools and professionals to work together symbiotically with the government for the common good of their 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.

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Appendix 1

Survey Instrument for Professional Accounting Organizations

Survey on response to technology disruption on the accounting profession

Dear Participants,

The technological disruption to the accounting profession has significant implications and this has been documented in a broad spectrum of accounting studies. You are invited to participate in this survey that seeks your views on technology disruption to the accounting profession in ASEAN.

This study is commissioned by the ASEAN Accounting Education Workgroup (AAEW) and is sponsored by the ASEAN Federation of Accountants (AFA). This study will be carried out in various ASEAN countries.

AAEW exists to provide input to and empower higher education accountancy programs across ASEAN. It has the vision to foster the development of ASEAN higher education accountancy programs, enhancing their abilities to produce graduates who can compete in the global accountancy markets. It further supports business and the accountancy profession development in the ASEAN Economic Community through advice on matters relevant to accounting education.

AAEW is interested in understanding the views and perceptions on how Professional Accounting Organizations (PAOs) in ASEAN are coping and dealing with technology disruptions in the accounting profession. Findings from this study are very important to the accounting profession, accountancy education and PAOs for ASEAN in preparing for the future demand of technology savvy accountants.

We believe that your participation in this survey will provide us with insights into technology disruptions in the accounting profession.

Kindly answer all questions to the best of your knowledge. All responses will remain anonymous, and all data collected will be kept strictly confidential.

Should you have any question regarding this study, please feel free to contact the lead researcher, [faculty name].

Your participation in this study is very much appreciated.

Thank you.

AAEW Research Team

Section A: Demographic profile

Instruction: Please choose the option that best describes you and fill in the spaces provided.

1. Name of the organization _____
2. What is your position within the organization
 - Senior management
 - Board member
 - Others (please specify) _____
3. What is the membership size of your organization?
 - Less than 10,000 members
 - Less than 30,000 members
 - Less than 50,000 members
 - Less than 70,000 members
 - Less than 100,000 members
 - 100,000 members or more
4. How many years has your organization been established?
 - Less than 10 years
 - 10 years to less than less than 20 years
 - 20 years to less than less than 30 years
 - 30 years to less than less than 40 years
 - 40 years to less than less than 50 years
 - 50 years or more
5. How many staff does your organization currently have?
 - Less than 50 staff
 - 50 staff to less than 100 staff
 - 100 staff to less than 200 staff
 - 200 staff to less than 300 staff
 - 300 staff to less than 400 staff
 - 400 staff to less than 500 staff
 - 500 staff or more
6. Does your organization have a digital technology roadmap to upscale the accounting profession?
 - Yes
 - No
 - Not sure

Section B: Please answer all questions according to the appropriate scale.

Awareness

7. Rate your member's awareness of the following advances in technology from 1 (Not at all aware) to 5 (Fully aware)

Technologies	Not at all aware 1	2	3	4	Fully aware 5
a. Artificial human assistants					
b. Artificial intelligence					
c. Augmented reality					
d. Blockchain					
e. Cloud computing					
f. Cybersecurity					
g. Data analysis / Big data					
h. Extended reality					
i. Machine learning/Intelligence					
j. Robotic process automation					
k. Visual Internet of Things					

Utilization

8. Rate your member's utilization (i.e., using the technologies at work) of the following advances in technology from 1 (Not at all utilized) to 5 (Utilized all the time)

Technologies	Not at all utilized 1	2	3	4	Utilized all the time 5
a. Artificial human assistants					
b. Artificial intelligence					
c. Augmented reality					
d. Blockchain					
e. Cloud computing					
f. Cybersecurity					
g. Data analysis / Big data					
h. Extended reality					
i. Machine learning/Intelligence					
j. Robotic process automation					
k. Visual Internet of Things					

Attitude

9. Please rate the following statements from 1 for Fully disagree to 5 for Fully agree

Statements	Fully disagree 1	2	3	4	Fully agree 5
a. Our members will benefit from adapting to the technological advances in accounting					
b. Our members can create more value as they adapt to the technological advances in accounting					
c. Our members will find it rewarding to adapt to the technological advances in accounting					

Subjective norm

10. Please rate the following statements from 1 for Fully disagree to 5 for Fully agree

Statements	Fully disagree 1	2	3	4	Fully agree 5
a. Senior leaders in the PAO think that the profession should adapt to the technological advances in accounting					
b. Other key PAO leaders think that the profession should adapt to the technological advances in accounting					
c. Our members think that the profession should adapt to the technological advances in accounting.					
d. The regulators of the profession think that the profession should adapt to the technological advances in accounting					

Perceived behavioural control

11. Please rate the following statements from 1 for Fully disagree to 5 for Fully agree

Statements	Fully disagree 1	2	3	4	Fully agree 5
a. It is easy for our members to adapt to the technological advances in accounting					
b. Our members have the available organizational resources to adapt to the technological advances in accounting					
c. Our members have the available financial resources to adapt to the technological advances in accounting					
d. Our members are provided with accessible continuing professional development programs related to the technological advances in accounting					

Intention to engage

12. Please rate the following statements from 1 for Fully disagree to 5 for Fully agree

Statements	Fully disagree 1	2	3	4	Fully agree 5
a. Our members are committed to adapt to the technological advances in accounting					
b. Our members are planning to adapt or continue adapting to the technological advances in accounting					

Thank you for your participation in the survey.

Appendix 2:

Survey Instrument for Institutes of Higher Learning

Survey on technology adoption by accountancy schools of higher education institutions in ASEAN

Dear Participants,

The technological disruption to the accounting profession has significant implications for accountancy education, and this has been documented in a broad spectrum of accounting studies. You are invited to participate in this survey that seeks to identify the levels of technology adoption by accountancy schools of higher education institutions in ASEAN. This survey seeks to document the issues and challenges faced by accountancy schools in their readiness to adapt and adopt various technologies. It also seeks to document how these technologies should be adopted.

This study is commissioned by the ASEAN Accounting Education Workgroup (AAEW) and is sponsored by the ASEAN Federation of Accountants (AFA). This study will be carried out in various ASEAN countries.

AAEW exists to provide input to and empower higher education accountancy programs across ASEAN. It has the vision to foster the development of ASEAN higher education accountancy programs, enhancing their abilities to produce graduates who can compete in the global accountancy markets. It further supports business and the accountancy profession development in the ASEAN Economic Community through advice on matters relevant to accounting education.

AAEW is interested in understanding the views and perceptions on how accountancy schools in higher education institutions in ASEAN are adopting the emerging technologies and tackling the technology disruptions. Findings from this study are very important to the accountancy profession and accountancy education for ASEAN in preparing for the future demand of technology savvy accountants.

We believe that your experience and your expertise will provide us with insights into the status of technology adoption at your academic institution. Kindly answer all questions to the best of your knowledge. All responses will remain anonymous, and all data collected will be kept strictly confidential. Should you have any questions regarding this study, please feel free to contact the lead researcher in your country, [Faculty name].

Your participation in this study is very much appreciated.

Thank you.

AAEW Research Team

Section A: Demographic profile

Instruction: Please choose the option that best describes you and fill in the spaces provided.

1. Name of university/institution: _____
2. Management position
 - Dean
 - Deputy / Associate / Assistant Dean
 - Head of programme
 - Secretary of study programme
 - Faculty teaching the accountancy programme
 - Others (please specify): _____
3. Number of Years of Establishment of the Accountancy Programme _____
4. School Accreditation:
 - a. _____
 - b. _____
 - c. _____
 - d. _____
5. Total number of enrolled accounting students in 2022: _____

Section B: Please answer all questions according to the appropriate scale.

6. Please state the level of your awareness of the following emerging technologies. [Please tick your responses]

Technologies	Not at all aware 1	Slightly aware 2	Somewhat aware 3	Moderately aware 4	Extremely aware 5
a. Artificial human assistants					
b. Artificial intelligence					
c. Augmented reality					
d. Blockchain					
e. Cloud computing					
f. Cybersecurity					
g. Data analysis / Big data					
h. Extended reality					
i. Machine learning/Intelligence					
j. Robotic process automation					
k. Visual Internet of Things					

7. Select the level of competency your school has to teach the given emerging technologies? [Please tick your responses]

Technologies	None 1	Foundation 2	Intermediate 3	Advanced 4
a. Artificial human assistants				
b. Artificial intelligence				
c. Augmented reality				
d. Blockchain				
e. Cloud computing				
f. Cybersecurity				
g. Data analysis / Big data				
h. Extended reality				
i. Machine learning/Intelligence				
j. Robotic process automation				
k. Visual Internet of Things				

8. In your view, which of the following emerging technologies are crucial to be incorporated into the accounting courses? [Please tick your responses]

Technologies	Most crucial 1	2	3	4	Least crucial 5
a. Artificial human assistants					
b. Artificial intelligence					
c. Augmented reality					
d. Blockchain					
e. Cloud computing					
f. Cybersecurity					
g. Data analysis / Big data					
h. Extended reality					
i. Machine learning/Intelligence					
j. Robotic process automation					
k. Visual Internet of Things					

9. At what level have the following emerging technologies been incorporated into the accounting course syllabus? [Please tick your responses]

Technologies	None 1	Foundation 2	Intermediate 3	Advanced 4
a. Artificial human assistants				
b. Artificial intelligence				
c. Augmented reality				
d. Blockchain				
e. Cloud computing				
f. Cybersecurity				
g. Data analysis / Big data				
h. Extended reality				
i. Machine learning/Intelligence				
j. Robotic process automation				
k. Visual Internet of Things				

10. Name any accounting software used and taught in your accounting courses :

	Software
a. Artificial human assistants	
b. Artificial intelligence	
c. Augmented reality	
d. Blockchain	
e. Cloud computing	
f. Cybersecurity	
g. Data analysis / Big data	
h. Extended reality	
i. Machine learning/Intelligence	
j. Robotic process automation	
k. Visual Internet of Things	

11. Please indicate the barriers your school faces to include the emerging technologies in the accounting syllabus [You can tick more than one response]:
- Lack of experts in the emerging technologies
 - Lack of flexibility of the accounting programme standards
 - Lack of understanding of the emerging technologies
 - Lack of funding for the establishment of facilities in the emerging technology areas
 - Tedious process for the approval of changes
 - Lack of clear business case to justify investment
 - Lack of support from top management
 - Others (please specify) _____
12. Who should teach the technology component?
- Accounting lecturers
 - IT lecturers
 - Industry experts
 - Hybrid: Accounting and IT lecturers
 - Others (please specify) _____
13. What is the kind of assistance needed to integrate emerging technologies into existing courses/modules? [You can tick more than one response]
- Training in these emerging technologies
 - Training in curriculum design and integration
 - Opportunities for industrial attachment
 - Others (please specify) _____
14. How should emerging technologies be integrated into the accounting programme?
- Taught separately as a course/module
 - Embedded into the existing accounting course/module
15. In your opinion, what is the best approach to embed the emerging technologies into the accounting programme?
- Include specific emerging technology courses as core subjects
 - Include specific emerging technology courses as elective subjects
 - Include emerging technology components in various subjects in the accounting syllabus

16. Which of the following technological tools do you currently use or have embedded in the last 3 years in your school? [Please tick your responses]

Technologies	Never used 1	2	3	4	Frequently used 5
Video conferencing and group collaboration tools					
Microsoft applications					
Cloud applications					
Accounting software					
Data analytics tools					
Audit software					

17. What stage is your school currently at in adopting technology in the accounting syllabus?

- Not started
- Less than 30%
- 31% to 70%
- More than 70%

Thank you for your participation in the survey.

Appendix 3:**Survey Instrument for
Accounting Professionals****Survey on technology adoption by
accounting professionals in ASEAN**

Dear Participants,

The technological disruption to the accounting profession has significant implications and this has been documented in a broad spectrum of accounting studies. You are invited to participate in this survey that seeks your views on technology disruption to the accounting profession in ASEAN.

This study is commissioned by the ASEAN Accounting Education Workgroup (AAEW) and is sponsored by the ASEAN Federation of Accountants (AFA). This study will be carried out in various ASEAN countries.

AAEW exists to provide input to and empower higher education accountancy programs across ASEAN. It has the vision to foster the development of ASEAN higher education accountancy programs, enhancing their abilities to produce graduates who can compete in the global accountancy markets. It further supports business and the accountancy profession development in the ASEAN Economic Community through advice on matters relevant to accounting education.

AAEW is interested in understanding the views and perceptions of how accounting practitioners in ASEAN are coping and dealing with technology disruptions in their practices. Findings from this study are very important to the accounting profession, accountancy education and PAOs for ASEAN in preparing for the future demand of technology savvy accountants.

We believe that your participation in this survey will provide us with insights into technology disruptions in accounting practices. Kindly answer all questions to the best of your knowledge. All responses will remain anonymous, and all data collected will be kept strictly confidential. Should you have any questions regarding this study, please feel free to contact the lead researcher, [Faculty name].

Your participation in this study is very much appreciated.

Thank you.

AAEW Research Team

Section A: Demographic profile

Instruction: Please choose the option that best describes you and fill in the spaces provided.

1. Name of your firm: _____
2. What is the legal status of the firm?
 - Limited liability partnership
 - Sole proprietorship
 - Partnership
 - Others, please specify: _____
3. Number of partners in your firm?

4. What is your position in the firm?
 - Owner / Practitioner / Partner
 - Manager/ Supervisor
 - Senior auditor
 - Junior auditor
 - Others, please specify: _____
5. How many years of business operations does your firm have?
 - 1 to 3 years
 - 4 to 6 years
 - 7 to 9 years
 - Above 9 years
6. How many partners/accountants are employed in your firm?
 - 10 and below
 - 11 to 20
 - 21 to 40
 - 41 to 50
 - Above 50

Section B: Please answer all questions according to the appropriate scale.

Awareness

7. Rate your firm's awareness of the following advances in technology from 1 (Not at all aware) to 5 (Fully aware)

Technologies	Not at all aware 1	2	3	4	Fully aware 5
a. Artificial human assistants					
b. Artificial intelligence					
c. Augmented reality					
d. Blockchain					
e. Cloud computing					
f. Cybersecurity					
g. Data analysis / Big data					
h. Extended reality					
i. Machine learning/Intelligence					
j. Robotic process automation					
k. Visual Internet of Things					

Utilization

8. Rate your firm's utilization of the following advances in technology in your work from 1 (Not at all utilized) to 5 (Utilized all the time)

Technologies	Not at all utilized 1	2	3	4	Utilized all the time 5
a. Artificial human assistants					
b. Artificial intelligence					
c. Augmented reality					
d. Blockchain					
e. Cloud computing					
f. Cybersecurity					
g. Data analysis / Big data					
h. Extended reality					
i. Machine learning/Intelligence					
j. Robotic process automation					
k. Visual Internet of Things					

Systems and software adoption

9. Indicate the systems and software being used by your firm in increasing productivity (You may tick more than one)
- Analytic & reporting software (e.g., KNIME, Tableau, R, SAP-HANA)
 - Chatbot (Cloud Messaging)
 - Enterprise content management
 - Enterprise resource planning (e.g., SAP, Oracle)
 - Human resources software
 - Machine learning and artificial intelligence
 - Office productivity tools (e.g., MS Office, Outlook, MS Excel, MS Access)
 - Planning and scheduling
 - Project management software
 - Robotic process automation
 - Sales & customer management
 - Software (e.g., UBS, SQL, QuickBooks)
 - Time cost management software (e.g., Superior Time cost & Time Sheet)
 - Others, please specify _____

Computer-Assisted Audit Technique (CAAT) usage

10. Indicate the computer-assisted audit technique (CAAT) being used by your firm in increasing productivity (You may tick more than one)
- Visualization tools (e.g., Tableau, QlikView, Qlik Sense, Power BI)
 - Audit management software (e.g., Audit Express – AXP, CCH)
 - Generalized audit software (e.g., ACL, Arbutus, IDEA, EAS)
 - Statistical package (e.g., SAS)
 - Specialized / Customized audit software (proprietary to the firm)
 - Business intelligence (e.g., Crystal Report, Business Objects)
 - Others, please specify _____

Technological preparedness

11. Using the scale below, please rate your technological preparedness by ticking ONE response to indicate your level of agreement with each of the following statements.

Determinants	Fully disagree 1	2	3	4	Fully agree 5
Technology					
a. My firm is aware of the current technology environment					
b. My firm is ready for technology adoption to its operation					
c. My firm is ready to take on the challenges associated with technology adoption and implementation					
d. My firm uses information technology tools and platforms					
e. My firm uses IT systems and software to improve productivity					
Manpower skills and knowledge					
f. My firm's employees utilize relevant technology that can be easily accessed for solving workplace problems					
g. My firm's employees are familiar with technological resources available in the firm that can facilitate their work					
h. My firm's employees are tech savvy and have sufficient technology skills to support their work					
i. My firm's employees feel confident in their ability to integrate multiple technologies in the performance of their job					
j. My firm's employees have sufficient knowledge and skills in as well as experiences from using technology					
Investment in technology					
k. My firm invests in information technology infrastructure to improve organization's processes					
l. My firm acquires computer infrastructure to keep up with technological trends and changes					
m. My firm capitalizes on network and connectivity infrastructure					
n. My firm provides an adequate budget for human skills enhancement					
o. My firm allocates a certain percentage of annual revenue for technology upgrading					

Attitude

12. Please rate the following statements from 1 for Fully disagree to 5 for Fully agree

Statements	Fully disagree 1	2	3	4	Fully agree 5
a. My firm will benefit from adapting to the technological advances in accounting					
b. My firm can create more value as they adapt to the technological advances in accounting					
c. My firm will find it rewarding to adapt to the technological advances in accounting					

Subjective norm

13. Please rate the following statements from 1 for Fully disagree to 5 for Fully agree

Statements	Fully disagree 1	2	3	4	Fully agree 5
a. Management of the firm thinks that the profession should adapt to the technological advances in accounting					
b. My firm's employees think that the profession should adapt to the technological advances in accounting					
c. Management believes that regulators of the profession think that the profession should adapt to the technological advances in accounting					

Perceived behavioural control

14. Please rate the following statements from 1 for Fully disagree to 5 for Fully agree

Statements	Fully disagree 1	2	3	4	Fully agree 5
a. It is easy for my firm's employees to adapt to the technological advances in accounting					
b. My firm's employees have the available organizational resources to adapt to the technological advances in accounting					
c. My firm's employees have the available financial resources to adapt to the technological advances in accounting					
d. My firm's employees are provided with accessible continuing professional development programs related to the technological advances in accounting					

Intention to engage

15. Please rate the following statements from 1 for Fully disagree to 5 for Fully agree

Statements	Fully disagree 1	2	3	4	Fully agree 5
a. My firm's employees are committed to adapt to the technological advances in accounting					
b. My firm's employees are planning to adapt or continue adapting to the technological advances in accounting					

Expected benefits

16. Please rate the following statements from 1 for Fully disagree to 5 for Fully agree

Determinants	Fully disagree 1	2	3	4	Fully agree 5
a. Better planning and controlling increase					
b. Higher customer satisfaction					
c. Greater agility (changes in business strategy & investment in systems)					
d. Human skills enhancement					
e. Productivity and efficiency					
f. Faster turnaround / response time					
g. Encourage a desired culture (do the right thing right)					
h. Greater flexibility					
i. Others, please specify:					

Challenges to adoption of technology

17. Please rate the following statements from 1 for Fully disagree to 5 for Fully agree)

Statements	Fully disagree 1	2	3	4	Fully agree 5
a. Lack of standards, regulations or certifications unclear economic benefits					
b. Insufficient knowledge of employees					
c. Insufficient skilled employees					
d. High investment costs					
e. Cultural readiness					
f. Lack of support from government					
g. Unresolved questions concerning data security					
h. Unclear legal situation concerning the use of external data					
i. Others, please specify:					

Thank you for your participation in the survey.

Appendix 4: Brunei

Dk Hj Siti Khadijah Pg Hj Mokin,
Brunei Darussalam Institute of Certified Practising Accountants

Adeline Lau Pik Wen, Brunei Darussalam Institute of Certified Practising Accountants

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Nanny Dewi, Universitas Padjajaran

Raditya Mahendrajaya, Universitas Trisakti

Background

For Brunei, the number of respondents is very limited. For each respondent category, we have only one respondent to our study.

The analysis will have to be read with care due to the limited sample size.

1. Professional Accountancy Organization

The Brunei Darussalam Institute of Certified Practising Accountants (BICPA) is a Non-Profit Organisation established in 1987 to provide an entity for accountants to support and advance the status and interests of the accountancy profession in line with the aims and objectives of the Government of His Majesty the Sultan dan Yang Di-Pertuan Negara Brunei Darussalam.

It is managed and run on a voluntary basis by a group of professionally qualified accountants. The membership of BICPA falls into one of several categories, namely, Honorary, Associate, Affiliate and Provisional.

An interview was conducted with the President/senior management of BICPA. The interview provides valuable insights into the state of the accountancy profession in Brunei regarding technological adoption and awareness.

BICPA, with its membership size of less than 10,000 and a staff count of less than 50, currently lacks a formal digital technology roadmap for the accountancy profession.

However, there is growing awareness among BICPA members about various technological advances, with Artificial Human Assistance, Artificial Intelligence, Cloud Computing, and Cybersecurity being the most familiar technologies, scoring around 4 on a scale of 1 to 5.

On the other hand, technologies like Augmented Reality, Blockchain, Data Analysis/Big Data, and Machine Learning/Machine Intelligence are not as well-known among members, scoring around 2-3 on the awareness scale.

This highlights the need for increased education and training to enhance members' understanding of these technologies and their potential benefits to the accountancy profession.

It is evident that utilization of these technologies is relatively low among BICPA members.

While larger firms may be utilizing advanced applications for data analysis, smaller firms seem to face challenges in fully adopting and integrating technology into their practices.

This suggests the importance of providing accessible resources and professional development programmes to support members in embracing digital technology and leveraging it to its full potential.

Despite the challenges, there is consensus among BICPA members, including the interviewees, other PAO leaders, and regulators, that the accountancy profession should adapt to technological advances.

However, commitment levels and available resources may require further attention to facilitate a smooth and effective transformation.

The interview also highlights that BICPA members are optimistic about the benefits of technological advances in accounting.

They believe that such advances will enable them to create more value and make it rewarding for them to pursue digitalisation in the profession.

However, the interviewees acknowledge that adapting to technological advances may not be easy for smaller or local firms, which may require additional support and resources to overcome the challenges.

In conclusion, the interview provides valuable data on the current state of technological adoption in the accountancy profession in Brunei.

While awareness about certain technologies is relatively high, there is room for improvement in educating members about less familiar technologies and promoting utilization across the profession.

Encouraging commitment, providing accessible resources, and fostering a culture of adaptability are essential to effectively integrate technological advancements and unlock the benefits they offer for the accountancy profession in Brunei.

As the profession continues to evolve and the use of technology becomes more widespread and intensified, a collaborative effort among BICPA, its members, other PAO leaders, and regulators will be crucial to ensure a smooth and successful transition towards a technologically advanced accounting landscape in Brunei.

Table 1: Interview with BICPA Representative

1. What are the perceptions and views on the changes in the accountancy profession arising from new technology?
A. The use of technology enhances processes and workflow creates greater efficiency. Use of technology, especially data analytics, is crucial to understanding the data better, to make more meaningful decisions.
2. What should the accountancy profession do to navigate this technology adoption?
A. Continue to upskill and evolve. With the spread of COVID, we have seen drastic changes in the profession and its ability to move quickly into a more digital environment.
3. What are the new technologies needed for the future practice of the accountancy profession?
A. It depends on the changes that are going to take place.
4. How should accountants be equipped with these new technologies?
A. To upskill digitally and make use of technology to their advantage, instead of being afraid of it.
5. How should the stakeholders work together to address this technological challenge?
A. Continuous upskilling and staying flexible

2. Accountancy school of institutions of higher education

a. Demographics of the respondents

There is only one respondent from Universiti Brunei Darussalam (UBD). It is a public university and was established in 1989. The number of students in total is around 2,600.

The respondent is the programme leader for accounting and finance in UBD School of Business and Economics.

Actually, we also interviewed Polytechnic Brunei. They perceive that technology adoption is challenging because of the many obstacles prevailing such as lack of expertise, lack of budget, among others.

b. Awareness, competencies, importance and incorporation of selected emerging technologies

Figure 1 shows the level of awareness of the respondents of the selected technologies. The selection is based on a literature review and industry sensing what are the more popular technologies used in the accountancy industry.

The respondent chose Visual Internet of Things, data analysis/big data, cybersecurity, and cloud computing as the emerging technologies with the highest level of awareness in the profession.

Figure 1: Level of awareness of the selected emerging technologies
(1 – Not at all and 5 – Fully aware)

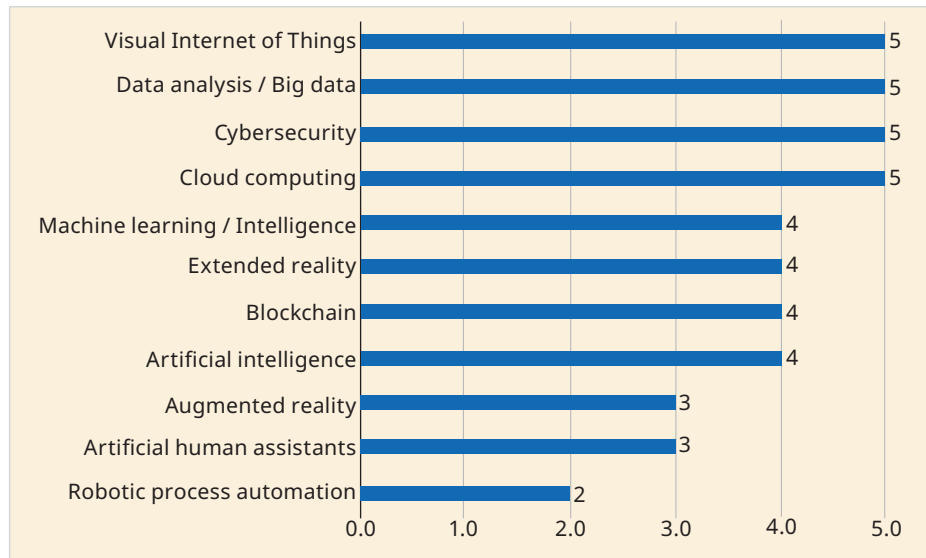
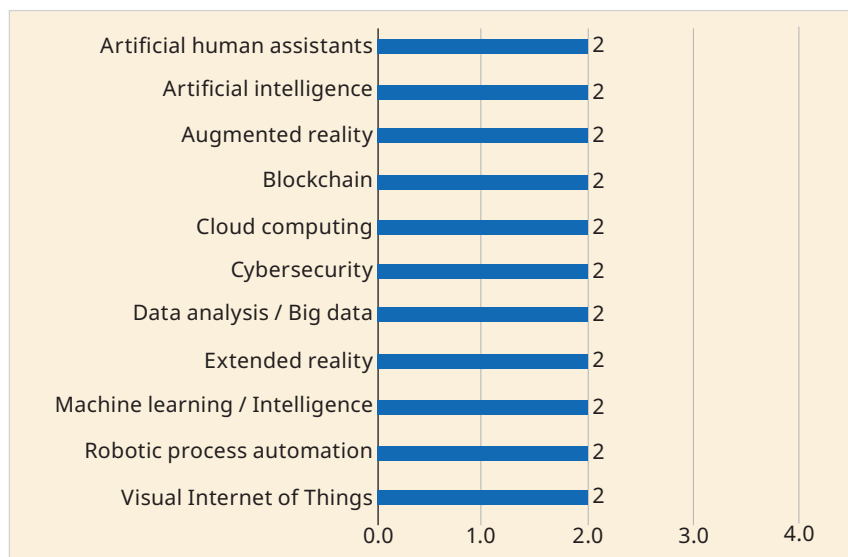


Figure 2 shows the response for the level of competency in the selected emerging technology.

The respondent is of the view that the level of competency is the foundation for the use of all technologies.

Figure 2: Level of competency in the selected emerging technology
(1 – None, 2 – Foundation, 3 – Intermediate, 4 – Advanced)



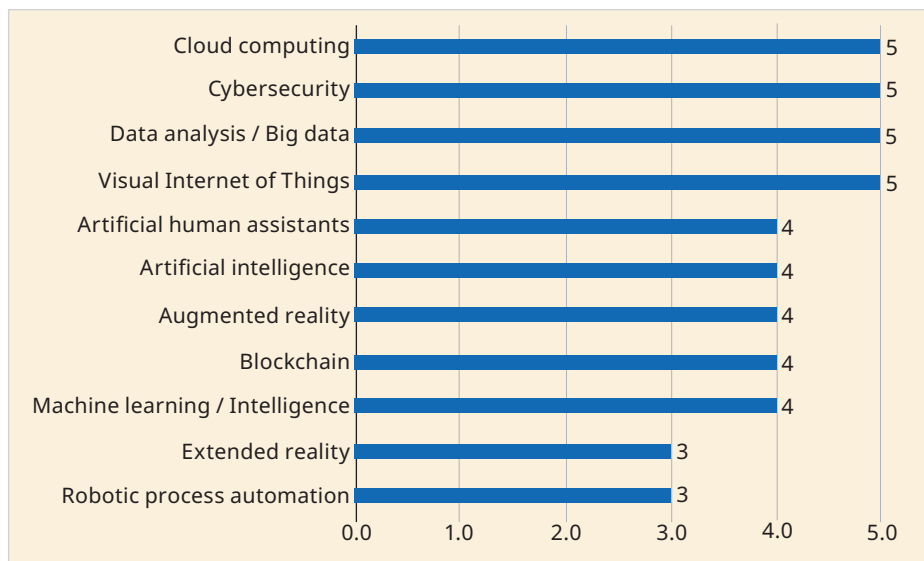
The respondent was further asked about which emerging technologies are crucial to be incorporated into their accountancy courses.

Figure 3 summarizes the respondent's view of the level of incorporation of technologies into their current accountancy curriculum.

The respondent views that the most crucial emerging technologies that must be incorporated into courses are Cloud Computing (5), Cybersecurity (5), Data Analysis/Big Data (5) and Visual Internet of Things (5) whereas the least crucial are Extended Reality (3) and Robotic Process Automation (3).

Figure 3: Level of importance of the selected emerging technologies to be incorporated into accountancy courses

(1 – Least crucial and 5 – Most crucial)



The respondent was asked about the implementation of emerging technologies in the accountancy curriculum.

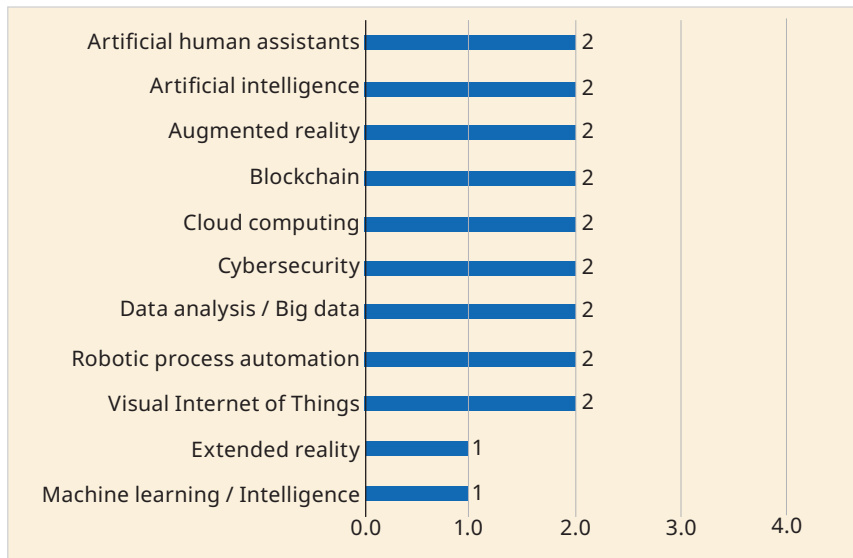
The response relating to the various technologies is not higher than the foundation level and this is shown in Figure 4.

Extended Reality and Machine Learning have not been adopted yet.

The respondent is of the view that in Brunei, emerging technologies are difficult to implement because of the lack of human, capabilities and the low demand from the industry.

Figure 4: Level of incorporation of the selected emerging technologies into the accountancy curriculum

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

**c. Software used in teaching technology courses**

The respondent was also asked to provide the list of software that their school uses to teach their courses. Table 2 summarizes the softwares used:

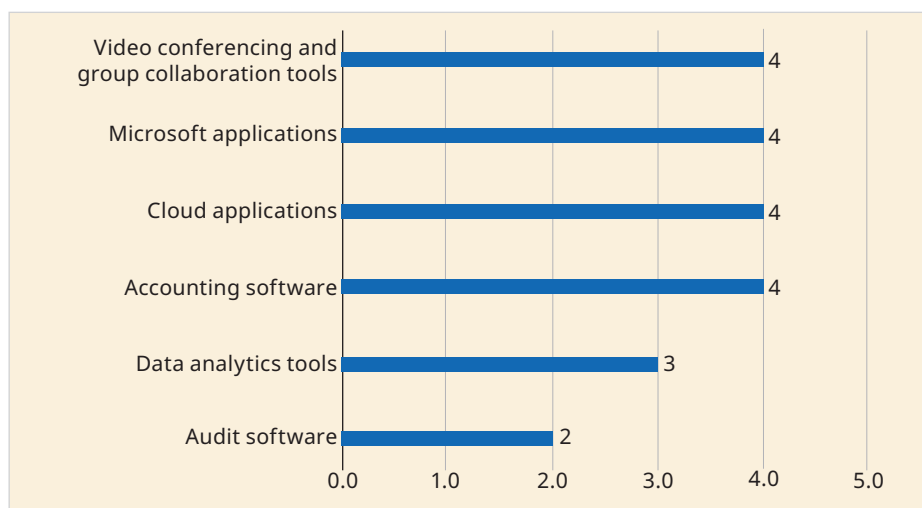
Table 2: Software used

Technologies	Software
Artificial intelligence	ChatGPT
Artificial human assistants	No mention
Augmented reality	No mention
Blockchain	Ethereum
Cloud computing	Google
Cybersecurity	No mention
Data analysis / Big data	Tableau
Extended reality	No mention
Machine learning / intelligence	No mention
Robotic process automation	No mention
Visual Internet of Things	No mention

The respondent was also asked how much of a selected suite of technology tools is currently used or had been embedded in the accountancy curriculum in the last 3 years.

The response is summarized in Figure 5 below. It seems like most of the tools are favoured except for data analytics (3) and audit software (2).

Figure 5: Technology tools used in accountancy curriculum
(1 – Never used and 5 – Frequently used)



The key barrier to incorporating technologies into the accountancy curriculum is the lack of experts in the emerging technologies. The respondent confirms that IHLs need training on how to integrate technology in the curriculum. When asked about how technology should be taught in the accountancy programme, the preferred mode mentioned is the hybrid approach. The respondent perceives that technology should be taught by IT experts. It is expected that students would need to know how to integrate technology into their accountancy work. Therefore, the best way to teach technology is to embed technology into the accountancy curriculum and assign both an accounting lecturer and an IT expert to teach the course.

The respondent was asked: What is the best approach to embedding the emerging technologies into the accountancy programme? The response is that the preferred approach is to integrate technology material into the accountancy course curriculum.

Finally, the respondent was asked the stage of technology adoption in the accountancy curriculum, and the response was around 70%.

To summarize, for Brunei Darussalam University, we can conclude that the university is aware of emerging technologies and it perceives technology as very important for its students. However, the key obstacle to integrating technology into the curriculum is the lack of IT experts. The way to teach technology is to embed the technology materials into accountancy courses.

3. Practitioners

There was only one respondent in the practitioner category. The response was obtained in an interview, and is presented below.

Table 3: Responses

1. What are the perceptions and views on the changes in the accountancy profession arising from new technology?
A. Changes are inevitable, and all stakeholders will have to embrace and adapt.
2. What should the accountancy profession do to navigate this technology adoption?
A. Understand, anticipate and be prepared for the adoption of technology.
3. What are the new technologies needed for the future practice of the accountancy profession?
A. Automation, AI, data analytics, and technologies that enable remote working.
4. How should accountants be equipped with these new technologies?
A. Ongoing training.
5. How should the stakeholders work together to address this technological challenge?
A. Ongoing collaboration through the relevant associations.

Conclusion for practitioners

The level of technology awareness by practitioners is high.

The respondent confirmed that accountants should raise their competency through technology.

She cites some emerging technologies that will be needed by accountants, such as data analytics.

Practitioners are convinced that if accountants remain reluctant to pursue digitalisation or ignore technology, they will become redundant and their roles taken over by those who are digitally savvy.●

Appendix 5:

Cambodia

Monileak Siem, National University of Management, and
(Corresponding author: siemmonileak@num.edu.kh)

Kirirom Cheav, National University of Management

I. Introduction

Over the last two decades, considerable advances in information technology (IT)¹ have been made (Venkatesh et al. 2012²).

Through the adoption and adaptation of information technologies, these improvements have enabled more productive and efficient processing of information and data.

The domains affected include economics, accounting, auditing, and corporate information and decision.

However, it was not until recently that developed and emerging countries have begun to notice a dramatic increase in digital adoption and adaptation on individual, government and corporate levels.

The digital economy³ has been regarded as a component of the global trend towards industrial revolution 4.0 since the advent of the Internet and the modernization of information and communication technology (ICT).

Cambodia expressed its interest in developing its digital economy beginning in 2018 with the introduction of the Rectangular Strategy and the goal to transform Cambodia into a digital economy by 2023.

The goal is that a digital economy can enrich the range of opportunities and move Cambodia to higher stages of development.

Discerning the urgency of diversifying Cambodia's economy and the significance of transforming the country into a digital economy, the Royal Government of Cambodia (RGC) has prepared and readily developed the Cambodia Digital Economy and Society Policy Framework 2021-2035⁴, Cambodia Digital Government Policy 2022-2035⁵, and Cambodia's Science, Technology and Innovation Roadmap 2030⁶.

1 According to Kaplan et al. (1998), Venkatesh et al. (2003), Kwon & Vogt (2010), information technology (IT) is a broad term for technology, both tangible and intangible, that makes it easier to gather, process, store, deliver, and share data and other digital content with the aim of providing relevant information and data for directing, evaluating and decision-making.

2 See: Venkatesh et al. (2012), Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology.

3 According to World Bank (2019); Heeks (2016); Pohjola (2002); Tapscott (1996), the term digital economy has grown in recognition due to the emergence of business and the adoption of internet and technology contributed to increasing organization's competitiveness since the late 1990s, and it highlighted the relationship between the new economy, new business, and new technology, and how they enable one another as parts of a digital economy.

4 See: Cambodia Digital Economy and Society Policy Framework 2021-2035, Supreme National Economic Council (2021).

5 See: Cambodia Digital Government Policy 2022-2035, Ministry of Post and Telecommunications (2022).

6 See: Cambodia's Science, Technology and Innovation Roadmap 2030, Ministry of Industry, Science, Technology & Innovation (2022).

This is in light of the challenges of time constraints and pressures introduced by the COVID-19 outbreak.

These framework, policies and roadmap were framed so as to take full advantage of the development of digital technology, and curate a long-term vision for Cambodia to build a vibrant digital economy and society.

This is in response to the RGC's ambitious longer-term aspirations, which is to have an upper middle-income economy by 2030 and a high-income country by 2050⁷.

A thorough grasp of the organizational context within which technology operates, encompassing both human and technological components, is necessary for the fruitful adoption of technology, information technology, and digitalization.

The purpose of this study is to examine, from the perspectives of Cambodia, how digital technology and digitalization are used in accountancy schools, accountancy and auditing firms, and the accountancy profession, as well as how ready these institutions are to accept technological change in the context of a new economy⁸.

Digital transformation is the process of adopting or capturing and maximizing the benefits of advances in Information and Communication Technology (ICT)⁹ and digital technology.

This is in order to increase productivity and economic efficiency, boost national economic growth, and build a civilized society in which digital citizens can benefit from the use of digital services.

The usage of digital services must result in high inclusiveness, reliability, and trustworthiness while maintaining national identity and culture¹⁰.

This study emphasizes and pays special attention to the impact of technology adoption, transformation, and disruption on accountancy schools, professionals, and practitioners as Cambodia's economy transitions to become a digital economy.

It highlights how government, the private sector, and market-related factors have influenced Real-World Applications¹¹ in the context of digitalization as seen in Figure 1.

7 See: Cambodia Industrial Development Policy 2015-2025, Market Orientation and Enabling Environment for Industrial Development, Approved by Council of Ministers at Its Plenary Meeting on 06 March 2015; and Cambodian Vision 2050 presented by Supreme National Economic Council (2022).

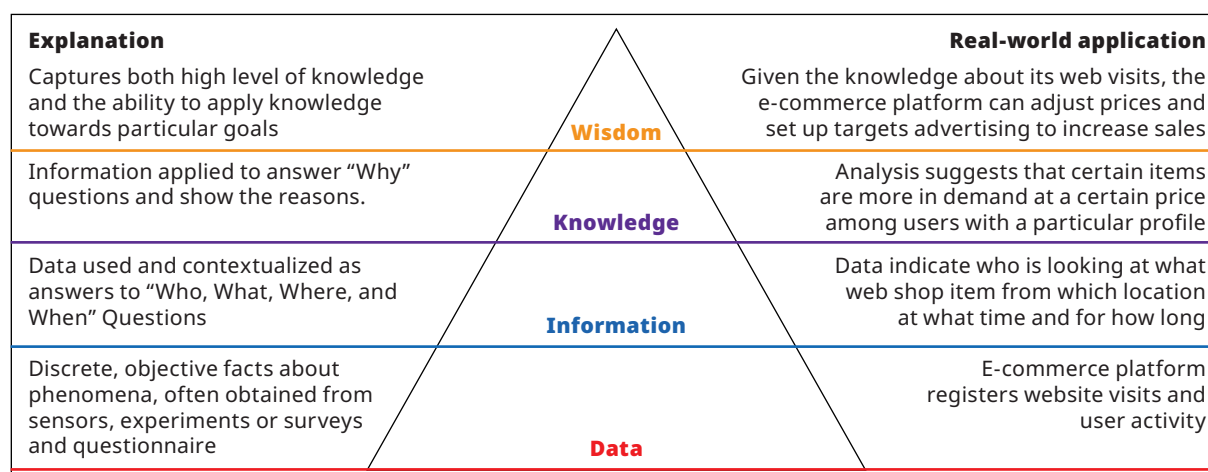
8 According to OECD (2013); European Commission (2014); Mesenbourg (2001); Kling & Lamb (2000); Bukht & Heeks (2017); Lane (1999), the term new economy refers to the digital economy, internet economy or web economy and/or platform-based economy, which employs information technology to influence production and consumption as well as the development and innovation, adaptation, output and market, and consumption of goods and services and which can be understood as an economy based on digital technologies, and can impact other sectors of the economy and society.

9 See: Policy on Higher Education Vision 2030 and Capacity Development Master Plan in Educational Sector 2020-2024; Policies and Strategies on Information and Communication Technology in Cambodia in 2004, Ministry of Education, Youth and Sports.

10 See: <https://education-profiles.org/eastern-and-south-eastern-asia/cambodia/~technology>.

11 See: Unctad (2014), United States Chamber of Commerce Foundation.

Figure 1: The pyramid of data and the trends in the data-driven digital economy



Source: Unctad (2014 & 2021)

According to Unctad (2019-2021), the growing digitalization of the economy and society is dramatically altering how individuals work, act and interact.

The exponential growth and development of digital technology and information technology and machine-readable information¹² or digital data over the Internet and digital platforms has been one of the distinguishing characteristics of many digital transitions and innovations.

These are rapidly evolving digital technologies, including data analytics, artificial intelligence (AI), blockchain, the Internet of Things (IoT), cybersecurity, cloud computing, robotic process automation, extended reality, augmented reality, and artificial human assistants as well as visual Internet of Things, machine learning and other Internet-based services. These digital technologies have become a critical economic resource.

The COVID-19 pandemic has hastened digitization, as more and more people maintain their operations through Internet channels to the greatest extent possible due to the physical lockdowns imposed during the pandemic.

With economic growth shrinking and going into negative territory in 2020 as a result of the COVID-19 pandemic, Cambodia saw a negative impact on economic activities, structural challenges and impulse shocks in both the short and medium term. The RGC has an important role to play in restoring, promoting, and developing a new growth model that is highly responsive and resilient to future changes in economic architecture and socio-economic welfare.

Digital technology has been at the heart of and is a key driving force of all parts of the manifold economic and social activities, efficiency, and productivity of operations. Collectively, these have been typically referred to as the digital transformation of daily lives.

Digital technology also promotes economic diversity, and creates jobs targeted at reducing poverty and narrowing social inequality. The digital sector can play three key

¹² Everything on the Internet is numbers or data. 0 or 1 represents a bit of machine-readable information, which is the smallest piece of information that is digitally readable; these can be seen as virtual representation of real life.

roles on the national socioeconomic scene such as new growth enabler¹³, driving force¹⁴ to support and sustain other sectors in the medium and long term, and becoming a value-added driver of all sectors¹⁵.

At the same time, technology and digitalization may lead to some negative outcomes, such as changes in business practices, the loss of low-skilled jobs or jobs that do not meet the sector's needs¹⁶, changes in culture that are at odds with customs and traditions, lifestyle changes that allow people to be more independent or even connected, loss of privacy due to the management and misuse of personal data, and problems with security and public order in both the public and private sectors.

According to Davis (1993); Abdul Gader et.al. (1996), social and cultural views are important considerations. Abdul Gader et.al. (1996); Carnoy (1997) suggested that significant obstacles to the spread of modern technologies in developing nations include a lack of highly competent management and a flexible, self-assured labour force. Many challenges and issues are related to human resources and this is one of the biggest obstacles to technology adoption in organizations.

According to Unctad (2021) data, information, knowledge and wisdom gaps were mainly discovered in the digital era that examined the use of technology in both public and private bodies.

Konrad-Adenauer-Stiftung (KAS, 2019) conducted a survey of 61 Cambodian enterprises which reveals three new skill kinds that are currently lacking: 49% of companies choose “Analytics”, which is the ability to create, format, modify, and represent data using sophisticated spreadsheet formulas and functions to extrapolate trends and patterns; 82% choose “Online Collaboration”, which entails using tools such as cloud storage, productivity applications, calendars, web meetings, and learning environments; and 90% choose “Managing Online Information”, which is the ability to find, identify, evaluate, and communicate online information.

Currently, 82% of employees use Microsoft Office, the Internet, and email often at work, whereas less than 40% utilize video-conferencing, online storage, or productivity tools, etc.

Cambodia's business sector is viewed as the primary engine driving the economy, propelling the country into developed status.

The “Law of Commercial Enterprises” and the “Law on Corporate Accounts, their Audit, and the Accounting Profession” established the country's basic criteria for accounting, financial reporting, and auditing in 2002.

The latter, commonly known as the Accounting Law, requires all businesses to utilize an accounting system based on international accounting standards. The leading

13 See: Harald Øverby & Jan Arild Audestad (2021): Introduction to Digital Economics, Foundations, Business Models and Case Studies, Second Edition; <https://doi.org/10.1007/978-3-030-78237-5>.

14 See: Asal Mustfa Taleb Al-Odat (1998); Abd Rahman (2008): The use of technology becomes a primary driving force.

15 According to the World Bank (2019), digital technologies promote economic development, innovation, and the economy as a whole and a variety of sectors, including digital entrepreneurship, e-commerce, FinTech, the ICT sector, and the digital transformation of industries.

16 See: Unctad (2021), Cross-border data flows and development for whom the data flow 2021; Recent trends in the data-driven digital economy.

institutes of higher education or universities must consider meeting the critical demand for accountancy professionals by preparing and updating courses that qualify students as highly specialized accountants and experts in finance and auditing to ensure that business organizations comply with international standards and regulations.

The end result is that work will be more productive, efficient, and effective. This is especially true in the financial sector. Graduates can work as auditors, financial analysts, business consultants, chief financial officers, chief executive officers, tax consultants, and other related roles in addition to accountants

The study has been divided into three parts to achieve its objective.

Part 1 describes the Audit and Accounting Professionals of the Kampuchea Institute of Certified Public Accountants and Auditors (KICPAA)¹⁷ and their roles in setting the requirements for legal individuals and entities seeking membership to the accountancy and auditing professions. KICPAA is also responsible for maintaining a register of those legal individuals and entities that are legitimately qualified to practise as accountants and auditors.

Part 2 explores the history of Cambodia's public and private universities, institutes and/or institutions that grant degrees in accountancy, as well as other accountancy schools.

Part 3 focuses on accountancy practitioners, including local and foreign accountancy and auditing firms that have been operating and practising in Cambodia.

Due to the nature of the study and the various stages of information technology and digital technology adoption in Cambodia in the field of accountancy amongst the universities, practitioners and professionals, a survey approach was used.

In-person interviews and questionnaires are suitable approaches for gathering data. The ability to engage directly with participants and learn more about the situation and issue is one key benefit of these techniques.

To get an update on the growth of the technology and digitalization ecosystem, the study gathered data from primary and secondary sources in two phases: in the first quarter of 2023, and then again, in the second quarter of 2023.

Public and private academic institutions, universities, institutes, accountancy and auditing firms, and KICPAA were surveyed in the study's initial phase to gather primary data and information.

Based on in-depth inputs from previous contacts and interviews with significant stakeholders, such as universities, accountancy and auditing firms, and selected targeted people, the preliminary report from the first phase was revised in the second phase.

Analysis was done on the data produced by the quantitative approach's descriptive statistics. Thereafter, qualitative interviews were used to supplement the survey data and investigate a variety of concerns collected by the survey for quantitative analysis.

17 The Kampuchea Institute of Certified Public Accountants and Auditors (KICPAA) was established in accordance with the Law on Corporate Accounts, Their Audits, and Accounting Profession (2002) and the Law on Accounting and Auditing (2016) of the Kingdom of Cambodia. KICPAA is the statutory body and regulator of the accounting profession in Cambodia. The Institute was established for the purpose of defending the public interests and the profession's interests; expanding professional capacity, enhancing adherence to standards, professional codes of conduct, rules, and regulations; and developing and supervising professional accounting education initiatives. <https://www.kicpaa.org/>

II. Background

In ASEAN, business digitalization has become a rapidly expanding phenomenon. By designating it as one of the top priorities for the updated Rectangular Strategy for Growth, Employment, Equity and Efficiency, the Cambodian government actively supports the preparation for and implementation of the digital economy and Industrial Revolution 4.0.

But it will be a long journey for Cambodia to fully embrace the new digital economy. The government needs to invest in infrastructure, such as promoting e-governance, improving people's digital literacy and abilities, and providing the right regulatory framework, among others.

These developments in Cambodia are already having effects on job growth and the composition of the labour market. The digital revolution will unavoidably enable a new model of economic growth to achieve the primary goal of the government to transform the country into a digital economy by 2023.

According to the Ministry of Economy and Finance, the Cambodian economy has grown at a rate of roughly 7% annually over the past 10 years.

However, it severely slowed down during the COVID-19 pandemic, and the nation is now embracing digitalization as a means of sustaining economic growth and avoiding stagnant development. However, according to Schwab (2019), Cambodia continues to be among the weaker competitive nations regionally and globally, particularly in ASEAN.

As long as digital technology and digital utilization continue to develop, it will pose a significant challenge to institutes of higher education and universities, particularly after COVID-19.

This is especially true when the world is transitioning to a new normal and the institutes of higher education and universities must not be left behind. After several years of steady and spectacular economic growth, Cambodia must harvest the economic opportunities presented by the digital revolution of the accountancy profession in higher educational institutions.

An increasing number of university students are quickly absorbing technology and digital technology. This is made possible by a rapid rise in the use of cell phones and other smart devices during the COVID-19 crisis. Investment in digital technology is anticipated to aid in the diversification and scaling up of the nation's economic system.

University students frequently learn fundamental hard skills and some digital software such as QuickBooks, SPSS, STATA for statistical data analysis through classroom courses and programs and other online learning tools. To benefit from a positive demographic trend, ongoing organized investment in technology education is essential.

At the moment, effective formal teaching of many digital skills is still lacking in Cambodian universities¹⁸.

The significant results of this study which are relevant to Cambodia are emphasized in the series of ILO publications titled "ASEAN in Transformation".

These publications examine how businesses and the labour market are changing

¹⁸ See: Olga J. Skriabikova (2020): Country report Cambodia technological change induced by the digital transformation in economic sectors and changing demand for skills.

as a result of current technology trends in the region's five main manufacturing and service sectors.

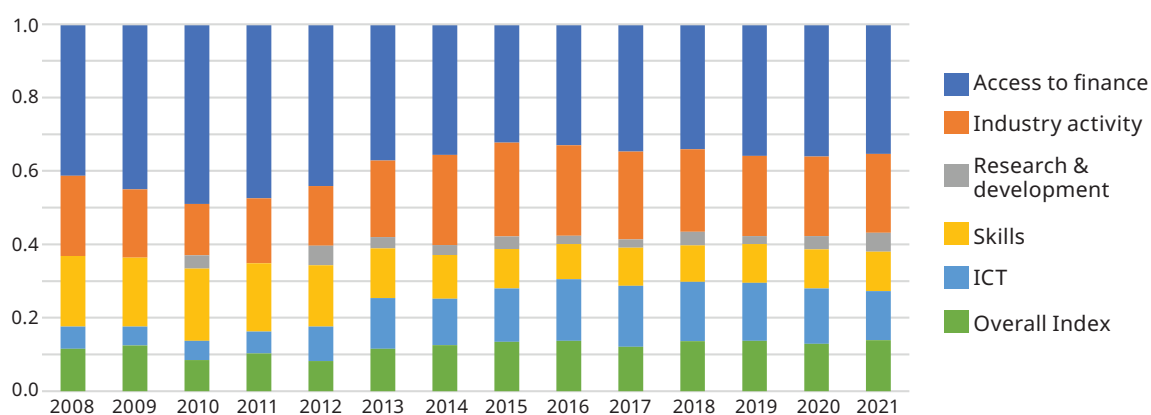
The surveys were conducted with 2,747 university and TVET students and 4,076 enterprises in the 10 ASEAN member states. Many obstacles prevent Cambodian businesses from modernizing their technology. Due to lower education levels in Cambodia as compared to the other ASEAN countries, the result shows severe skills gaps in Cambodia.

According to businesses in Cambodia, technology does require an upgrade. This might be because technology is regarded as being expensive and Cambodian wages are comparably lower and thus there is no need to pivot using technology as manpower is cheap. However, given that technology prices are falling and labour costs are rising, these views could change soon¹⁹.

Cambodia was ranked 104th out of the 131 economies in the Network Readiness Index (NRI 2022)²⁰. According to Unctad (2023), only a few countries are currently developing frontier technologies. The index is based on five components: ICT deployment, skills, R&D activity, industry activity, and access to funding.

Figure 2 presents Cambodia's frontier technology readiness and desire to embrace digital transformation in all facets of the economy.

Figure 2: Frontier Technology Readiness Index for Cambodia 2008-2021



Source: Author's calculation and Unctad (2023)

It is anticipated that a thorough digitalization of the economy will usher in digital innovation, encourage universities to adopt technological changes, open up job opportunities, promote economic growth, and alter Cambodia's economic environment. Despite the many advantages and benefits of digital technology though, there could also be some drawbacks for those who use digital technologies.

However, there has not been much empirical research on the possible effects of

19 See: ILO (2017): Cambodia Country Brief: ASEAN in transformation: How technology is changing jobs and enterprises.

20 The Network Readiness Index (NRI) is one of the leading global indices on the application and impact of information and communication technology (ICT) in economies around the world. The NRI Report (2022) maps the network-based readiness landscape of 131 economies based on their performances in four different pillars: Technology, People, Governance, and Impact. Each of these pillars is itself comprised of three sub-pillars that are populated by a total of 58 variables.

digitalization in Cambodia, particularly on how the adoption of digital technology will affect accountancy schools, accountancy firms, and the accountancy profession in the near future.

According to UNCTAD (2019), Bukht & Heeks (2017), the new economy has a favourable impact on job creation, growth and productivity, and innovation. Over the past 10 years, Cambodia's information technology, Internet and digital industry has experienced significant growth. RGC is mainly responsible for creating and implementing digital technology-related policies and initiatives to direct the development of the digital economic sector in Cambodia. This is done by crafting relevant policies and providing guidance and an implementing mechanism for the successful development and enhancement of the digital sector.

1. National Accounting Council and Kampuchea Institute of Certified Public Accountants and Auditors (KICPAA)

In Cambodia, all companies are required to comply with Cambodia International Financial Reporting Standards (CIFRS) which are based on International Financial Reporting Standards (IFRS). The National Accounting Council is responsible for developing and improving accounting standards in Cambodia by adopting the IFRS.

The Law on Accounting and Auditing was promulgated by the Royal Kram No. NS/RKM/1215/016 dated 11 April 2016. This law sets forth certain accounting requirements. For instance, an audit shall be carried out by an independent auditor registered with the KICPAA. There is an obligation to submit annual audited financial statements.

KICPAA is a vital force for matters ranging from strengthening professional accounting ethics to sustaining and ensuring the confidence of the public about accountancy professionals.

To fulfil its obligations and responsibilities as the national professional body of accountancy in Cambodia, KICPAA must elevate its reputation and increase public recognition and awareness of the profession in order to attract future-ready and able members such as accountants, auditors, public institutions, enterprises and individuals. Currently, audit firms registered officially as members with the KICPAA total 52 firms.

2. Higher education institutions (HEIs)

Since the late 1990s and the signing of the Paris Peace Accord, the Cambodian government has paid specific attention and undertaken initiatives to develop higher education.

New subjects such as economics, accountancy and finance were added to the bachelor's degree programmes.

The National University of Management is the oldest and leading public university in Cambodia. It commenced as the first accountancy school in Cambodia about 29 years ago after it was founded on 18 March 1983 as the Institute of Economics.

The first accounting class and programme was introduced in 1994 as a four-year course. As the education landscape has advanced over the years, the accountancy degree is now offered by both public and private universities or institutes across Cambodia.

Accountancy education has significantly improved, starting with getting schools to

follow rules and principles and expanding reforms for the schools to continue to develop and employ quality resources – teachers, school management and study materials. These quality inputs are chosen based on specific criteria and standards.

The higher education reform is focused on strengthening governance, improving the qualifications of doctoral-level professors, improving the curriculum in response to industrial development, promoting research, establishing centres of excellence for assessing the quality of education.

The general situation of higher education in Cambodia is that the quality of the programmes must meet the national minimum standards. However, schools have to strive to meet international quality standards and they would need increased investment in research and the publication of research articles, along with the transfer of knowledge and technology with the private and industrial sectors.

According to the Ministry of Education, Youth and Sports (MoEYS), there were 130 higher education institutions in Cambodia in 2022, of which 82 were privately run. These higher education institutions are under the supervision of 16 different ministries and institutions. MoEYS is in charge of 82 higher education institutions.

In the academic year 2021-2022, there were 186,658 students enrolled in both undergraduate and graduate programmes (MoEYS, 2022). There were significant increases in student enrolment each consecutive year between 2015 and 2019. In the wake of the recent slight decrease in student enrolment following peak enrolment in 2019, there is an ongoing debate about how teaching quality can be promoted in the context of digitalization and technology changes as seen in Table 1.

Table 1: Number of student enrolments 2015-2022

Year	Students enrolled		
	Bachelor	Master	Doctor
2015-2016	174,142	18,723	1,229
2016-2017	165,359	20,272	1,222
2017-2018	168,242	22,022	1,349
2018-2019	179,258	23,256	790
2019-2020	171,183	9,984	961
2020-2021	170,246	8,465	978
2021-2022	175,962	9,483	1,213

3. Accountancy and auditing practitioners

The General Accounting Plan that was issued by the Ministry of Economy and Finance (MEF) in 1993 governs the accounting system in Cambodia. The Plan contains a recommended Chart of Accounts, the list of accounts to be applied, accounting treatment, and accounting principles and guidelines for financial statement presentation.

Foreign companies in Cambodia adopt International Accounting Standards (IASs) due to the requirements of their overseas parent companies and the influence of existing international accounting firms in Cambodia. The Audit Law was passed in March 2000 and the General Provisions provided for the establishment of an independent National

Audit Authority²¹ that was responsible for executing the external auditing function of the Government. This law provides that the Auditor-General is empowered to conduct an audit of transactions, accounts, systems, controls, operations, and programmes of government institutions, in accordance with generally accepted auditing standards and government auditing standards.

This Law on Audit also provides for the establishment of an internal audit function in government ministries and public enterprises. The Internal Audit Department must report to the head of each ministry, institution and public enterprise and submit reports to the National Audit Authority. The Internal Auditing function is also established to examine and evaluate the efficiency of systems of internal controls within each institution, ministry and enterprise (ADB, 2000).

Yapa, et al. (2010) pointed out that there was no professional accounting body in Cambodia until 2002 when the promulgation of the “Law on Corporate Accounts, Their Audit and the Accountancy Profession 2002” resulted in the creation of two accountancy institutions: the National Accounting Council (NAC) and the Kampuchea Institute of Certified Public Accountants and Auditors (KICPAA).

The Big Four of the world’s largest accountancy and auditing firms have a presence in Cambodia – Deloitte, KPMG, PricewaterhouseCoopers (PwC), and Ernst and Young (EY). With multinational clients from all over the world looking to expand in the region, the Big Four are helping businesses – large and small – to navigate Cambodia’s challenging commercial and tax regulations.

Accounting and auditing are considered important components of Cambodia’s economic growth, therefore, higher education institutions (HEIs), the Ministry of Economy and Finance (MEF) and Accounting and Auditing Regulator (ACAR) are key players in developing, teaching and regulating the accountancy profession and financial reporting practices in Cambodia.

The Law on Accounting was first promulgated by Royal Kram No. NS/RKM/0702/011 on 8 July 2002, which mandates the “*organization, management, and function of the accounting system based on international accounting standards for enterprises either natural persons or legal entities to have an independent profession in the Kingdom of Cambodia*”.

In Cambodia, digital transformation refers to the adoption, capture, and maximization of the benefits of advances in information and communication technology and digital technology in order to increase production and economic efficiency. Digital transformation is the combination of digital technologies with business processes. Digital transformation has a concrete impact on accountancy information systems and the accountancy profession.

The impacts range from storing, classifying, and summarizing financial data to analysing financial statements, building the financial management and reporting system, and maintaining the system’s effective continuity. Accountants in business are back-office personnel who assist with operational duties in accordance with the business model of

21 See: Law on Audit (2000): The Law on Audit of the Kingdom of Cambodia enacted by the National Assembly on the 12th of January 2000 at its plenary approved by the session of the second legislature and entirely Senate on its form and legal concepts on the 21st of January 2000 at its second plenary session of the first legislature and was declared constitutional.

their companies. Their duties include producing timely and reliable financial statements in accordance with legislation and standards.

These digital transformations and technological changes are perceived to be critical to the accountancy profession and auditors, for them to constantly renew and improve themselves in tandem with digital advances.

Furthermore, the emerging digital technology, as well as the faster and safer operations performed by accountants necessitate a change in the profession's social image. In the process of digitalisation, the accountancy profession will be transformed by reforming itself to meet the challenges of the digital age.

Technology has the ability to automate much of the everyday compliance work performed by accountants and auditors. Accountancy firms were significantly affected by technological transformation and disruption encountered in modernizing accounting and auditing practices in response to market demand and the need to secure market position amidst intense competition. It is not surprising that the accountancy industry today has several gaps and challenges that need to be addressed by all key players and stakeholders in the context of digitalization and technological changes and disruptions.

One key reason is that robotic process automation (RPA), artificial intelligence (AI), and machine learning are harnessing the power of data to transform accounting and auditing. While the auditor of the future will employ data analytics and significantly larger amounts of information from a number of agencies, artificial intelligence (AI) in accounting will change quickly from being a tool for compliance to becoming a tool that offers advice.

With these perspectives, accountancy practitioners must be well-prepared to adopt, adapt, and transform by strengthening digital knowledge, skills, and experience, as well as staying abreast of accounting developments and having access to cutting-edge auditing technology in order to carry out their work effectively and efficiently.

The RGC has encouraged the digital economy and Industry 4.0 in its high-level policy strategies and programme in the public and private sectors, according to ADB's research as is set out in the report, "Cambodia's Ecosystem for Technology Startups (2022)".

The Rectangular Strategy IV also strongly aims to build digital infrastructure and develop the digital legal system. It promotes the "digital system in business and SMEs".

It also fosters the incorporation of digital technology into academic curricula, the training of digital skills, the promotion of entrepreneurship through a digital ecosystem for startups and businesses and so on.

III. Findings / results

Part 1: Professional Accounting Organization (PAO) – KICPAA

The survey instrument was sent to the Kampuchea Institute of Certified Public Accountants and Auditors (KICPAA).

Cambodia has only one national PAO, which is the only independent and non-profit institution in the accountancy and auditing sector in Cambodia. It was established by the 2002 Law on Corporate Accounts, Their Audits, and the Accounting Profession, and subsequently the 2016 Law on Accounting and Auditing of the Kingdom of Cambodia. KICPAA has fewer than 10,000 members. The KICPAA was formed less than 30 years ago

and functions as a professional membership body. It has a full-time staff of fewer than 50 people. The respondent referred to is a PAO board member. The Institute’s top management also participated in the survey. Further discussions with senior KICPAA members allow a more in-depth analysis of the survey responses.

According to KICPAA’s top management, the Institute does not have a digital technology roadmap for advancing the accountancy profession. However, a digital technology roadmap will be prepared and developed based on the government’s policy and regulatory frameworks – set out in “Cambodia Digital Economy and Society Policy Framework 2021-2035”, “Cambodia Digital Government Policy 2022-2035”, and Cambodia’s “Science, Technology, and Innovation Roadmap 2030” from the Ministry of Economy and Finance, Ministry of Post and Telecommunications, and Ministry of Industry, Science, Technology, and Innovation.

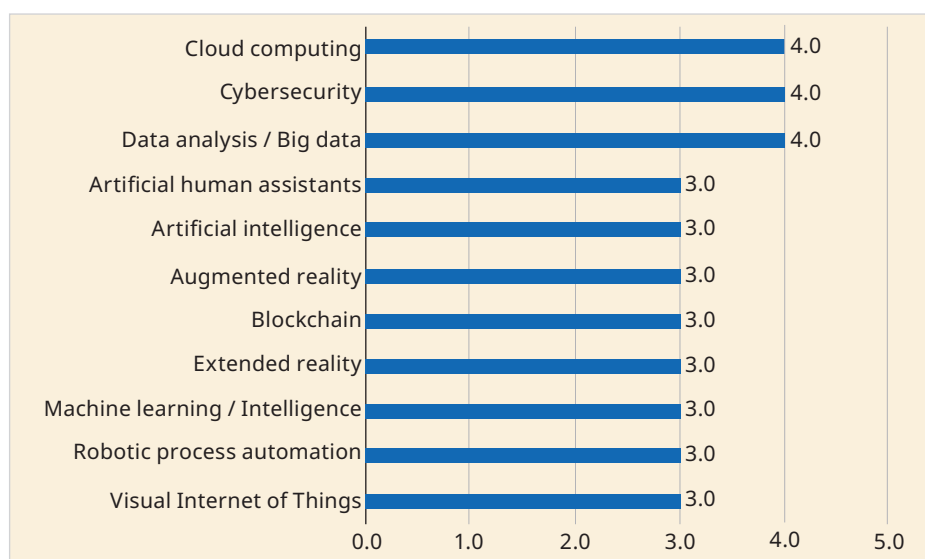
a. Technological preparedness

KICPAA was asked about its readiness for technology adoption across four dimensions: i) attitude toward technology adoption, ii) subjective belief about technology adoption in the accountancy sector, iii) perceived behavioural control over technology adoption, and iv) the accountancy sector’s intention to engage technology.

Awareness

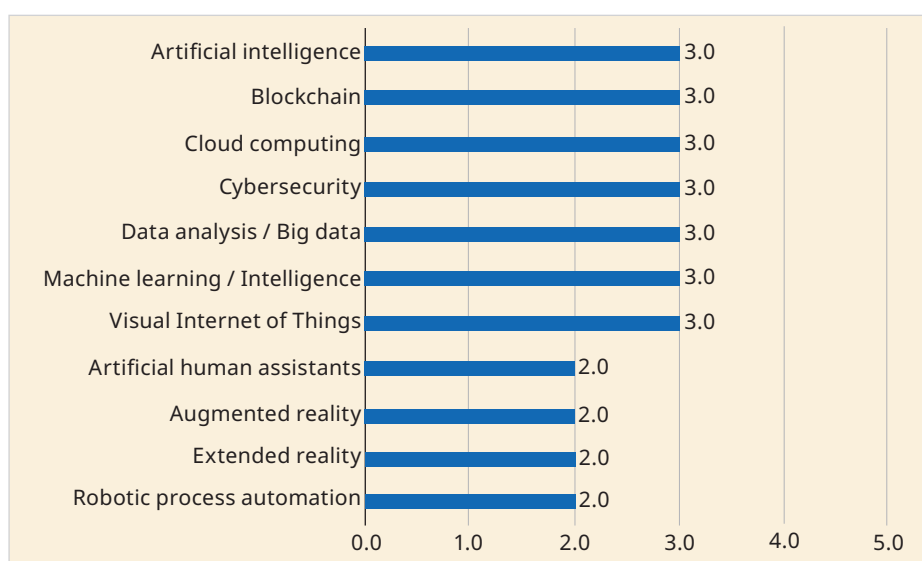
According to the respondent, KICPAA is aware of all of the developing technologies depicted in Figure 3. The respondent is moderately aware of the usefulness of adopting some emerging technologies. Artificial human assistants, artificial intelligence, augmented reality, and other technologies fall into this category with a common score of ‘3.0’. The survey also reveals that the respondent indicates a fair understanding of data analysis/big data, cybersecurity, and cloud computing, with the highest rating of ‘4.0’ for ‘attitude toward technology adoption’.

Figure 3: Level of awareness of the selected emerging technologies
(1 – Not at all and 5 – Fully aware)



Utilization

Figure 4: Level of utilization of the selected emerging technologies
(1 - Not at all utilized and 5 - Utilized all the time)

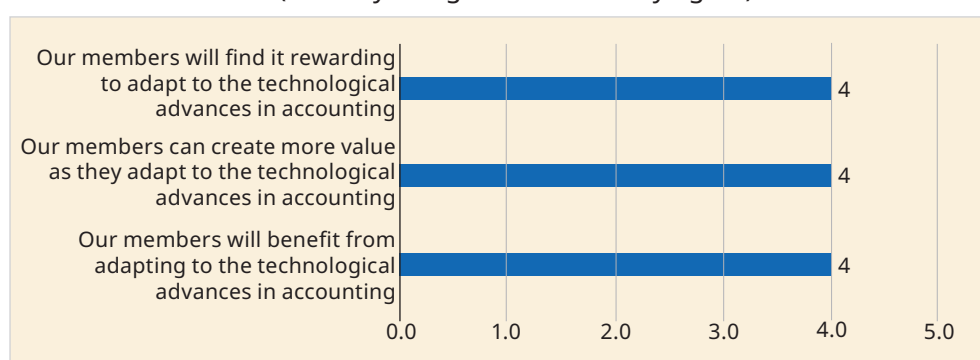


In terms of utilization, as shown in Figure 4 above, the respondent assigned a relatively low degree of utilization to certain technologies such as robotic process automation (2.0), extended reality (2.0), augmented reality (2.0), and artificial human assistants (2.0).

The respondent chose a rating of '3.0' (considered high) for the visual Internet of Things), machine learning/intelligence, data analysis/big data, cybersecurity, cloud computing, blockchain, and artificial intelligence. This brings up the point that being aware of technologies is one thing, but really using them is quite another.

b. Theory of Planned Behaviour Attitude

Figure 5: Attitude – The Theory of Planned Behaviour
(1 – Fully disagree and 5 – Fully agree)



The respondent agrees that the adoption of technology in accounting and auditing generates numerous positive outcomes, such as enhancing firm values, increasing value-added benefits or receiving customer rewards.

Figure 5 depicts the scores given for attitude to technological advances. Furthermore, the Respondent fully agrees that senior management or leaders in the KICPAA and the profession should embrace technological advances in accounting and auditing. In other words, the respondent agrees that KICPAA encourages the profession to incorporate

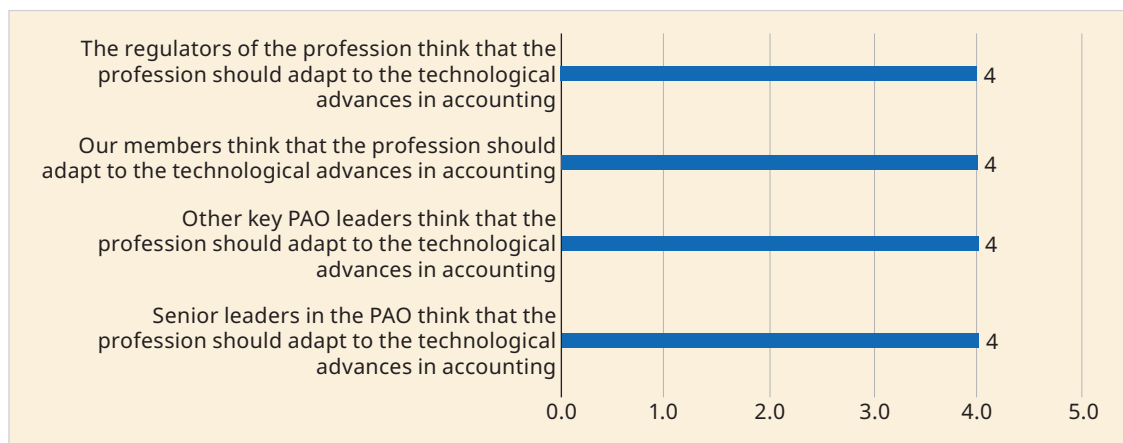
technological improvements in accounting and auditing. Unfortunately, there are still many disagreements and challenges in working with members to implement technological developments in accounting and auditing.

Subjective norm

KICPAA believes that emerging technology should be adopted by everyone. It also believes that technology is easy to understand and to learn. The user's friendly perception and belief can influence the intention to engage with technology. Accordingly, the study documents a high score for the subjective norm, perceived behavioural control, and intention to engage with technology as shown below in Figures 6, 7 and 8.

The subjective norm regarding what KICPAA's senior management, key leaders in the accountancy profession, regulators, and members think and believe about technological improvements was also asked of KICPAA. The KICPAA expressed its support for the many stakeholders adapting to technology improvements in accountancy.

Figure 6: Subjective Norm – of The Theory of Planned Behaviour
(1 – Fully disagree and 5 – Fully agree)



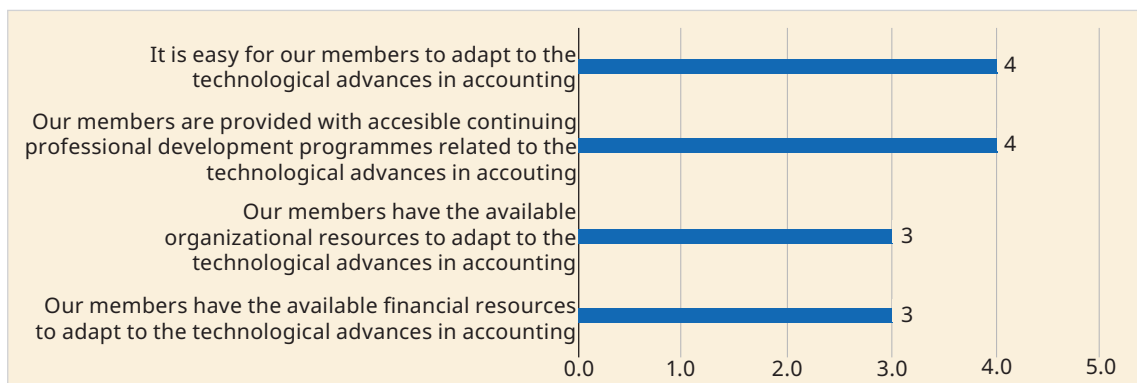
KICPAA sees technology adoption as a vital revolutionary force that will dispel the incorrect and misleading stereotype that accountancy and finance professionals are exclusively “bean counters”.

Accountancy and finance professionals will be able to better actualize and realize their potential as strategic advisors, regulatory policy makers and champions in emerging areas such as sustainability, artificial intelligence, and digitalization as a result of technology adoption.

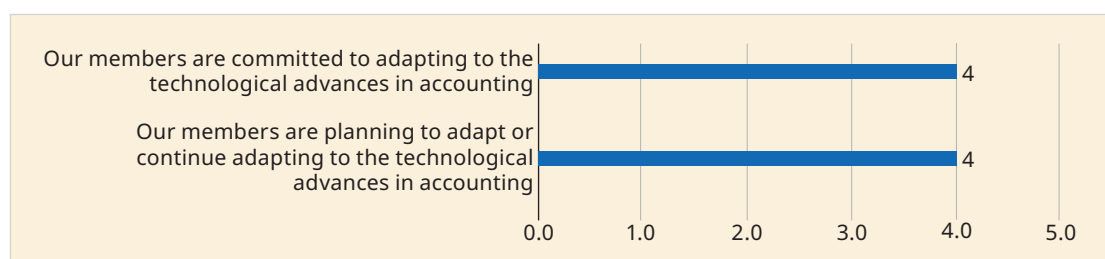
Overall, KICPAA believes that with technology adoption, accountancy and finance professionals will benefit from a more meaningful career as well as more diverse career pathways.

Figure 7: Perceived behavioural control

(1 – Fully disagree and 5 – Fully agree)

**Figure 8: Intention to Engage**

(1 – Fully disagree and 5 – Fully agree)



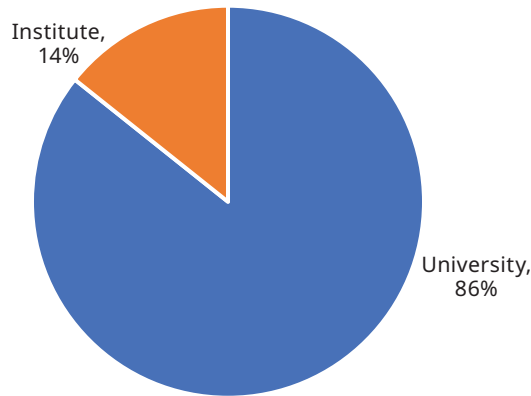
Part 2: Higher education institutions (HEIs)

a. Demographics of the respondents

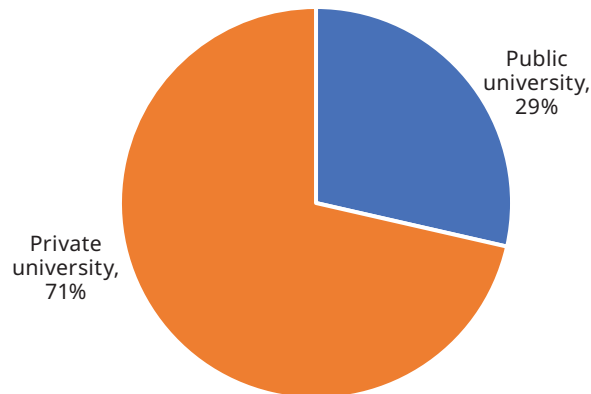
The higher education reform focuses on strengthening governance, enhancing doctoral-level qualifications, improving the curriculum in response to industrial development, developing the use of digital technology, boosting research, and establishing centres of excellence and quality for educational assessment.

According to the Ministry of Education, Youth, and Sports, higher education is defined as education after secondary school. Higher education institutions in Cambodia are classified into 3 types. These are the Royal Academy, the University, and the College. A bachelor's degree takes 4 years of higher education in Cambodia. A master's degree takes another 2 years and a doctorate takes 3 to 6 years after attaining a bachelor's degree. This section presents findings from responses from accountancy schools of HEIs in Cambodia.

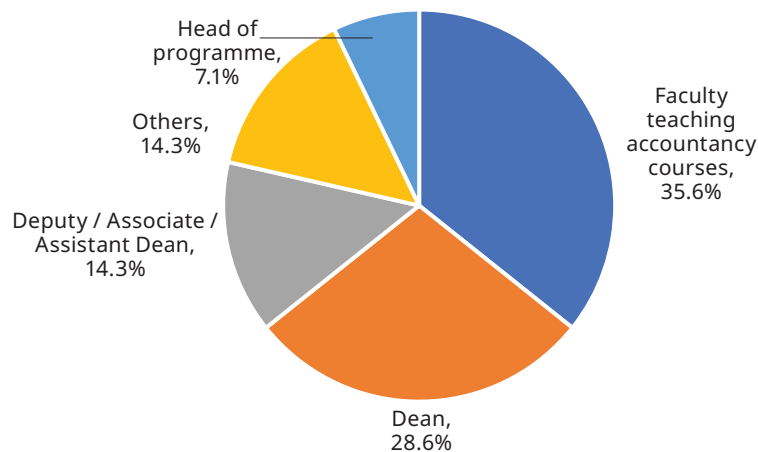
A survey instrument was sent to 14 HEIs comprising both public and private universities and institutes. Of the 14 HEIs, 12 are universities (86%) and the remaining 2 are institutes (14%) as shown in Figure 9.

Figure 9: Respondents by type of higher education institutes (HEIs)

Among the respondents, 4 (29%) are from public universities and 10 (71%) from private universities, as depicted in Figure 10.

Figure 10: Respondents by ownership of HEIs

The survey instrument was completed by senior staff in the respective HEIs. They included 4 deans (29%), 2 deputy/associate/assistant deans (14%), 1 head of programme (7%), 5 faculty lecturers of accountancy courses (36%) and 2 of other academic ranks (14%) as shown in Figure 11.

Figure 11: Position of the respondents at the HEIs

According to data from both public and private accountancy institutions, the total number of enrolled accountancy students in 2022 was around 610 students. Among these institutions, the National University of Management is the oldest and most prestigious public university, having established the first accountancy school and programme about 29 years ago as the Institute of Economics on 18 March 1983.

The first accounting course and curriculum were established in the early 1990s as a four-year programme.

With respect to the accreditation sought by the various schools, all the respondent HEIs have been accredited in Cambodia since 2003 under Royal Decree NS/RKT/0303/129 on the “Accreditation of Higher Education”.

b. Awareness, competencies, importance and incorporation

Awareness

Figure 12 shows the level of awareness of the respondents of the selected technologies from the HEIs from the Cambodian perspective. The selected technologies are based on a literature review and industry sensing of what are the more popular technologies employed in the accountancy industry. Data analysis/big data (2.86) and artificial intelligence (2.71) are the two technologies with the highest level of awareness followed by 6 other technologies. There was a moderate level of awareness of 3 technologies, namely, extended reality (1.93), augmented reality (2.00) and artificial human assistants (2.14).

Figure 12: Level of awareness of the selected emerging technologies
(1 – Not at all and 5 – Fully aware)

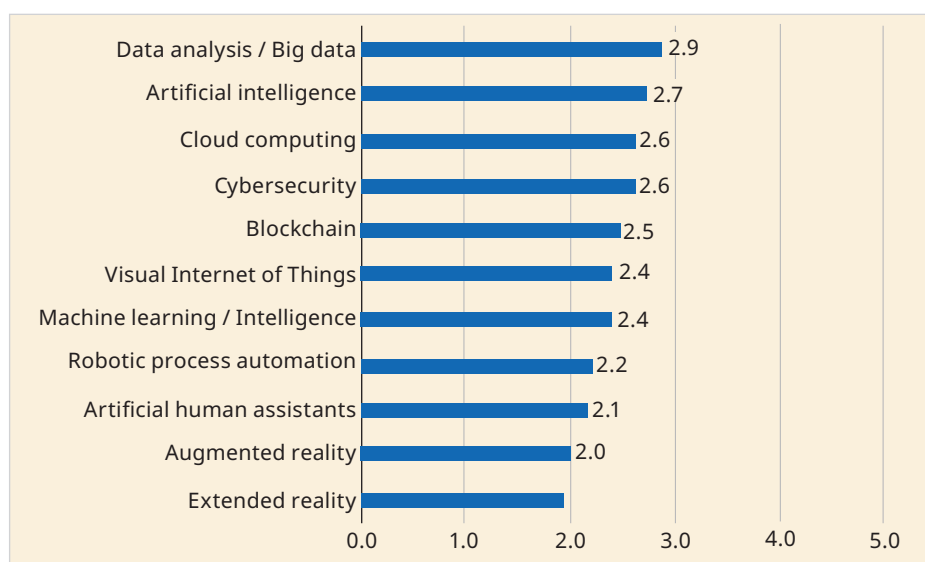
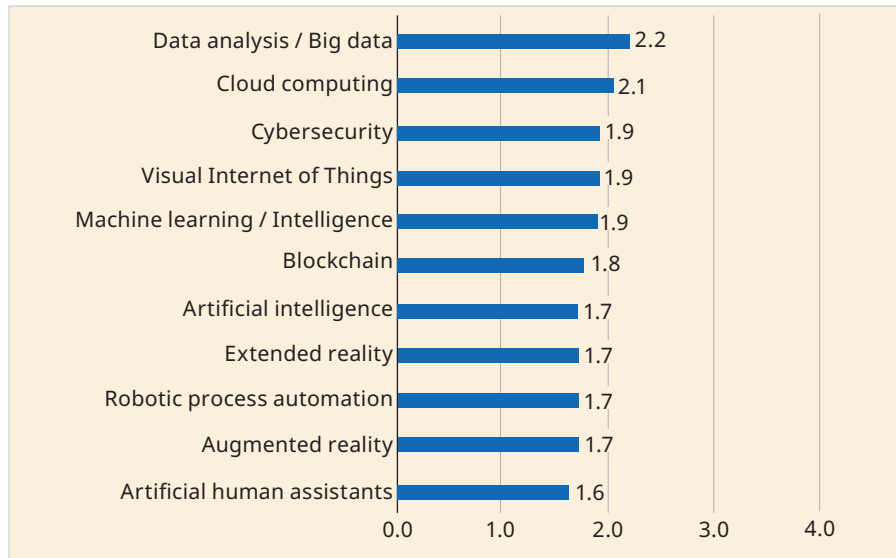


Figure 13 indicates that data analysis/big data (2.2) and cloud-computing (2.1) are the two technologies with the greatest level of teaching competency followed by 2 other technologies: cybersecurity (1.9) and visual Internet of Things (1.9), while respondents indicate that they have the least degree of competency in artificial human assistants (1.6). The recorded scores are low (i.e., less than 2.5).

Figure 13: Level of teaching competency of selected emerging technologies

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



The respondents were further asked which upcoming emerging technology they believe should be incorporated into their accountancy courses. Figure 14 summarizes their responses. Robotic process automation (3.1) and data analytics/big data (2.9) were clearly the first and second frontrunners respectively. The least crucial are visual Internet of Things (2.3), machine-learning/intelligence (2.4), cybersecurity (2.4) and blockchain (2.4).

Figure 14: Level of importance of selected emerging technologies to be incorporated into accountancy courses

(1 – Least crucial and 5 – Most crucial)

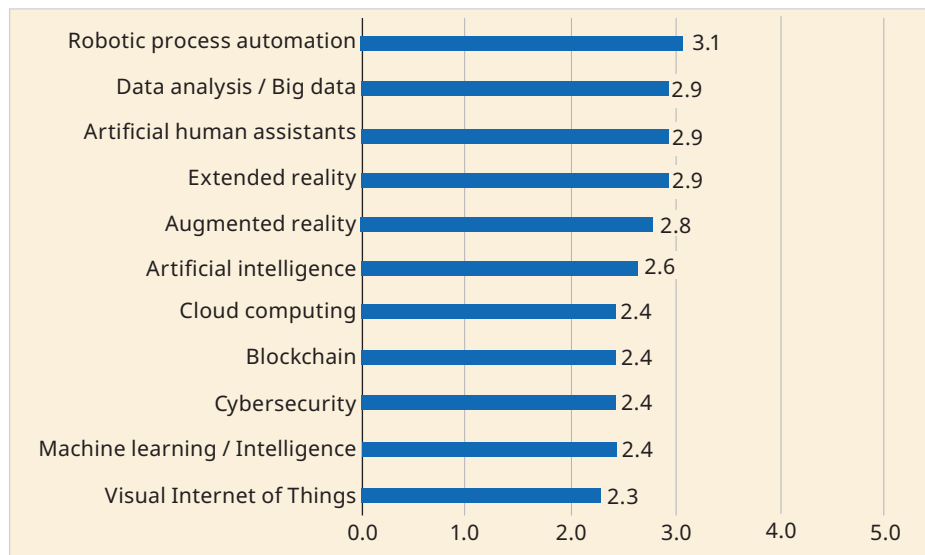


Figure 15 summarizes responses regarding the level of incorporation of the selected technologies into the respondents' current accountancy curriculum. Data analysis/big data (2.5) are the emerging technologies with higher levels of incorporation into the accountancy curriculum, followed by cybersecurity (2.1) and visual Internet of Things (2.1). The respondents view the incorporation and implementation of emerging technologies in the course curriculum at the foundational level.

Figure 15: Level of incorporation of selected emerging technologies into the accountancy curriculum

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

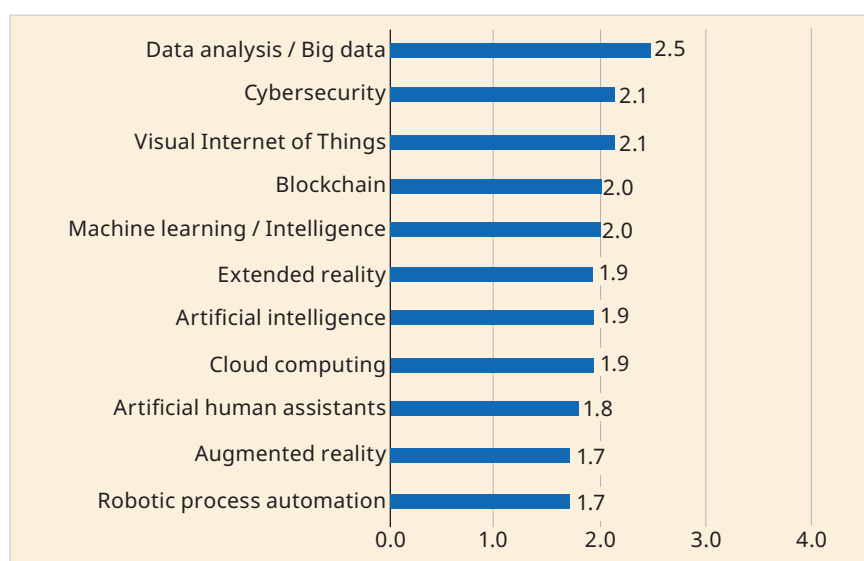


Table 2 summarizes the findings in Figures 12–15, specifically, ranging from the level of awareness of the technologies and incorporating them into the accountancy curriculum. The table indicates how respondents rank the various technologies in terms of awareness, competency, importance, and incorporation of technology. The top 3 technologies are data analysis/big data (1.3), cybersecurity (4.3) and cloud computing (4.8).

Table 2: Ranking of the 4 responses to selected emerging technologies on awareness, competency, importance and incorporation

	Awareness		Competency		Importance		Incorporation		Average rank
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	
Data analysis / Big data	2.9	1	2.2	1	2.9	2	2.5	1	1.3
Cybersecurity	2.6	4	1.9	3	2.4	8	2.1	2	4.3
Cloud computing	2.6	3	2.1	2	2.4	7	1.9	7	4.8
Artificial intelligence	2.7	2	1.7	7	2.6	6	1.9	7	5.5
Visual Internet of Things	2.4	6	1.9	3	2.3	11	2.1	2	5.5
Blockchain	2.5	5	1.8	6	2.4	8	2.0	4	5.8
Machine learning/ Intelligence	2.4	7	1.9	5	2.4	8	2.0	4	6.0
Robotic process automation	2.2	8	1.7	7	3.1	1	1.7	10	6.5
Extended reality	1.9	11	1.7	7	2.9	3	1.9	6	6.8
Artificial human assistants	2.1	9	1.6	11	2.9	3	1.8	9	8.0
Augmented reality	2.0	10	1.7	7	2.8	5	1.7	10	8.0

There is a substantial level of convergence among the top 3 emerging technologies in the rankings for awareness, competency, importance and incorporation in the accountancy curriculum.

First, data analysis/big data has the biggest score and tops the average ranking (1.3). It ranks '1' for awareness, competency, and incorporation into the accountancy curriculum; yet, it is ranked second in the level of importance. A possible explanation is that there is a common belief that data analysis/big data will play an important role in the future, but there are still questions about how these technologies will be implemented in the accountancy sector. Despite these concerns, HEIs are including these technologies in their curricula.

Second, while respondents have a higher degree of awareness of and competency in cybersecurity and cloud computing, the level of importance and incorporation into the accountancy curriculum in comparison to other technologies is lower with average ranking of 4.3 and 4.8 respectively.

Third, robotic process automation has an average ranking of 4.8 and is considered as of a high level of importance and incorporation in the syllabus.

Fourth, even though artificial intelligence recorded a higher level of importance; yet the levels of awareness, competency and incorporation for this technology are the lowest among the four technologies.

The rest of the other technologies are ranked lower for awareness, competency, importance and incorporation in the syllabus. This study seeks to find support for the above responses by the HEIs by examining their current accountancy curriculum.

The HEIs' respondents, particularly the faculty of finance and accounting of National University of Management (NUM), need to be well prepared to adopt and transform some critical course programmes and syllabi in order to teach technology in accountancy and finance classes. The teaching should include data analytics, cybersecurity, cloud computing and artificial intelligence at the very least.

The digital transformation in accountancy and finance schools enables and drives Cambodia's economy and society forward by developing strong human capital competencies to cater to the 4.0 industrial revolution, the digital era, and the new economy. This will align well with regional and global trends, promote new economic growth and improve social welfare.

What are some of the software used in teaching technology courses?

Cambodian universities and other HEIs were also asked to provide the list of software that they use to teach accountancy courses. Recently, some HEIs started to shift from physical classrooms to a hybrid learning through a platform that includes Classroom Management (Zoom, Google Classroom, Google Meet and Microsoft Teams), Cloud-Based Learning (Google Drive, Dropbox, and iCloud), and some online tools and applications for quizzes and exams.

They also offer accounting software courses such as QuickBooks, Peachtree and Sage50. Students are also introduced to and taught software applications that aid in data processing and statistics such as EXCEL, SPSS, STATA and EVIEWS. These classes are offered to students from the National University of Management, particularly.

Table 3: Software used in teaching technology

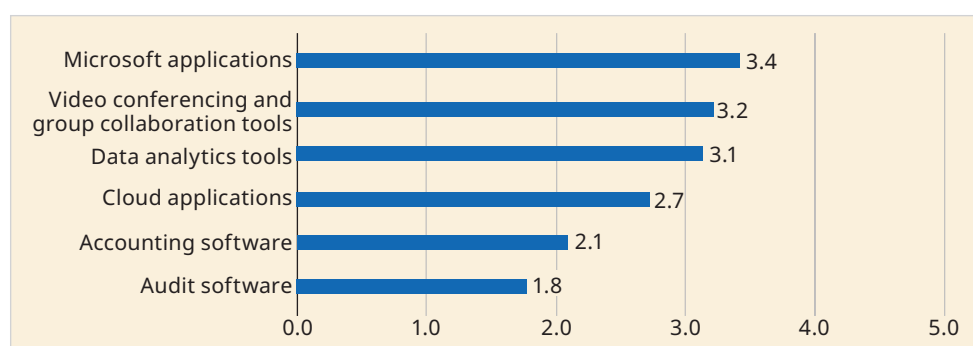
Accountancy course	Software
Cloud computing	Meet, Microsoft Teams, Zoom and Others
Data analysis/Big data	Excel, SPSS, Stata, Eviews
Artificial intelligence	No mention
Artificial human assistants	No mention
Augmented reality	No mention
Blockchain	No mention
Cybersecurity	No mention
Extended reality	No mention
Machine learning / Intelligence	No mention
Robotic process automation	No mention
Visual Internet of Things	No mention

Which of the following technological tools do you currently use or have embedded in the last 3 years in your school?

The respondents were asked how much of a selected suite of technology tools is currently used or has been embedded in the accountancy curriculum in the last 3 years. The responses are summarized in Figure 16. The findings suggest that the most popular tools are Microsoft Applications (3.4), Video Conferencing (3.2) [due to COVID-19 lockdowns], followed closely by data analytical tools (3.1) and cloud applications (2.7).

Figure 16: Technology tools used in accountancy curriculum

(1 – Never used and 5 – Frequently used)



What are some of the barriers to incorporating technologies into the accountancy curriculum?

Respondents were asked to select from a list some of the possible barriers to incorporating technology into their accountancy curriculum. Figure 17 provides a summary of their responses.

Some of the significant barriers include: shortage of experts in emerging technologies (92.9% of respondents), lack of funding for the establishment of facilities in the emerging

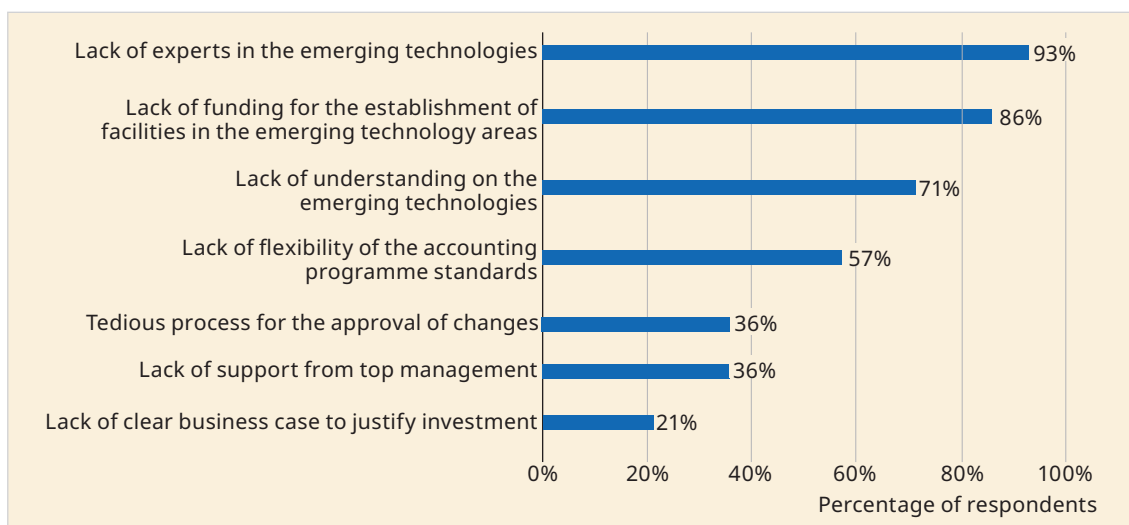
technology arena (85.7%), lack of understanding of emerging technologies (71.4%), and lack of flexibility in the accountancy programme standards (57.1%).

71.4% and 57.1% of the respondents cited a lack of funding for the establishment of facilities in the emerging technology area, lack of understanding on the emerging technologies, and lack of flexibility of the accountancy programme standards as a barrier for adoption respectively.

There are 3 barriers that have a response rate of less than 50.0%. 35.0% of the respondents cite the lack of support from top management and the tedious process for the approval of changes in curriculum as barriers. The lack of a clear business case to justify investment in technology adoption attracts a response rate of 21.4%.

The findings suggest that the greatest barrier to technology adoption is finding the experts and funds needed to teach emerging technologies.

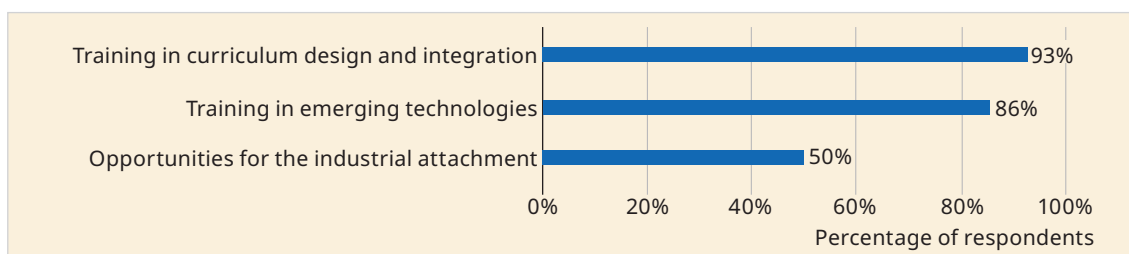
Figure 17: Barriers to adoption of technologies in accountancy curriculum



What kind of help is needed to incorporate technologies into the accountancy curriculum?

Respondents were also asked what type of assistance they would want to have to integrate emerging technologies into existing courses/modules. The summary of their responses is shown in Figure 18.

Figure 18: Kind of help needed to incorporate technologies into the accountancy curriculum



It is encouraging to document that 92.9% of respondents state that professors and lecturers should receive training in curriculum design to integrate technology into the accountancy and finance curriculum. The findings also show that 85.7% of faculty respondents believe that training in emerging technologies is an important strategy to

incorporate the technology into the accountancy curriculum. 50.0% of respondents say that training in the various technologies can be gained through industry attachments.

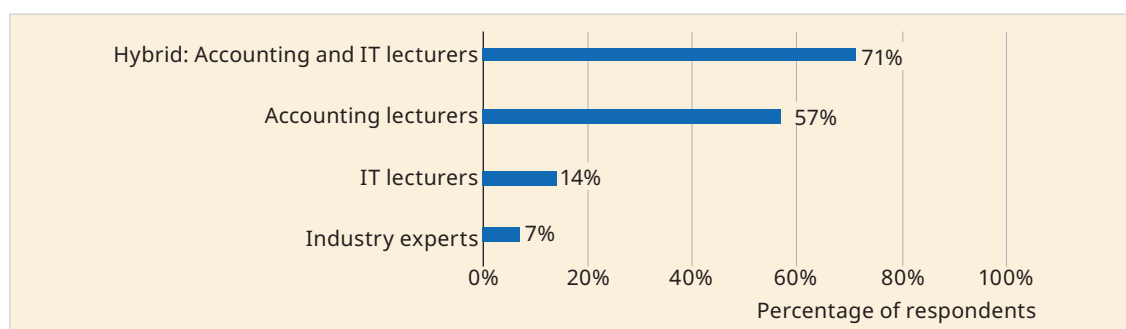
How should technology courses be taught in accountancy programmes?

The discussion in the accounting literature is that, ideally, technology for accounting should be taught by accounting instructors who are experts or are very conversant with technology. However, there is a severe shortage of such technologically inclined accountancy instructors. Alternatively, the technology could be taught by technology experts from the accountancy industry. These are also short in supply. Finally, a hybrid approach is suggested that would bundle accountancy instructors with IT instructors to co-teach the technology course. The advantage of this approach is to overcome the shortage of technologically inclined accounting educators. However, the disadvantage of this hybrid approach is that the technology portion of the course could be taught without an accounting context and the course could become disjointed.

Who should teach the technology component?

Respondents were asked who should be the main instructors for technology courses. They were allowed to make more than one choice. Figure 19 shows the responses of the HEIs. 71.4% of the respondents believe that technology courses should be jointly taught by accountancy and IT lecturers. However, 57.1% of the respondents also believe that accountancy lecturers should be the instructors.

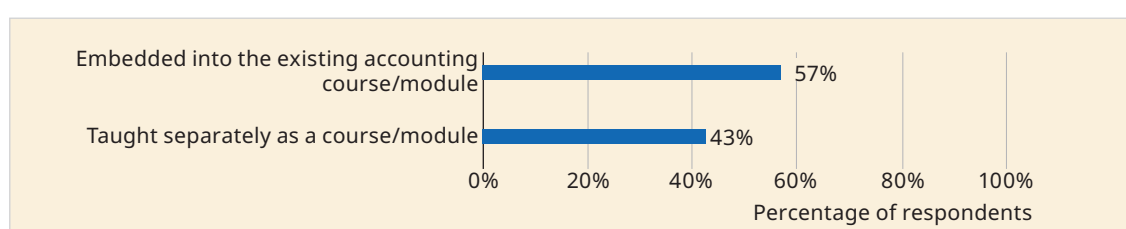
Figure 19: Who should teach technology courses in the accountancy programme



How should emerging technologies be integrated into the accountancy programme?

Figure 20 shows the respondents' view towards teaching technology in accountancy courses. The majority of the respondents prefer the technology course to be taught as a separate course/module.

Figure 20: How technology is to be taught in the accountancy programmes



Respondents were further asked their preferred mode of conducting technology courses. Should the technology course be taught as a stand-alone course or should technology be embedded into accountancy courses? Both methods have their advantages and disadvantages.

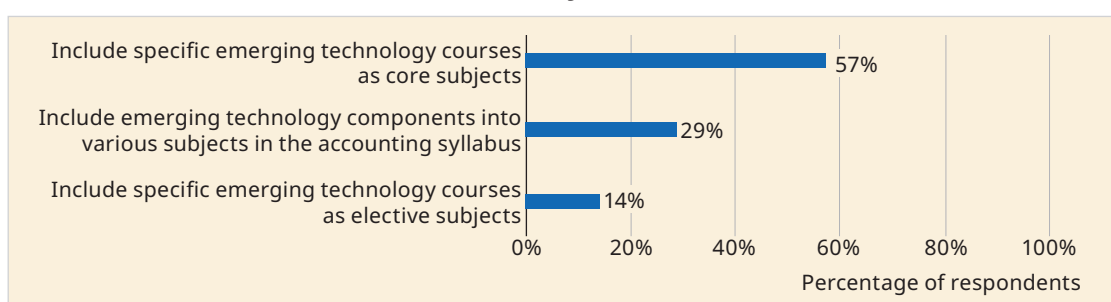
A stand-alone technology course provides the opportunity for the instructors to drill deep into the technology. However, the knowledge can be unrelated to accounting and suffers from a lack of integration with the accountancy domain. The other approach is to incorporate the technology as part and parcel of the core accountancy courses. This is ideal but it suffers from two major weaknesses. First, it is much harder to teach an accountancy course with embedded technology and the danger is that the course may end up having insufficient depth and coverage in both accountancy and technology knowledge. Secondly, it is very difficult to get accounting instructors who can weave technology effectively into the core accountancy courses.

In your opinion, what is the best approach to embed the emerging technologies into the accountancy programme?

The majority of the HEIs prefer to teach technology in accountancy courses as a separate subject. Given the general preference to embed the technology into the existing courses, the respondents were further asked how they should incorporate the selected emerging technologies into their courses? Figure 21 shows the responses.

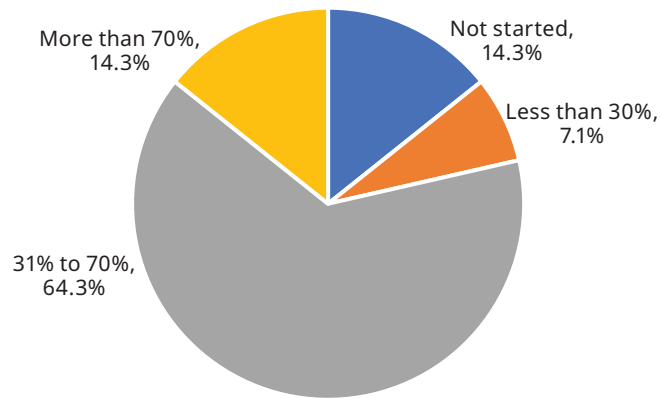
Figure 21 indicates that HEIs which prefer to incorporate technology as a separate course would use the same approach for emerging technologies. Likewise, those who prefer to embed the technology into existing courses would apply the same approach to emerging technologies. Therefore, there are multiple approaches to incorporating emerging technologies into the accountancy curriculum.

Figure 21: Incorporating emerging technologies into the accountancy curriculum



What is the current stage of adoption of technology by HEIs?

Respondents were asked a final question on the stage of adoption of technology in their accountancy curriculum. Figure 22 summarizes their responses. The HEIs are all at different stages of adoption and they are equally divided along the spectrum from less than 30% to more than 70%. The stage of technology adoption for the majority of them is between 31% to 70%. Technology adoption is a continuous journey and it is heartening to document the fact that IHLs are aware of their stage of adoption and the technologies they need to work with.

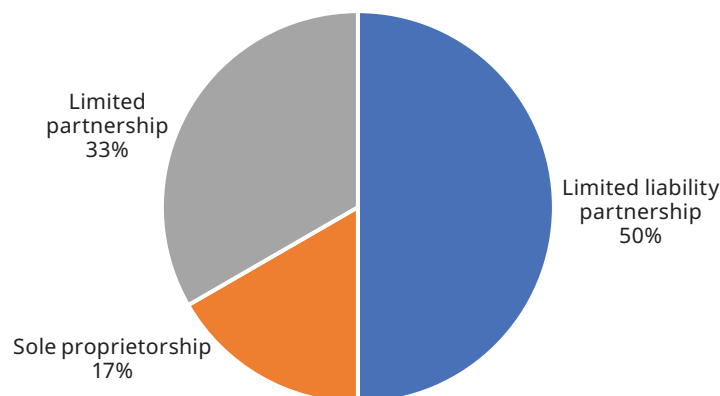
Figure 22: Stage of technology adoption in accountancy curriculum

In summary, the survey provides evidence that HEIs in Cambodia are taking significant steps to incorporate technology into their accountancy curricula. The levels of awareness and activity are high. The two main constraints are the lack of curriculum space and technologically-inclined accounting instructors to teach the technologies. Accountancy and IT instructors may have to work together to teach technology in the accountancy programme because of the lack of technologically-inclined accounting instructors. There is a general preference to weave technology into accountancy courses rather than offer it as mere stand-alone technology courses.

Part 3: Accountancy and auditing practitioners

a. Demographics of the respondents

The survey instrument was sent to accountancy and auditing firms for their responses. There were altogether 6 respondents and the types of firms they represent is shown in Figure 23. There were three firms limited liability partnerships, one sole proprietorship, and two limited partnerships.

Figure 23: Profile of respondents

The respective status of the respondents are shown in Figure 24. The survey shows that 4 of the 6 respondents are owners, practitioners or partners of their respective firms. The other two respondents are a manager/supervisor and a senior auditor.

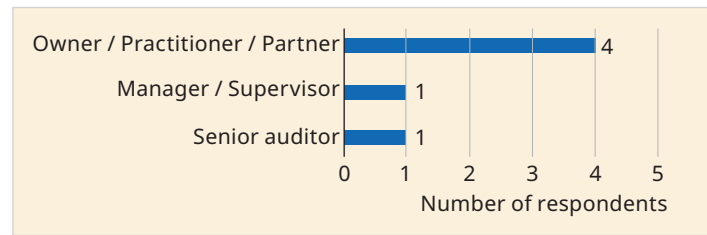
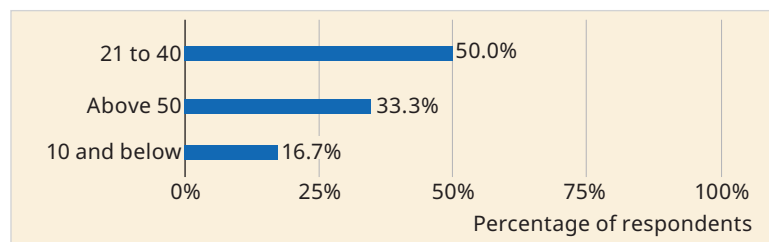
Figure 24: Positions of the respondents in their firms

Figure 25 provides an indication of the size of the firms of the respondents. 2 (33.33%) of the 6 respondents hire more than 50 staff while 1 (16.67%) has up to 10 staff and 3 (50%) have between 21 to 40 staff.

Figure 25: Number of employees in the respondent firms

The respondents were asked to disclose how long the firm has been in existence. 4 out of the 6 respondents have been in existence for more than nine years while the other 2 firms have operating for 4-6 years, and 7-9 years.

b. Awareness and utilization of selected emerging technologies

The respondents were asked to provide an indication of their level of awareness of advances in technology pertaining to their industry. Figure 26 shows the level of awareness of 11 selected emerging technologies. The respondents have the highest level of awareness of cloud computing, cybersecurity, and data analysis/big data. The three merging technologies that have the lowest level of awareness are machine learning/intelligence, artificial human assistants and augmented reality.

Figure 26: Level of awareness in selected emerging technologies

(1 – Not at all and 5 – Fully aware)

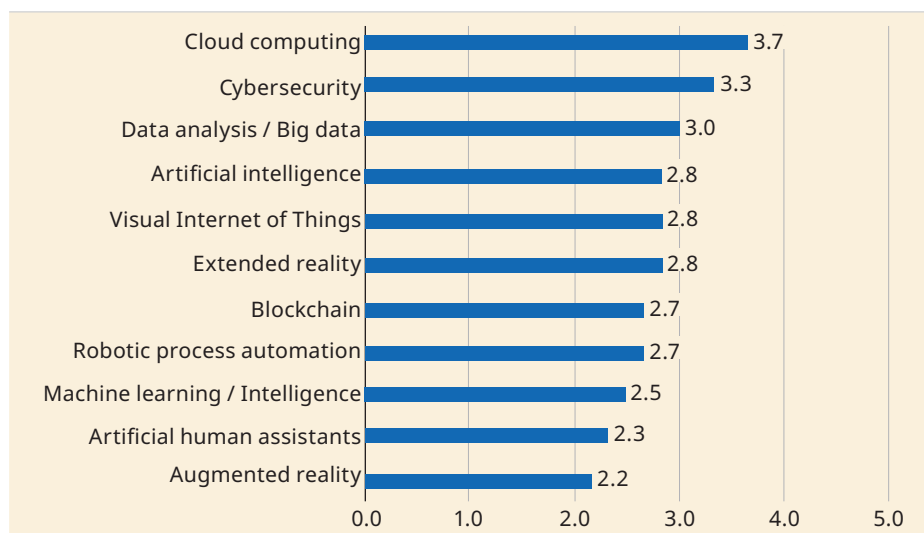


Figure 27: Level of adoption of the selected emerging technologies

(1 - Not at all utilized and 5 - Utilized all the time)

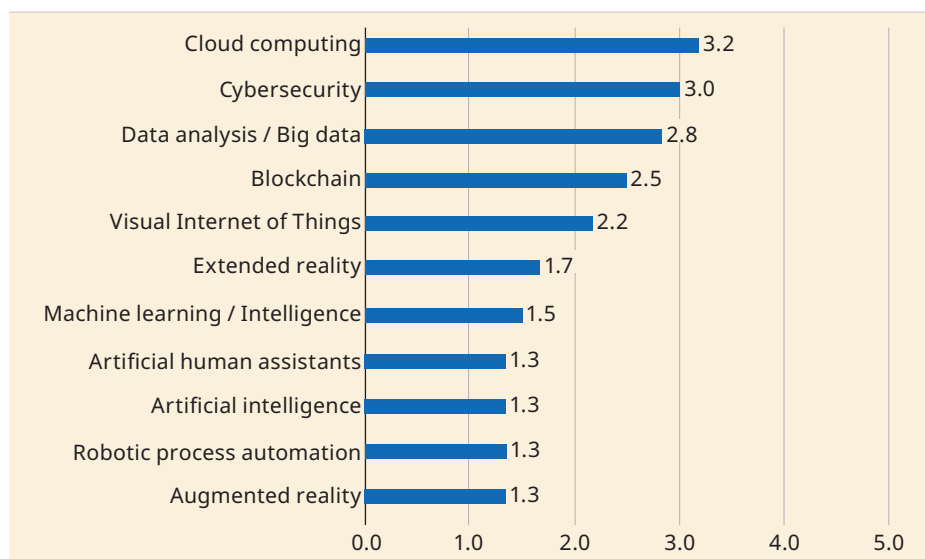


Figure 27 above shows the level of utilization of emerging technologies.

The three most utilized emerging technologies are: cloud computing (3.2), cybersecurity (3.0), and data analysis/big data (2.8).

However, the level of utilization on average is lower than the level of awareness.

This could mean that it is one thing to be aware of a technology, but it is another thing to be utilizing the technology.

This is particularly the case for those technologies with an average utilization level of less than 3.0.

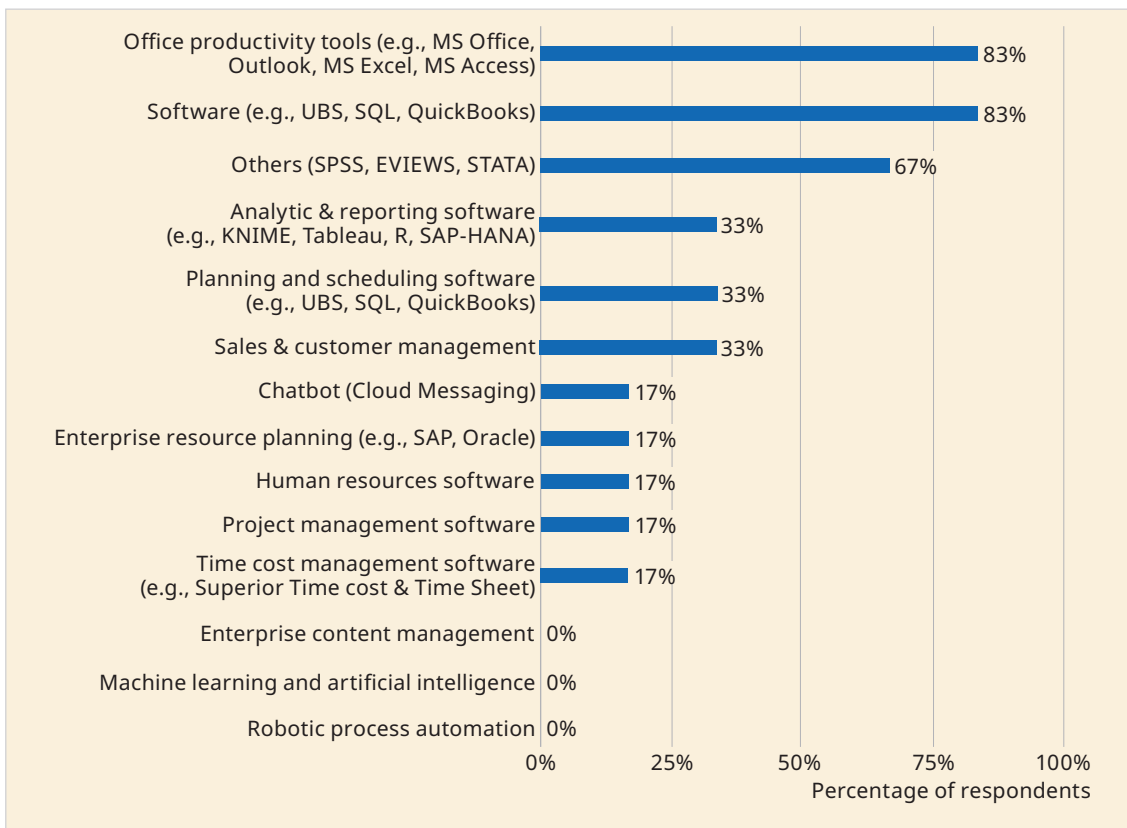
c. Systems and software adoption

The respondents were asked to provide their inputs on the type of systems and software which they currently adopt in their work.

Figure 28 shows the list of systems and software adopted by the respondents.

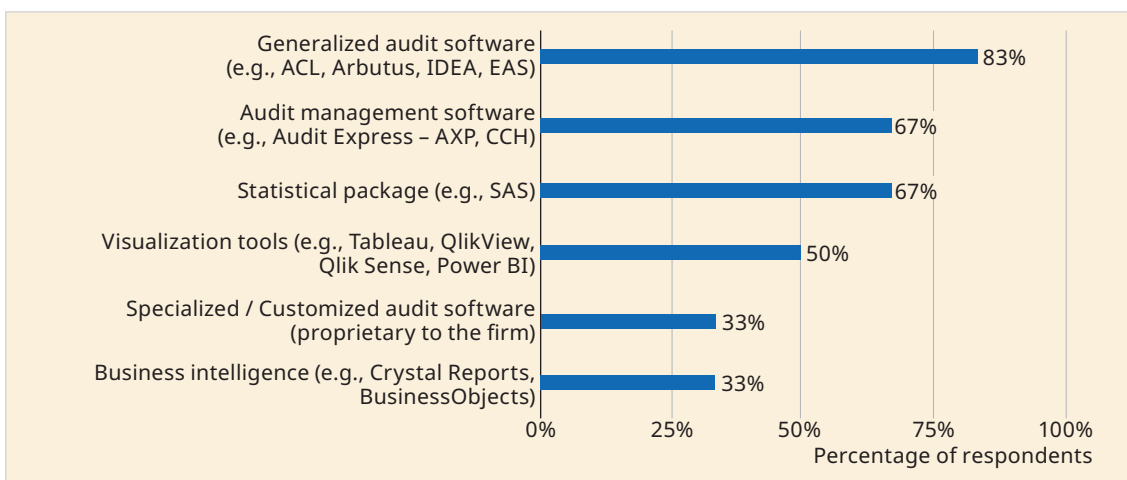
The top 3 most popular systems or software adopted are office productivity tools (83.3%), accounting software applications UBS, SQL, QuickBooks (83.3%), and data analytics tools such as SPSS, EVIEW and STATA (66.67).

The findings suggest that for these 6 respondents, the use of systems and software in their business is prevalent.

Figure 28: Types of systems and software adopted

d. Computer-assisted audit technique (CAAT) adoption

The respondents were specifically requested to provide inputs on the adoption of computer-assisted audit techniques (CAAT). Figure 29 provides a summary of CAAT adoption. 83.33% of the respondents use generalized audit software in their operations. Interestingly, 66.67% of the respondents also use audit management software and statistical packages for data analytics, some of which are proprietary to their firms. This suggests that the use of audit software is imperative in the current landscape of auditing. Visualization tools are also used by 50% of the respondents.

Figure 29: Types of computer-assisted audit techniques (CAAT) adopted

e. Technological preparedness

The respondents were asked about their preparedness for technology adoption in three different dimensions such as the approach to technology, manpower skills and knowledge, and investment in technology. Figure 30 shows the respondents' input on five statements regarding their approach to technology. The respondents provided positive responses to the five statements and it can be concluded that the key motivation for adoption of IT system and software is to improve productivity and hence the profitability of their operations. This is particularly critical in the face of talent shortages in the accountancy sector and in HEIs in Cambodia.

Figure 30: Approach to technology

(1 – Fully disagree and 5 – Fully agree)

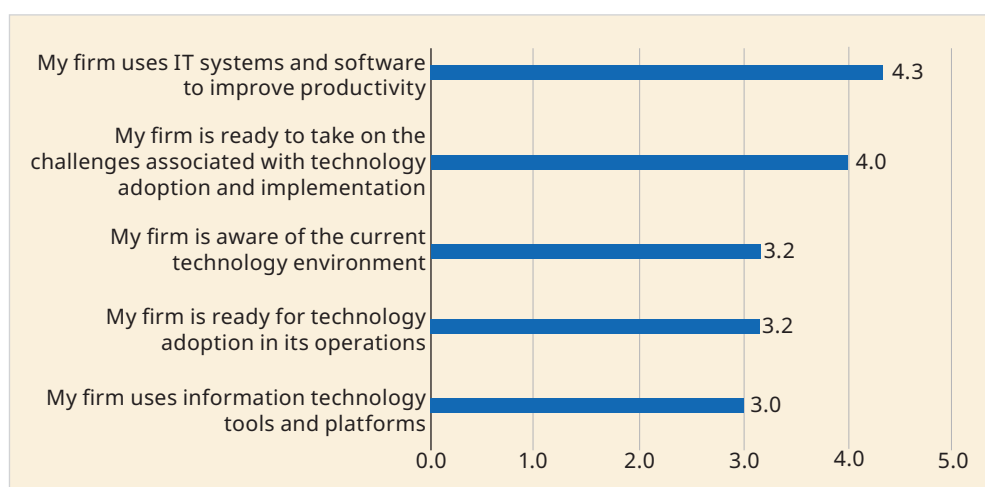


Figure 31 provides a summary of the feedback of the respondents with regard to their manpower skills and knowledge vis-à-vis the technological challenge. The responses are generally positive about the manpower's skills and knowledge. This is affirmed by the firms' view that staff's skills and competence are specifically related to whether the technology is easily accessible for solving workplace problems. The findings here may suggest that more can be done to upskill the staff through technology-related training.

Figure 31: Manpower skills and knowledge

(1 – Fully disagree and 5 – Fully agree)

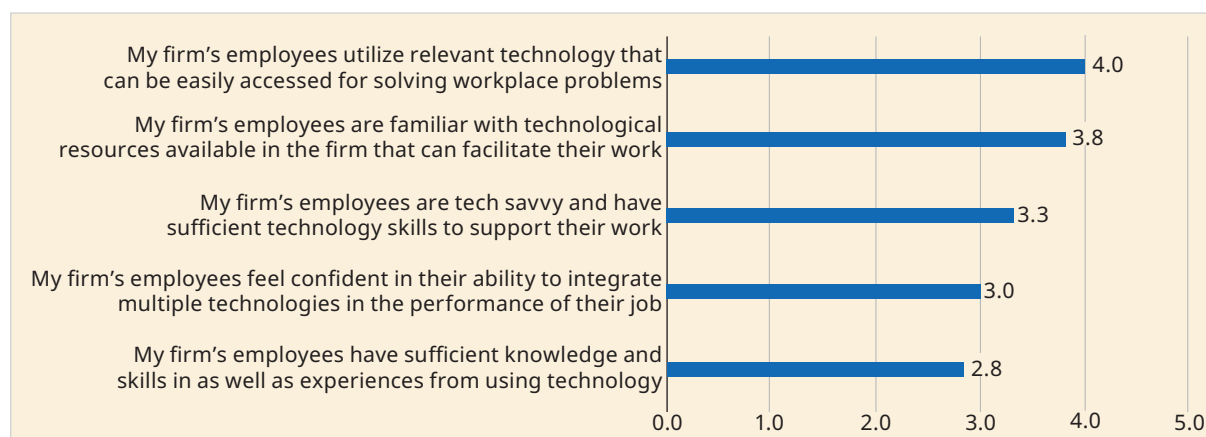
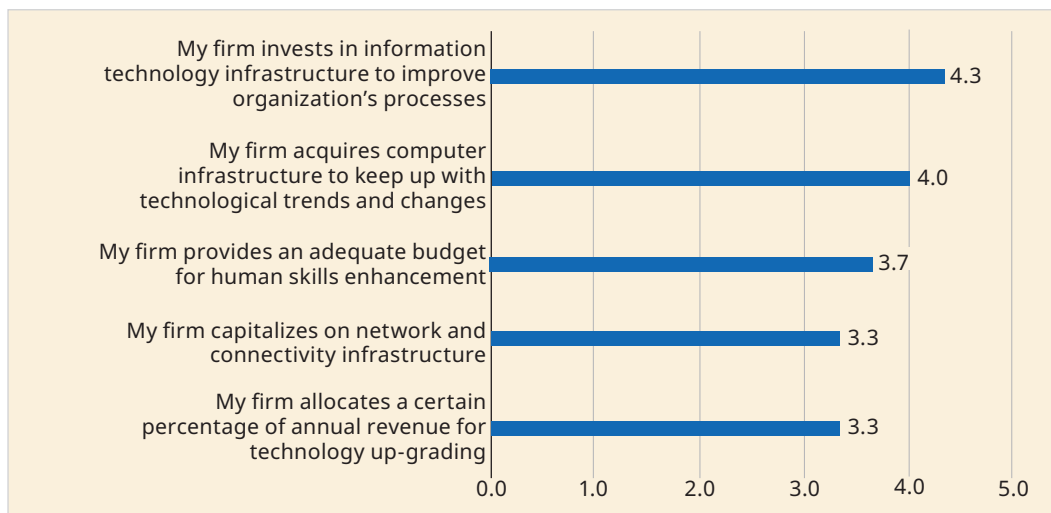


Figure 32 shows the respondents' feedback on their firms' investments in technology. The ratings are high, lying in the range of 3.3 to 4.3. The responses are consistent with the respondents' views about the adoption of technology and the need for manpower development in the field of technology. The findings suggest that the respondents are willing to invest in technology infrastructure and may have undertaken actions and planned strategies to enhance their organizations' capabilities in technology.

Figure 32: Investment in technology
(1 – Fully disagree and 5 – Fully agree)



f. Planned behaviour towards technology adoption

The respondents were further requested to provide responses to statements that help to assess their planned behaviour toward technology adoption. The planned behaviour covers four key aspects: attitude, subjective belief, perceived behavioural control and intention to engage.

Figure 33 summarizes the respondents' feedback on their attitude towards technology. It shows very positive responses from the respondents regarding their attitude towards technology. There is a strong belief that their firms will benefit from adapting to the technological advances in accountancy enjoy more value creation. The respondents believe that they will be rewarded for adapting to the technological advances.

Figure 33: Attitude towards technology
(1 – Fully disagree and 5 – Fully agree)

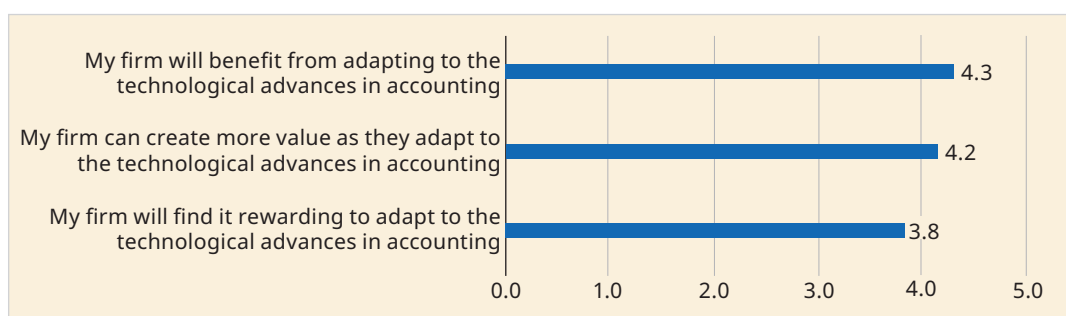


Figure 34 summarizes the ratings of the respondents on their subjective beliefs. There is a very strong subjective belief that regulators, the accountancy profession and staff think that the adoption of technological advances in accounting is imperative to the accountancy profession. It seems that there is a subjective belief that technological advancement cannot be stopped and firms must adapt to survive.

Figure 34: Subjective belief about technology

(1 – Fully disagree and 5 – Fully agree)

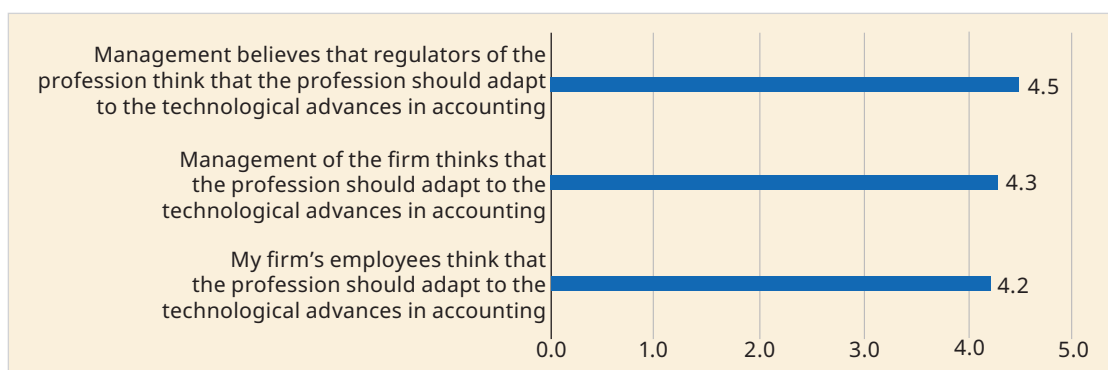


Figure 35 shows the planned behaviour of the respondents in tackling the adoption of technology for their firms. The respondents articulate their planned behaviour in a positive and affirmative manner. There is a general positive agreement on the planned actions. The most important action is supporting employees in terms of financial resources (3.7), access to technology, and professional development (4.0) to enable employees to upskill to face technological challenges. However, the level of planned behaviour responses is much lower than the attitude and subjective belief responses towards the technologies.

Figure 35: Planned behaviour for technology adoption

(1 – Fully disagree and 5 – Fully agree)

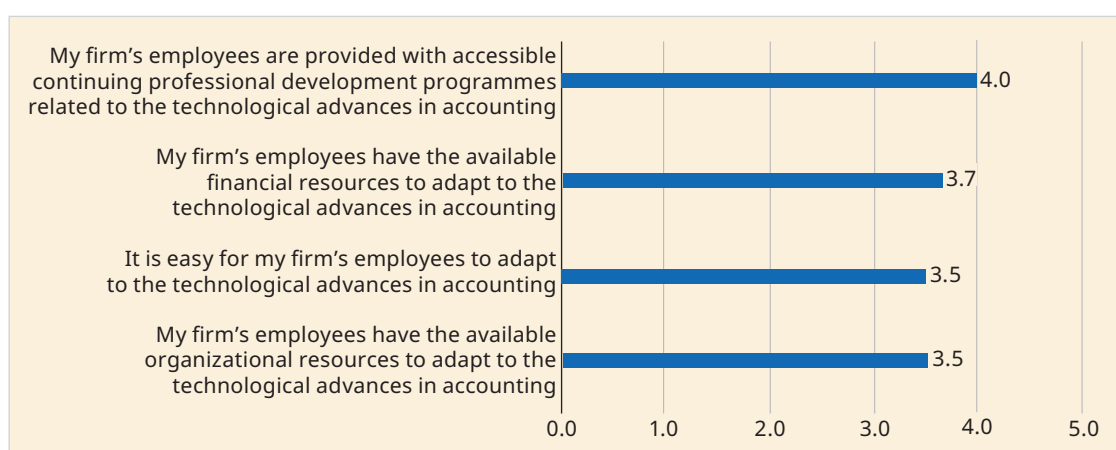
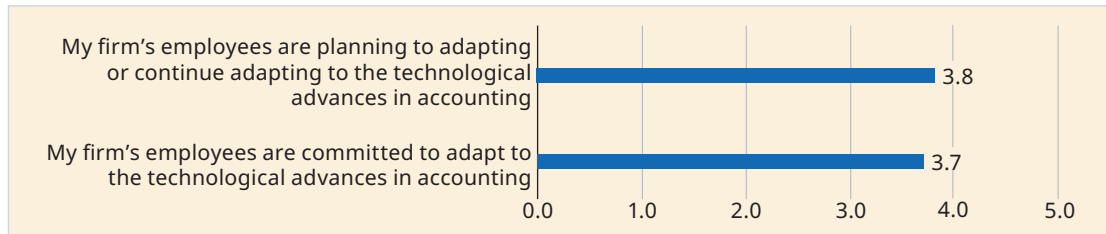


Figure 36 summarizes the respondents' inputs on their intention to adopt technology in their business. The findings in Figure 36 are interesting. Even though there is a positive attitude toward adopting technology, a strong subjective belief that technology is crucial to the accountancy sector, and planned behaviour to engage in technology, there are relatively lower positive sentiments about the employees' intention to engage in technology. This

could be a reflection of the shortage of technologically-inclined employees and the difficulty in upskilling them. The difficulty could be due to the unwillingness of the employees to learn new skills or the lack of opportunities to acquire new skills.

Figure 36: Intention to engage in technology

(1 – Fully disagree and 5 – Fully agree)

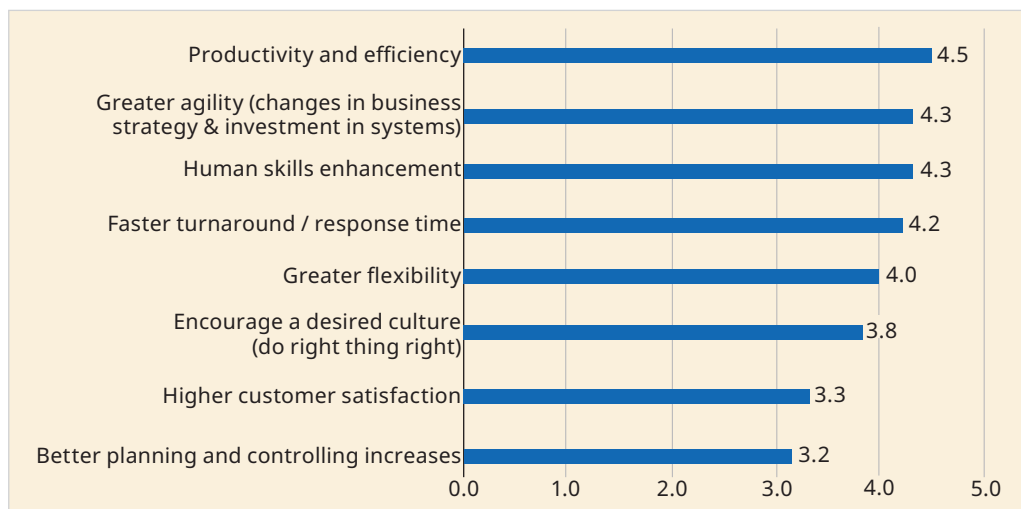


g. Expected benefits of technology adoption

The respondents were further asked to articulate the expected benefits of technology adoption. The list of benefits was curated from the accounting literature and industry dialogues. Figure 37 provides a summary of the respondents' feedback on the articulated expected benefits.

Figure 37: Expected benefits of technology adoption

(1 – Fully disagree and 5 – Fully agree)



There is strong affirmation from the respondents of the well-documented benefits of technology adoption. The most compelling benefit is productivity and efficiency gains. A few of the respondents name other reasons for the adoption of technology. They include improved work quality and less reliance on manpower in getting work done.

h. Challenges to adoption of technology

The respondents were asked a final question on the challenges to the adoption of technology? Figure 38 provides a summary of the responses.

Figure 38: Challenges to adoption of technology

(1 – Fully disagree and 5 – Fully agree)



From Figure 38, the top challenge is cultural readiness (3.5). The responses seem to suggest that there is significant resistance to the adoption of technology because it means change. The second most agreed challenge is high investment costs (2.7). There also seems to be concerns about the lack of clarity of standards, regulations or certifications (2.5) which do not correlate with articulated economic benefits. Inadequate skills (2.3) and the shortage of knowledgeable employees (2.3) are challenges which are well documented. Interestingly the lack of support from the government (1.7) as a source of challenge is the least of the concerns. Respondents indicate that the challenges can be overcome with proper attention and resources, particularly the training of employees. A few of the respondents name other challenges including the lack of a dedicated team to push technology adoption, high maintenance costs of hardware and software, the stability of service providers and continuity and sustainability of technology adoption. One possible solution to these challenges could be the establishment of a shared services platform that could be set up by vendors, professional bodies, or institutes of higher learning. This may be particularly useful for small and medium-sized accountancy firms.

Conclusion

In conclusion, there is a high level of awareness and utilization of particular technologies that are said to be most valuable to accountancy and auditing firms. These include cybersecurity, data analysis/big data, artificial intelligence and cloud computing. As expected, the level of adoption is lower than the extent of awareness. Accountancy and auditing firms have a positive attitude toward the importance of technology and approaches to it. The main challenges, however, are a lack of technologically skilled and qualified talent. Accountancy organizations are open to technological upskilling because they feel that technology adoption would bring several benefits. These benefits include increased productivity and efficiency, enhanced human abilities, and quicker turnaround/response times. In accountancy firms, the main hurdle to technology adoption is the firm's cultural readiness, as well as investment costs.●

Appendix 6: Indonesia

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Background

Indonesia has many accounting study programmes starting from the Diploma 3 degree to a doctoral degree.

In total, there are 1,217 study programmes consisting of 312 Diploma 3 programmes; 67 Diploma programmes; 727 undergraduate programmes; 82 Master's degree programmes and 8 doctoral degree programmes.

The Indonesian professional accountancy associations recognized by the Indonesian government are The Institute of Indonesia Chartered Accountants (IAI), The Institute of Public Accountants (IAPI) and The Institute of Indonesia Management Accounting (IAMI). All 3 are managed by the Finance Ministry.

IAI was established in 1957 and currently has 8,025 active members. IAPI was established in 2007 and has 6,705 members. IAMI was established in 2008, and currently has more than 600 active members.

Accountancy as a degree was first introduced in Indonesia in 1952 by Universitas Indonesia. An accountancy degree is one of most popular degrees in Indonesia.

In Indonesia, all accountancy degrees are awarded by the National Higher Education Accreditation Standard Board (NHEASB) and specifically those earned through professional accounting courses.

It is not common for a study programme to receive accreditation from professional associations. A very small number of course providers submit their curriculum to get accreditation from professional associations, such as ACCA, ICAEW, IMA, etc.

The quality of accounting study programmes is related to their accreditation ratings. The ranking starts from 'A' or 'Excellent' down to "Not accredited". Besides the quality of courses, prospective students also pay attention to the curriculum content. They consider how much of the curriculum is up to date, such as including the adoption of technology.

Technology is both an enabler and a threat to the accountancy profession.

As an enabler, it allows accountancy professionals to be more effective and efficient in their work as the technology will provide access to timely and quality information for decision making.

However, AI, robotic processing automation and other technology can be a threat

as technology can make redundant some of the work which are traditionally done by accountancy professionals. Nonetheless, instead of being technophobic, accountancy professionals should learn to embrace technology and exploit it to be more efficient and effective.

This study documents the adoption of technology by the accountancy sector in Indonesia. Views from the various Indonesia professional accountancy associations, educational institutions and accounting entities are sought to provide a baseline model of the current stage of technology adoption.

Thereafter, a roadmap to enhance technology adoption in the accountancy sector in Indonesia can be developed.

1. Professional Accounting Organizations (PAOs) – IAI, IAMI, IAPI

The survey instrument for PAOs was sent to all 3 professional accounting associations. 2 of the representatives of the respondent associations (66.7%) are from the senior management and the third is from the board.

All 3 professional associations confirm that they have drawn up a technology roadmap.

a. Technology awareness

Figure 1: PAO technology awareness

(1 – Not at all and 5 – Fully aware)

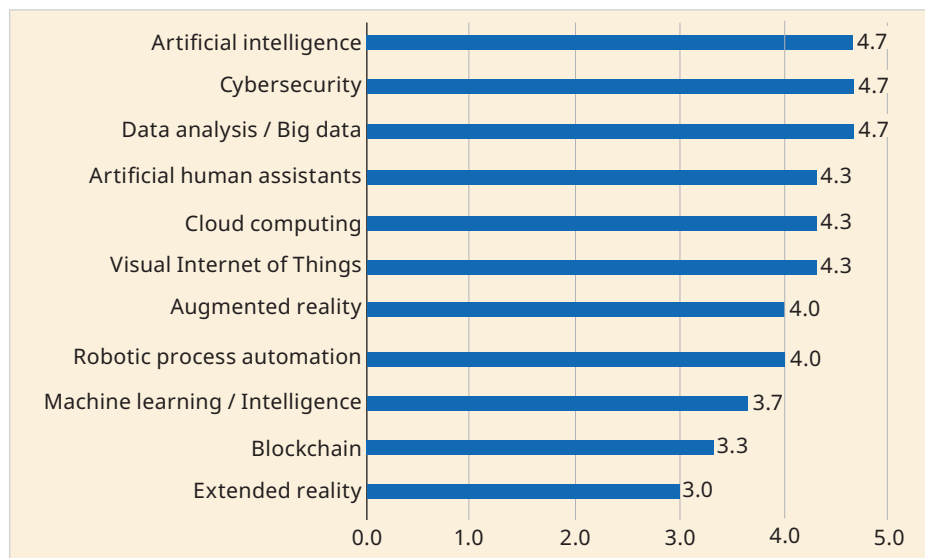


Figure 1 shows the level of awareness of the PAOs of the selected technologies.

The selection is based on a literature review and industry sensing of the more popular technologies employed in the accountancy industry.

Data analysis/big data (4.7), cybersecurity (4.7) and artificial intelligence (4.7) are the three technologies with the greatest amount of awareness followed by other technologies (in order of positive responses): visual Internet of Things (4.3), cloud computing (4.3), artificial human assistants (4.3), robotic process automation (4.0), augmented reality (4.0), machine learning/intelligence (3.7), blockchain (3.3), and extended reality (3.0).

Utilization

Figure 2: PAO technology utilization
(1 - Not at all utilized and 5 - Utilized all the time)

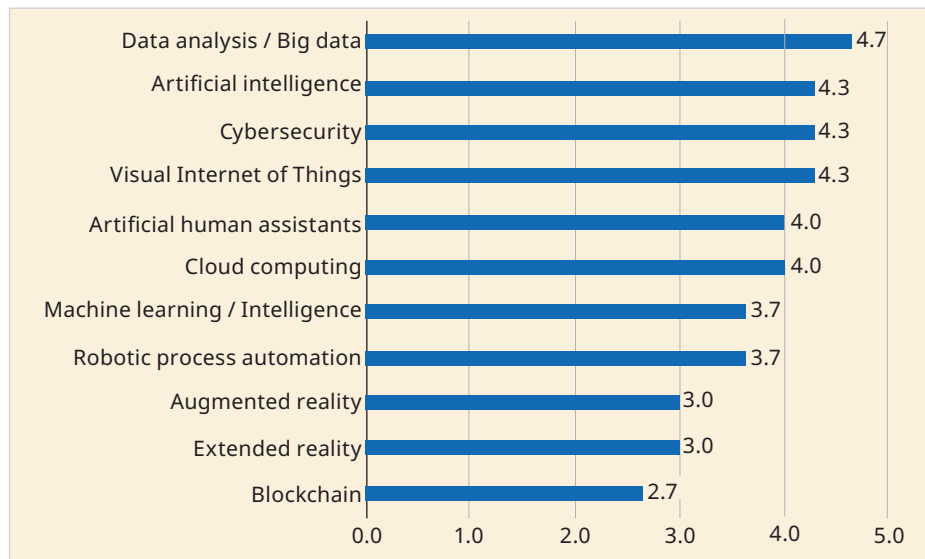


Figure 2 shows the responses of the PAOs with respect to the utilization of technology. Data analysis/Big data has the highest rating of 4.7, followed by virtual Internet of Things, cybersecurity and artificial intelligence, all with a 4.3 score.

This is relatively consistent with the awareness rating.

Subjective norm, perceived behavioural control and intention to engage

Figure 3: PAO subjective belief
(1 – Fully disagree and 5 – Fully agree)

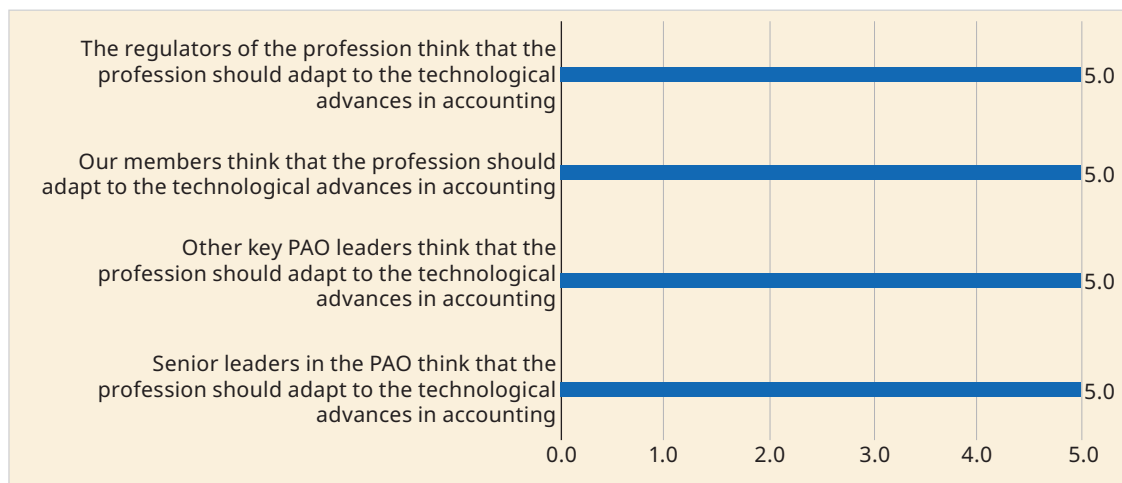


Figure 3 shows that PAOs believe that everybody should adopt emerging technologies. The PAOs rated highly all the subjective beliefs on the adoption of technology.

They also perceive that technology is easy to adopt.

It is important to note that subjective belief influences significantly the awareness and utilization of technology.

The results show that the higher the subjective norm, the higher is the awareness and intention to engage technology.

Figure 4: Perceived behavioural control

(1 – Fully disagree and 5 – Fully agree)

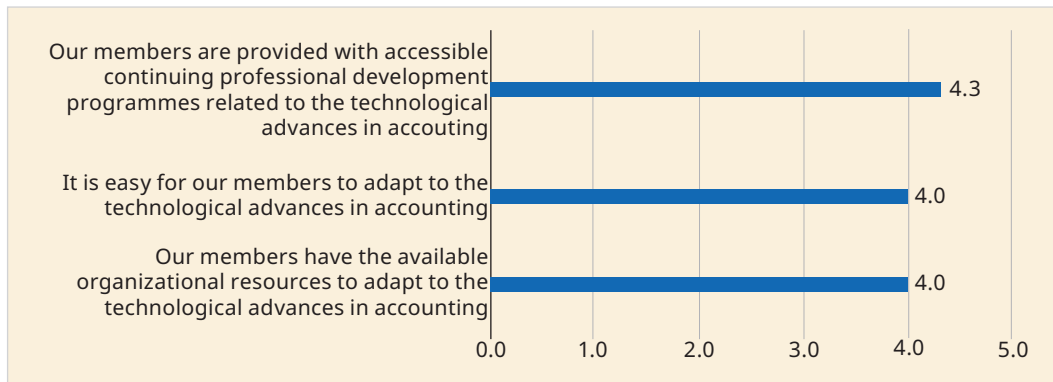


Figure 4 shows the perception of the PAOs of their members' adoption of technology. Interestingly, their perception is not as high as their subjective belief of the importance of technology

This suggests that there is a gap between what the PAOs believe should be good for the accountancy profession vis-à-vis technology adoption and what their perception is of actual developments on the ground.

The PAOs perceive that members face challenges adopting technology in terms of organizational resources and accessibility of the opportunities to acquire technology.

Figure 5: Intention to engage

(1 – Fully disagree and 5 – Fully agree)

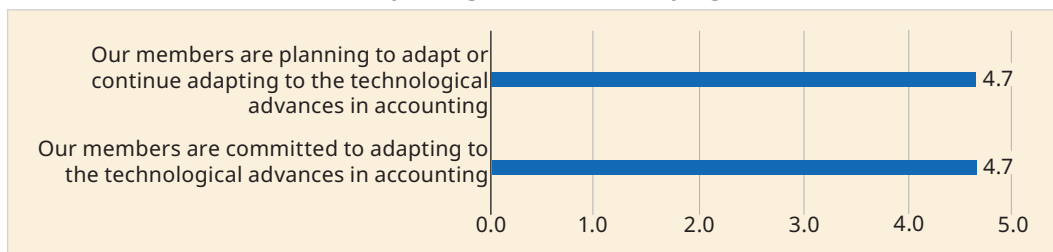


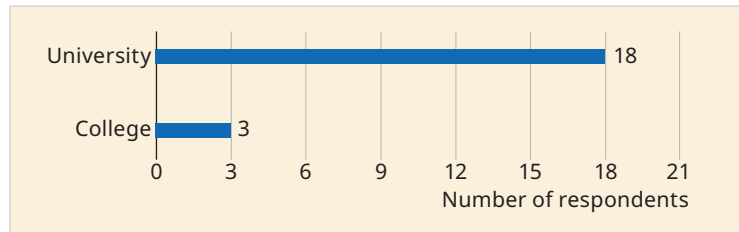
Figure 5 shows the PAOs' belief that their members are committed to the pursuit of technology despite challenges.

2. Accountancy schools of institutions of higher education

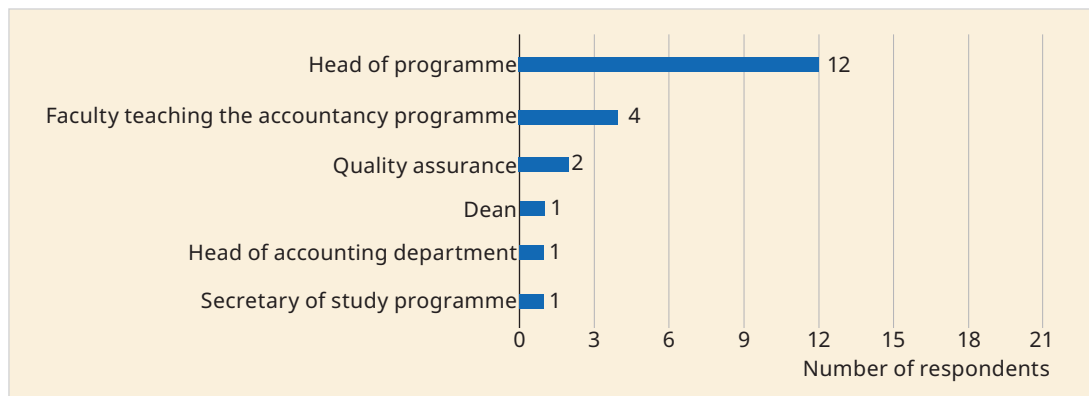
a. Demographics of the respondents

A survey instrument was sent to the current members of IAI's Department of Accountancy Educators (Kopartemen Akuntan Pendidik).

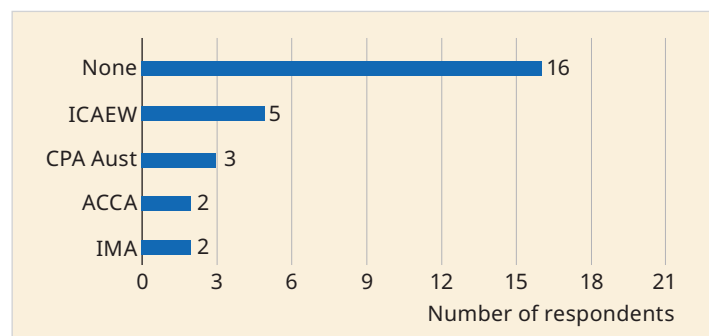
In total, there are 259 members, and the number of questionnaires received was 21, consisting of 3 from colleges and 18 from universities as shown in Figure 6 below.

Figure 6: Respondents by types of institutions of higher education

The survey instrument was completed by senior staff of their respective accountancy schools and Figure 7 shows the designations of the representatives of the respondents. Most of them are heads of accountancy programmes.

Figure 7: Position of the respondents at the education institution

The combined student enrolment of the 21 respondents in accountancy studies is almost 19,000 students.

Figure 8: Accreditation obtained by the institutions

Based on Figure 8, ACCA recognition was obtained by two universities, namely BINUS and TSM; 5 universities (Airlangga, Binus, TSM, Padjajaran, and Tarumanagara) have ICAEW accreditation; 3 universities (Trisakti, Binus, Tarumanagara) have Australian CPA recognition; and 2 universities (Binus and Trisakti) have IMA recognition.

16 universities are not yet accredited.

b. Awareness, competencies, importance and incorporation of selected emerging technologies

Figure 9: Level of awareness of the selected emerging technologies
(1 – Not at all and 5 – Fully aware)

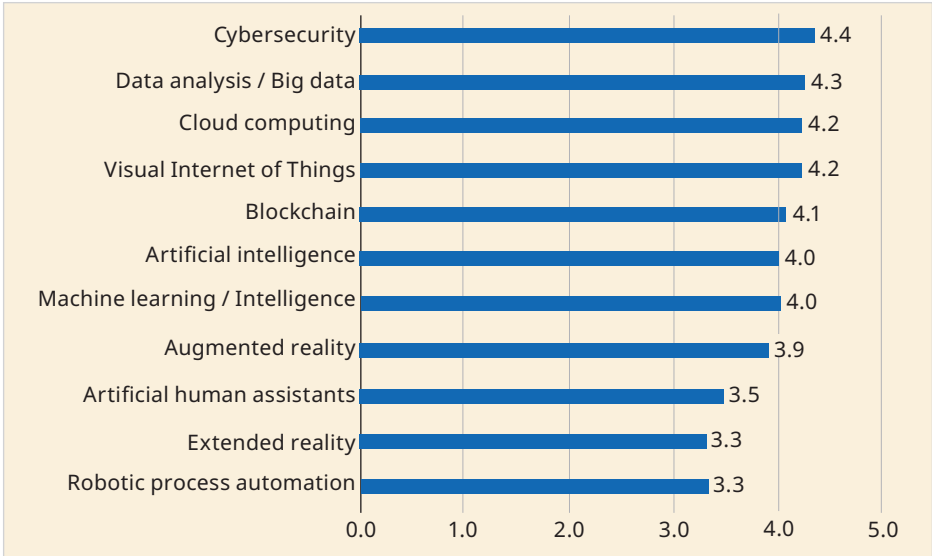
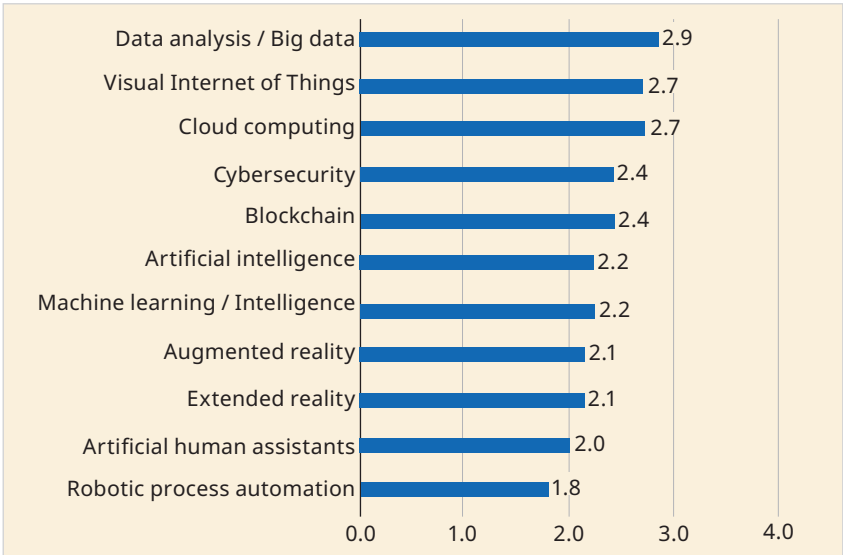


Figure 9 shows the level of awareness of the respondents of the selected technologies. The selection is based on a literature review and industry sensing of the more popular technologies employed in the accountancy industry.

Cybersecurity is the technology with the greatest amount of awareness (4.4) followed by other technologies: data analysis/big data (4.3), visual Internet of Things (4.2), cloud computing (4.2), blockchain (4.1), machine learning/intelligence (4.0), artificial intelligence (4.0), augmented reality (3.9), artificial human assistants (3.5), robotic process automation (3.3) and extended reality (3.3).

The level of awareness is reasonably high for all the technologies.

Figure 10: Level of competency in the selected emerging technologies
(1 – None, 2 – Foundation, 3 – Intermediate, 4 – Advanced)



The respondents were further asked about which emerging technologies the schools are competent in. Figure 10 shows the summary statistics of their responses.

The first observation is that the ratings for competency are much lower than those for awareness.

Data analysis/big data (2.9), cloud computing (2.7) and visual Internet of Things (2.7) were the top choices but their scores are only in the 2.7 to 2.9 range as compared to the scores of 4.2 to 4.3 for awareness (Figure 9).

Figure 11: Level of importance of the selected emerging technologies to be incorporated into courses
(1 – Least crucial and 5 – Most crucial)

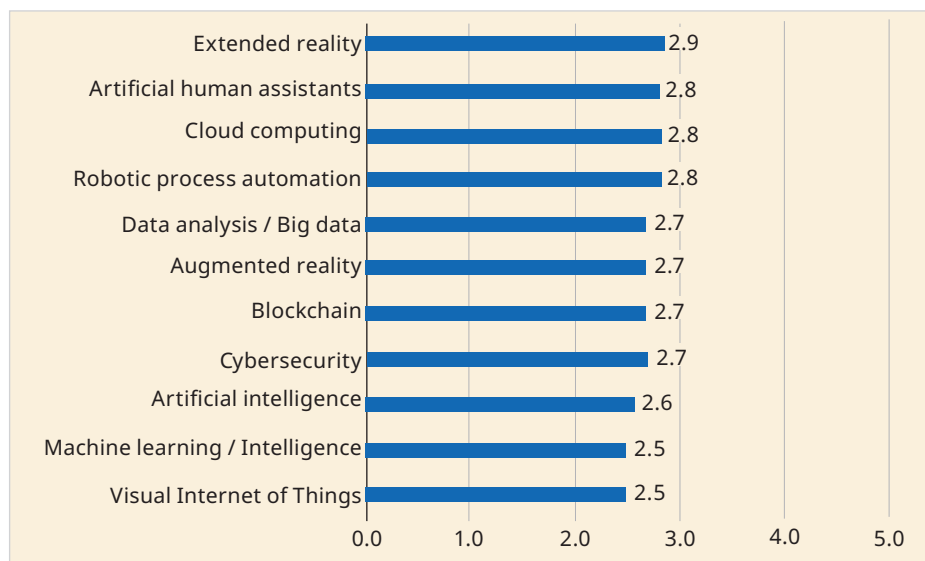


Figure 11 shows the relative importance of the emerging technologies and the need to incorporate them into the accounting course.

The top 3 technologies are: extended reality (2.90), cloud computing (2.81) and artificial human assistants (2.81).

These are followed closely by robotic process automation (2.76) and data analysis/big data (2.71). The ranking is very different from those for the level of competency.

This may suggest that there is a need to incorporate these technologies into accounting programmes even though faculty in accountancy schools may lack the competency to teach them.

Figure 12: Level of incorporation of the selected emerging technologies into the accountancy curriculum

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

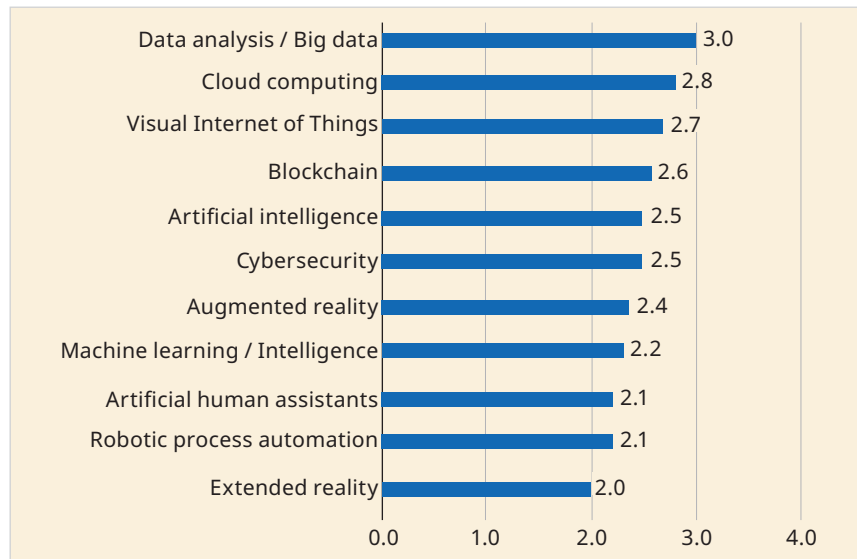


Figure 12 summarizes the responses on the level of incorporation of technology into the accountancy curriculum.

Not surprisingly, again data analysis/big data and cloud computing are the two front runners here but their ratings are still low as compared to awareness, namely, the scores for the level of incorporation of these technologies are between 2.8 and 3.0.

Table 1 below pulls together the findings in Figures 9 to 12, namely, getting feedback on the level of awareness of technologies to their incorporation into the accountancy curriculum. The table shows the rankings by the respondents with regard to each response to the technologies: awareness, competency, importance and incorporation.

Table 1: Ranking of the 4 responses to technology – awareness, competency, importance and incorporation

	Awareness		Competency		Importance		Incorporation		Average rank
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	
Data analysis / big data	4.3	2	2.9	1	2.7	5	3.0	1	2.3
Cloud computing	4.2	3	2.7	2	2.8	2	2.8	2	2.3
Cybersecurity	4.4	1	2.4	4	2.7	5	2.5	5	3.8
Visual Internet of Things	4.2	3	2.7	2	2.5	10	2.7	3	4.5
Blockchain	4.1	5	2.4	4	2.7	5	2.6	4	4.5
Artificial intelligence	4.0	6	2.2	6	2.6	9	2.5	5	6.5
Augmented reality	3.9	8	2.1	8	2.7	5	2.4	7	7.0
Machine learning / intelligence	4.0	6	2.2	6	2.5	10	2.2	8	7.5
Artificial human assistants	3.5	9	2.0	10	2.8	2	2.1	9	7.5
Extended reality	3.3	10	2.1	8	2.9	1	2.0	11	7.5
Robotic process automation	3.3	10	1.8	11	2.8	2	2.1	9	8.0

There is a significant level of convergence of the top 3 technologies in all 4 responses. However, there are four observable differences and these are highlighted in Table 1.

Firstly, data analysis/ big Data is highly ranked for awareness, competency and incorporation in the curriculum but it is only ranked fifth when it comes to the importance of technology being incorporated into the accountancy curriculum. This could mean that data analysis/big data has already been incorporated into most of the accountancy curriculum and thus this is not a priority at this juncture.

Secondly, even though cybersecurity has a high level of awareness, the levels of competency, importance and incorporation in the curriculum are relatively low (ranked 5th). This is not surprising as cybersecurity is a very specialised domain for which it is very difficult to find competent instructors and to incorporate into the accountancy course.

Thirdly, the level of awareness of robotic process automation is ranked almost at the bottom for awareness, competency and incorporation into the accountancy curriculum. Interestingly, it is ranked highly for importance. The respondents realize that in the future, many industries will depend on robots and thus its importance; but awareness and competency are low such that it is difficult for this technology to be incorporated into the accountancy curriculum. This could also reflect a shortage of competent instructors.

Fourthly, interestingly, even though extended reality recorded a high level of importance, the levels of awareness, competency and incorporation seem to be the lowest amongst the other technologies. This could be because the technology is still at its infancy stage. However, the respondents realize that this technology will develop quickly and will become important to the industry.

c. Software used in teaching technology courses

The respondents were also asked to provide the list of software that they in teaching technology. Table 2 summarizes the software:

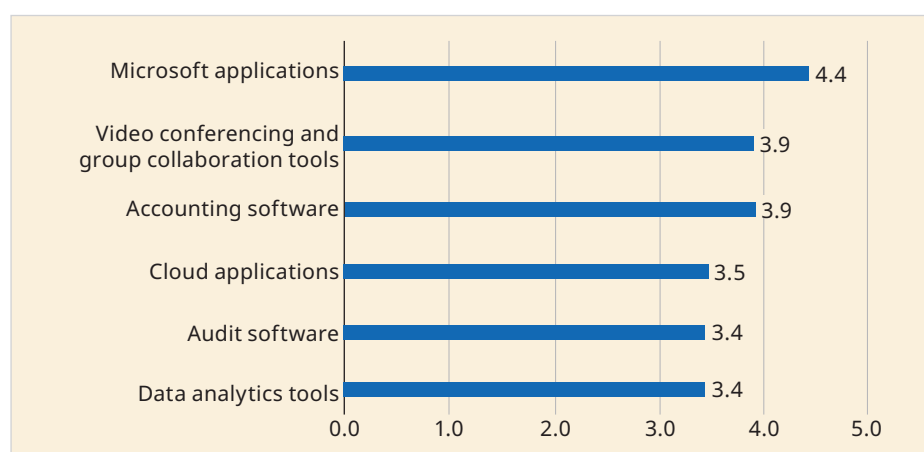
Table 2: Software used in teaching technology

Technologies	Software
Artificial intelligence	Accounting System, ATLAS, H2OAI, machine learning software, ChatGPT, Ms Excel, SPSS, Ms Visio, Myob, SAP, Zahir and Accurate, Zia (Zoho's AI Assistant for Business)
Artificial human assistants	Google assistant, chatbots software Accounting Programmer SIRI , Cortana, Smartphone, GPS, Zahir and Accurate
Augmented reality	Accounting System, Computer Accounting, 3d engine software, Sky map, Google Translate, Zahir and Accurate, Zoom
Blockchain	Free open-source windows, blockchain software
Cloud computing	Accurate cloud version, Atlas, Big Data, Erzap, Google Cloud, Google Drive, LAN, Zoom Cloud, OneDrive
Cybersecurity	Accounting System and Audit, Anti-virus, Kleopatra, Python ,”R” software
Data analysis / Big data	”R”, Tableau, Python, Accounting System and Audit, Microsoft, HDInsight, Analytics, Excel, Google Chrome SQL, ZOHO, Microsoft Power Bi, Knime, Orange
Extended reality	AVEVA XR
Machine learning / intelligence	Python, R-Language, R Studio, Scikit learn, Weka
Robotic process automation	Computer Accounting, Netlytic, MoonsonSIM, Open source tools, RPA for Python, TagUI, Robocorp, UI Path
Visual Internet of Things	Accounting System, Google Chrome MSTeams, Zoom, Python, SAP, ORACLE, Vosviewer

The respondents were asked how much of a selected suite of technology tools is currently used or has been embedded in the accountancy curriculum in the last 3 years. The responses are summarized in Figure 13.

Figure 13: Technology tools used in accountancy curriculum

(1 – Never used and 5 – Frequently used)

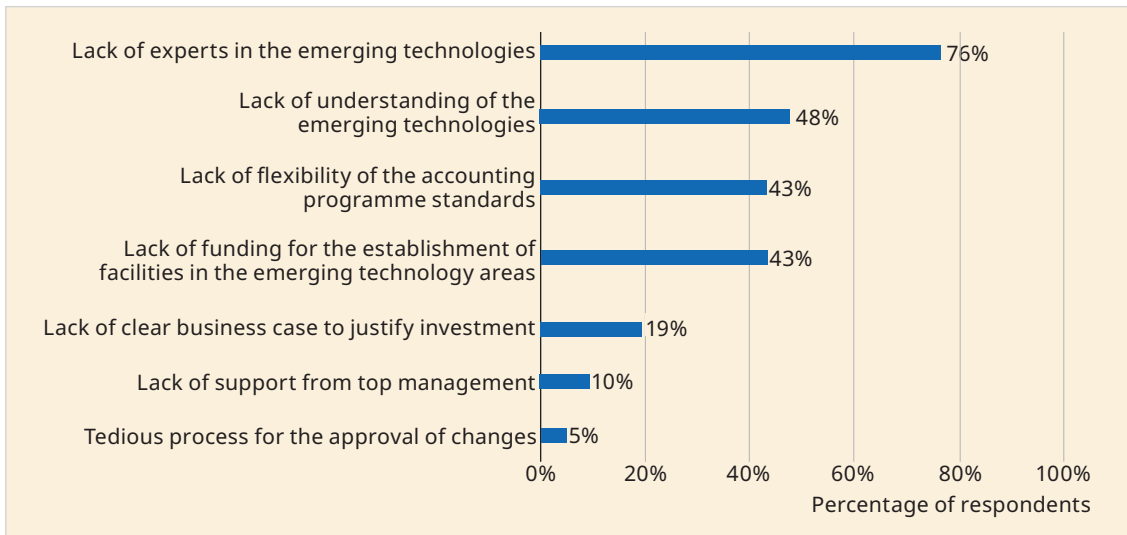


From Figure 13, it seems like the most popular tools are the Microsoft applications (4.4), video conferencing (3.9) and accounting software (3.9) followed closely by cloud applications (3.5), data analysis (3.4) and audit tools (3.4).

d. Barriers to incorporating technologies into the accountancy curriculum

Respondents were asked to select some of the possible barriers which hinder them in incorporating technologies into the accountancy curriculum. Figure 14 provides a summary of their responses.

Figure 14: Barriers to adoption of technology in accountancy curriculum



The top two barriers are: a lack of experts in emerging technologies (76%) and a lack of understanding of the emerging technologies (48%). 43% of the respondents are of the view that the lack of flexibility and funding are barriers to adoption. Interestingly, only 1 respondent mentions that it is a tedious process to obtain the necessary approval to implement a change in the curriculum.

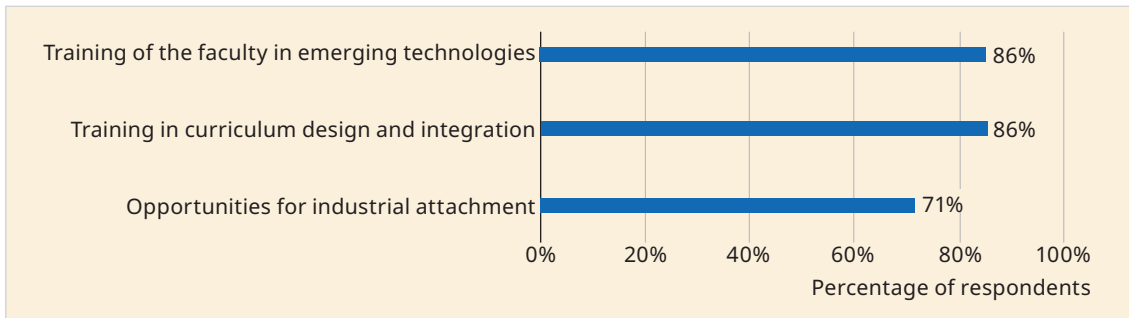
There seems to be a suggestion that the accountancy schools are really short of experts to teach technology in accountancy schools.

e. Help needed for incorporating technology into the accountancy curriculum

Regarding the lack of experts in emerging technologies, respondents were further asked what kind of assistance they would like to have to integrate emerging technologies into existing course/modules.

Figure 15 provides a summary of their responses.

Figure 15: Kind of help needed to incorporate technology into the accountancy curriculum



It is heartening to see on Figure 15 that the large majority of the respondents believe that training in the emerging technologies for the faculty, training in curriculum design, and opportunities for industrial attachment, represent the way forward to incorporating technology into the accountancy curriculum.

The responses indicate opportunities for accountancy schools to work closely with the accounting firms.

f. How should technology courses be taught in accountancy programmes

The discussion in the accounting literature is that ideally, teaching accountancy students technology should preferably be conducted by accountancy instructors who are experts or very conversant with technology.

However, there is a severe shortage of such technologically inclined accountants. Alternatively, technology could be taught by technology experts from the accounting industry. These are also short in supply.

Finally, a hybrid approach is to bundle accounting instructors with IT instructors to co-teach the technology course. The advantage of this approach is to overcome the shortage of capable instructors.

However, the disadvantage of this hybrid approach is that the technology portion of the course could be taught without an accounting context and the course can then become disjointed.

Respondents were asked in what ways technology should be taught in accountancy schools, including who should be the main instructors. Figure 16 shows the responses with regard to who should teach the technology component.

Figure 16: Views on how to technology should be taught in the accountancy curriculum

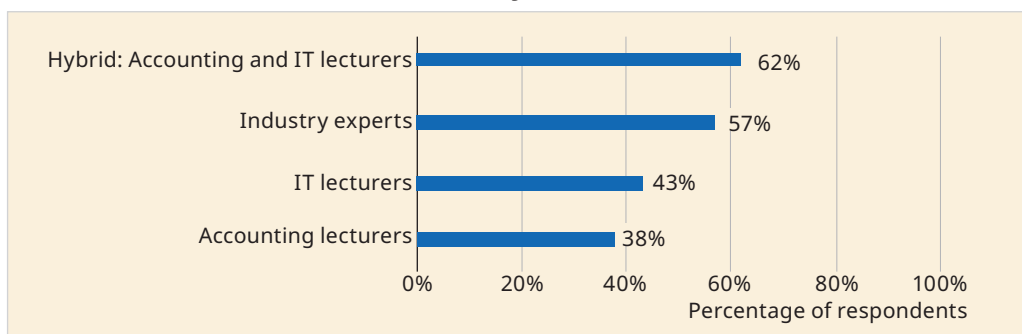


Figure 16 shows that at this juncture, a hybrid approach would be ideal.

This could be due to the shortage of accounting experts who are highly conversant in technology.

Interestingly, the least preferred method is the accounting lecturer. This may be an indication of the lack of technology-related competencies generally in accountancy lecturers.

In incorporating technology into the accountancy curriculum, respondents were asked to name their preferred mode of conducting the course.

Should the technology course be taught as a stand-alone technology course or should the technology be embedded into the accounting courses?

Both methods have their advantages and disadvantages.

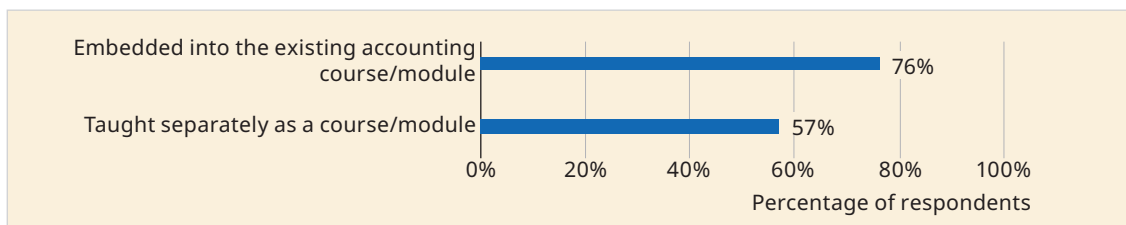
A stand-alone technology course grants the opportunity for the instructors to drill deep into the technology. However, the knowledge can be unrelated to accounting and suffer from a lack of integration with the accounting domain.

The other approach is to incorporate technology as part and parcel of the core accounting courses. This is ideal but it suffers from two major weaknesses. First, it is much harder to teach an accounting course with embedded technology.

The danger is that the course may end up having insufficient depth and coverage in both the accountancy and the technology domains. Secondly, it is very difficult to get accounting instructors who can weave technology effectively into the accounting core courses.

Figure 17 summarizes the respondents' views on teaching technology in the accountancy curriculum.

Figure 17: The way technology is to be taught in the accountancy curriculum



In Figure 17, respondents much prefer to teach technology in accounting courses in an embedded manner, for example, embedding data analytics into auditing.

Given this general preference to embed the technology, the respondents were specifically asked how they will incorporate the selected emerging technologies into their courses.

Figure 18 summarizes their responses.

Figure 18: Incorporating the selected emerging technology into the accountancy curriculum

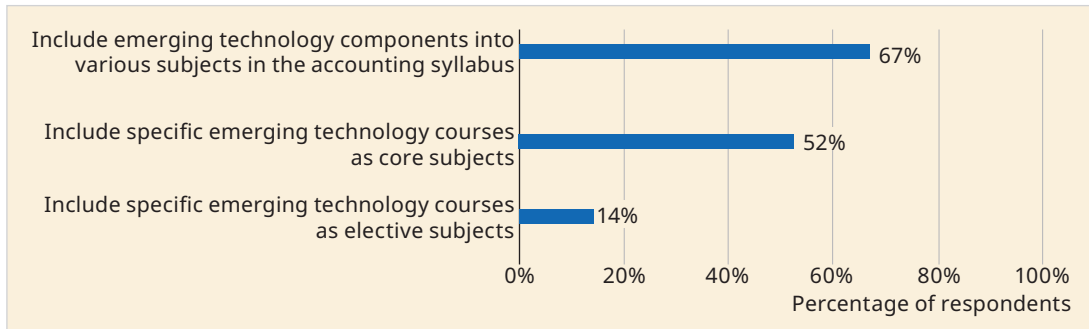


Figure 18 shows that accountancy schools prefer to incorporate technology as components into various subjects in the accountancy curriculum (67%). Only a small handful of respondents (14%) prefer to include technologies as electives.

g. Stage of adoption of technology by accountancy schools

Respondents were asked a final question on the stage of adoption of technology in their accountancy curriculum.

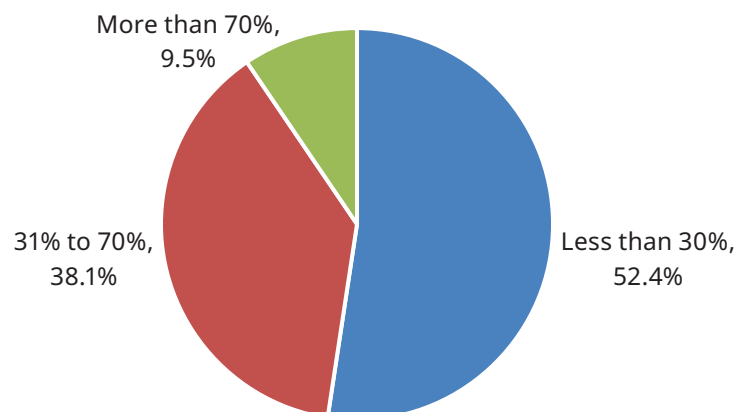
Figure 19 summarizes their responses.

The respondents are all at different stages of technology. They are equally distributed along the spectrum.

Most of the respondents (52%) have only adopted technology in less than 30% of their curriculum; 38% of respondents are at the 31% to 70% stage of adoption, and only 9.5% have adopted technology in more than 70% of their curriculum.

Interestingly, there are no respondents who have not started to adopt technology.

Figure 19: State of technology adoption in the accountancy curriculum

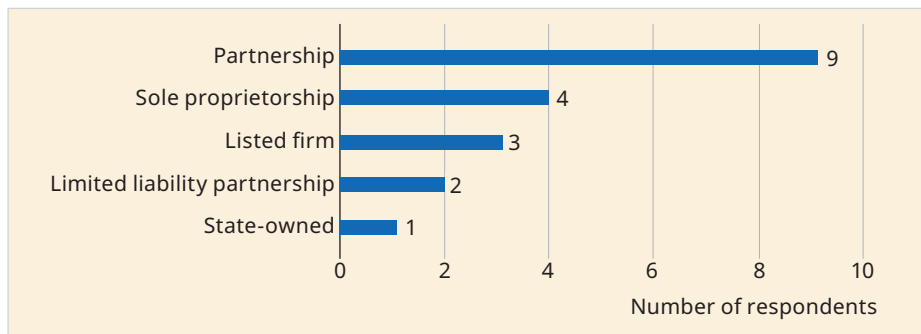


Accountancy professionals

a. Demographics of the respondents

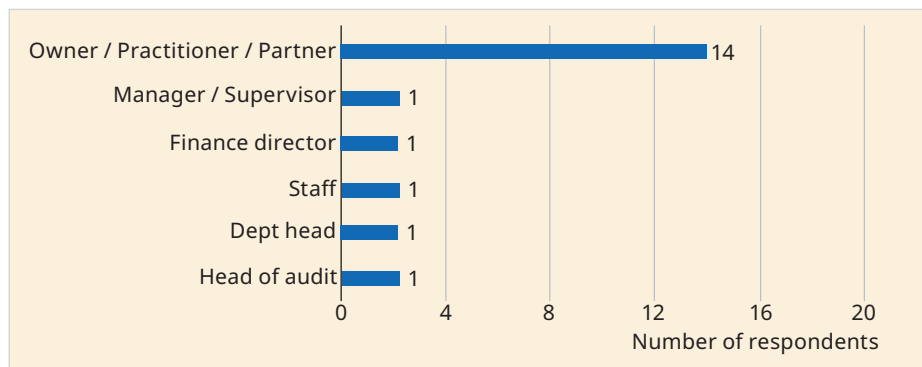
A survey instrument was sent to accounting practitioners for their responses.

Figure 20: Profile of respondents



There were altogether 19 respondents and the types of firms they represent are shown in Figure 20. There were 4 sole proprietorships, 2 limited liability firms, 9 partnerships, 1 state-owned firm and 3 listed firms.

Figure 21: Corporate positions of the respondents in their firms



The respective corporate positions of the respondents are shown in Figure 21.

14 of the 19 respondents are owners, practitioners or partners of their respective firms. The other respondents are managers, supervisors or heads of certain departments.

Figure 22: Number of employees in the respondent firms

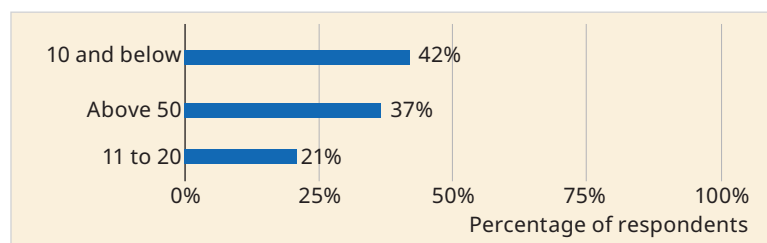
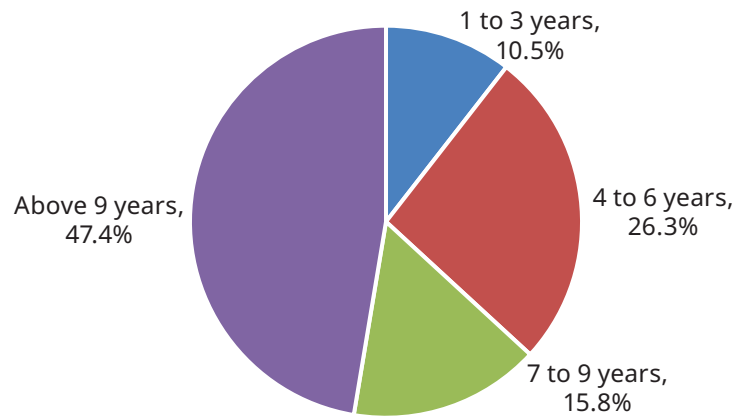


Figure 22 provides an indication of the size of the firms of the 19 respondents.

37% (or 7) of the respondents have more than 50 staff in their firm while 21% (4) and 42% (8) of the respondents have 11 to 20 staff and up to 10 staff, respectively.

Figure 23: Years of operations of the respondent firms

The respondents were asked to disclose how long their firm has been in existence. Figure 23 shows that 47% (or 9) of the 19 respondents have been in existence for more than 9 years while only 11% (or 2) of the respondents have been in operation for 1 to 3 years.

b. Awareness and utilization of the selected emerging technologies

The respondents were asked to provide an indication of their level of awareness of advances in technology pertaining to their industry.

Figure 24: Level of awareness in the selected emerging technologies

(1 – Not at all and 5 – Fully aware)

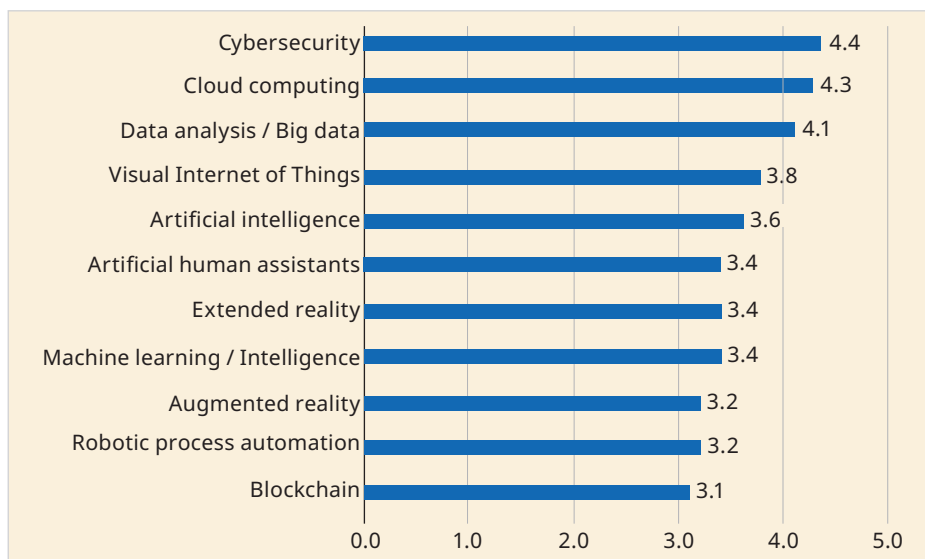


Figure 24 provides a statistical summary of the level of awareness of respondents of 11 selected emerging technologies.

The top 3 emerging technologies of which the respondents have the highest level of awareness are: cybersecurity (4.4), cloud computing (4.3) and data analysis/big data (4.1).

The 3 emerging technologies that have the lowest level of awareness are blockchain (3.1), robotic process automation (3.2) and augmented reality (3.2).

Figure 25: Level of adoption of the selected emerging technologies

(1 - Not at all utilized and 5 - Utilized all the time)

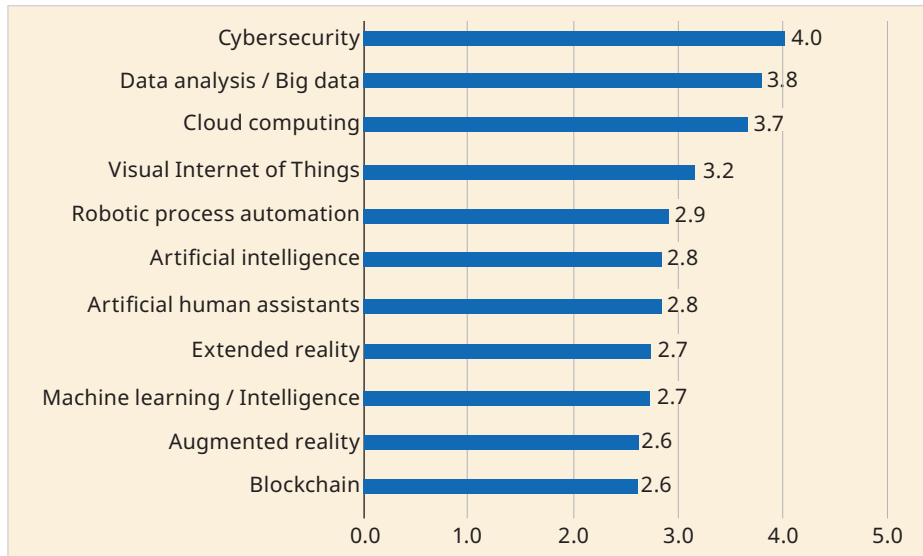


Figure 25 shows the level of utilization of the emerging technologies.

The top 3 most utilized emerging technologies have also the highest level of awareness: cybersecurity (4.0), data analysis/big data (3.8) and cloud computing (3.7).

However, the level of utilization (3.7 to 4.0) on average is lower than the level of awareness (4.1 to 4.4).

This could mean that it is one thing to be aware of a technology but it is another thing to be utilizing the technology.

This is particularly the case for those technologies with an average utilization level of less than 3.

c. Systems and software adoption

The respondents were asked to provide their inputs on the type of systems and software which they currently adopt in their work.

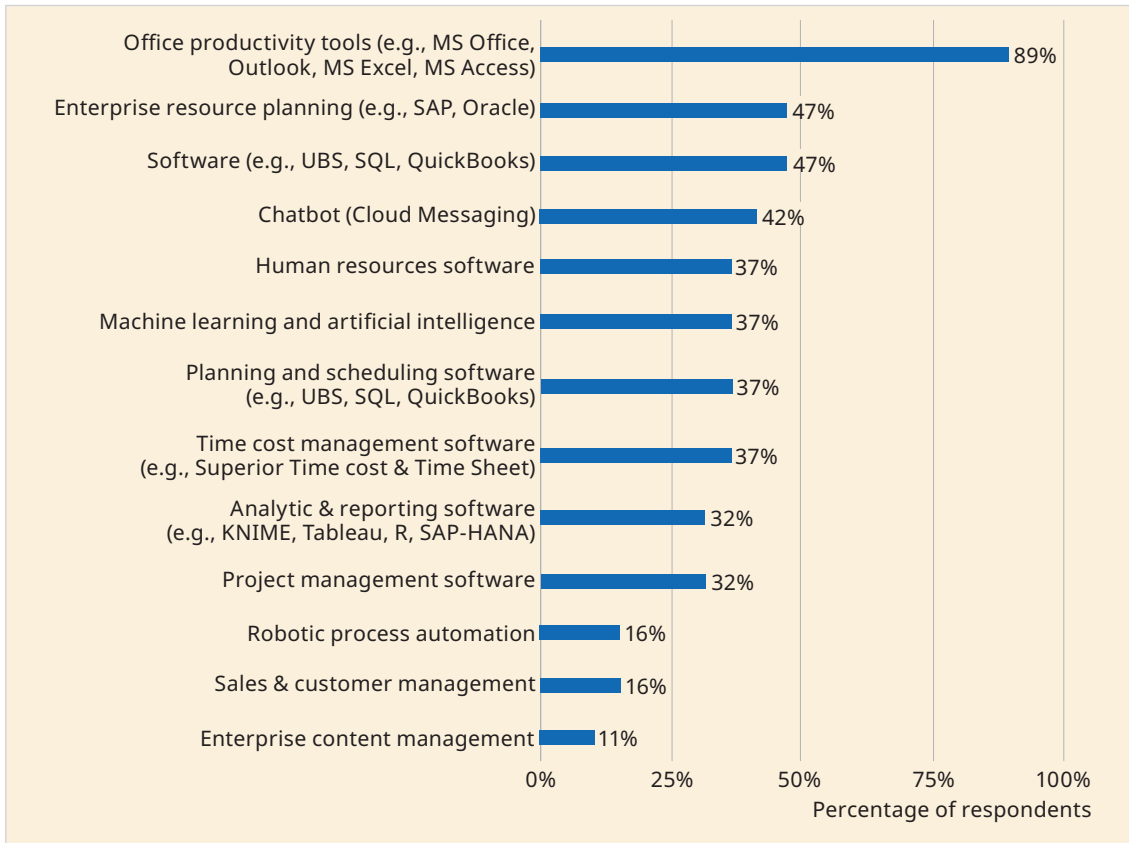
Figure 26: Types of systems and software adopted

Figure 26 shows the list of systems and software adopted by the respondents.

The top 4 most popular systems or software adopted are: office productivity tools (89%), followed by enterprise resource planning (47%), software (eg. UBS, SQL, QuickBooks) (47%) and chatbot (cloud messaging) (42%).

The least popular software is enterprise content management (11%).

d. Computer-assisted audit techniques (CAAT) Adoption

The respondents were specifically requested to provide inputs on the adoption of computer-assisted audit techniques (CAAT). Figure 27 provides a summary of the CAAT adoption.

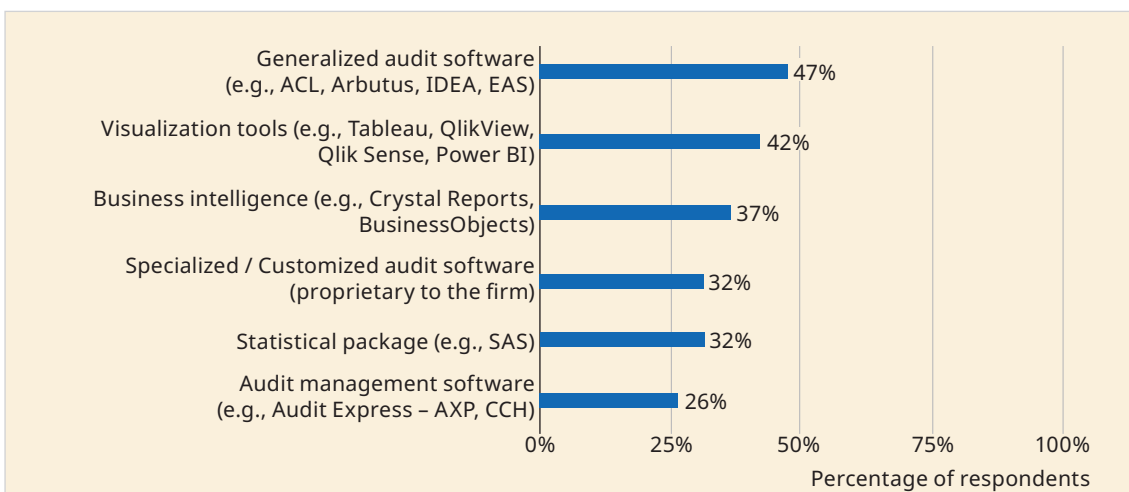
Figure 27: Types of computer-assisted audit techniques (CAAT) adopted

Figure 27 shows that 47% of the respondents use generalized audit software in their operations. Interestingly, 32% of the respondents also use specialised or customised audit software – which is proprietary to their firm – audit management software in their operations. This suggests that the use of audit software is imperative in the current auditing landscape. Visualisation tools are also used by 42% of the respondents and enjoy the next highest usage level.

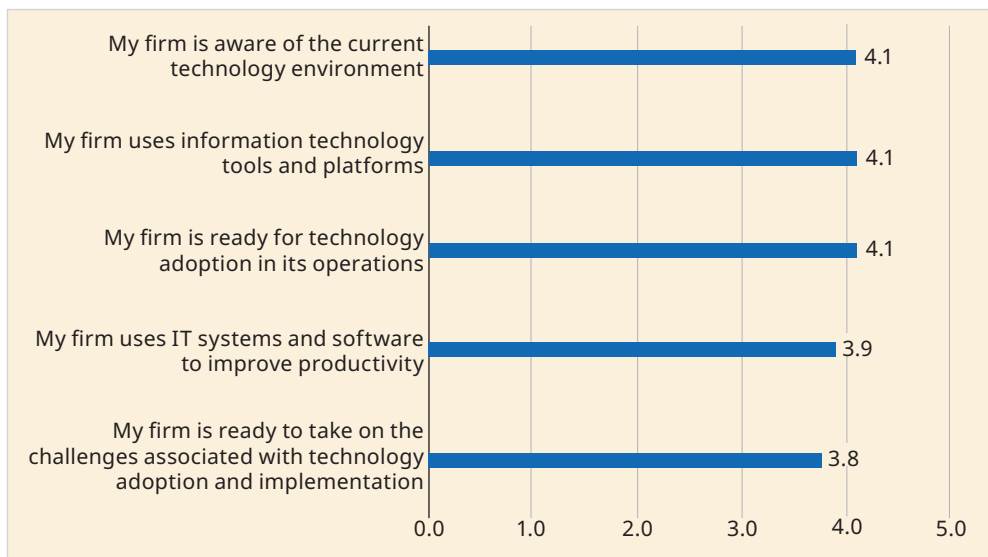
e. Technological preparedness

The respondents were asked about their preparedness for technology adoption from three different dimensions: the approach to technology, manpower skills and knowledge, and investment in technology.

Figure 28 shows the respondents' input on five statements regarding their approach to technology.

Figure 28: Approach to technology

(1 – Fully disagree and 5 – Fully agree)



The respondents provided very positive responses to the five statements and it can be concluded that one key finding is that technology is vital to the operations of accountancy firms.

In addition, Figure 28 shows the following main findings on the adoption of IT systems and software: 1) firms are ready to adopt technology; 2) firms use technology tools and platforms in their operations; 3) firms are highly aware of the current technological environment; 4) technology boosts productivity; and 5) firms are ready and willing to tackle the challenges that come with the use of technology.

Figure 29: Manpower skills and knowledge

(1 – Fully disagree and 5 – Fully agree)

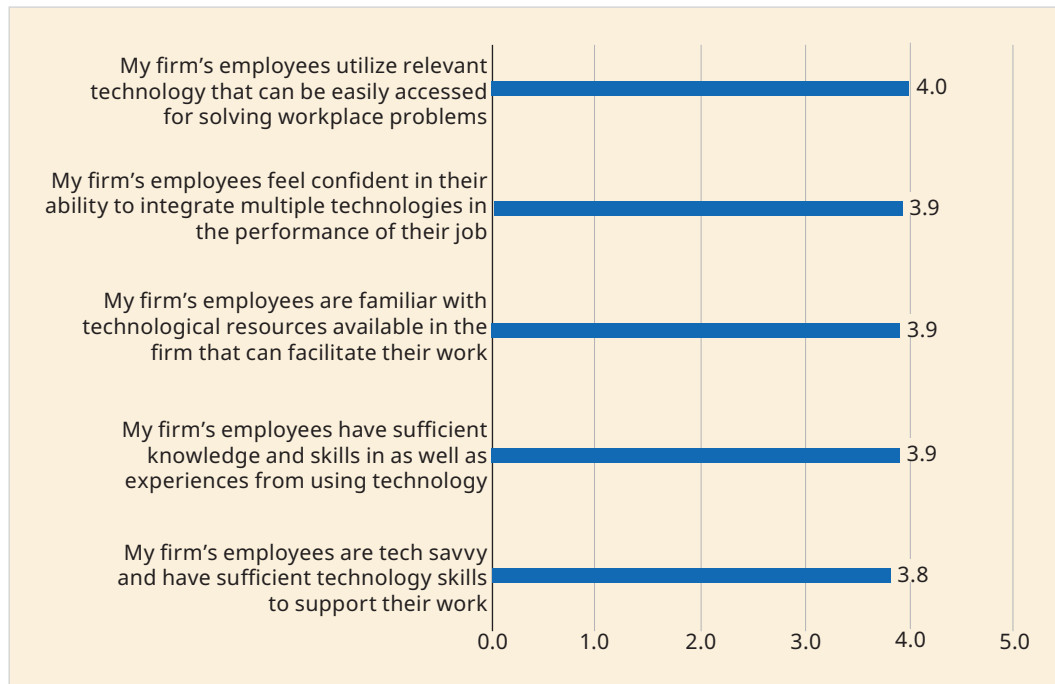


Figure 29 provides a summary of the feedback of the respondents on the skills and knowledge of their manpower vis-à-vis the technological challenge.

The responses are generally positive about the manpower's skills and knowledge.

The respondents are of the view that their employees are tech savvy, have sufficient knowledge and skills, are familiar with technological resources available in the firm, and are confident to integrate technologies into their work and utilize the relevant technology.

However, the responses seem to be slightly lower than for the degree of conviction about the firms' approach to technology.

The key findings here may suggest that more can be done to upskill the staff through technology-related training.

Figure 30: Investment in technology

(1 – Fully disagree and 5 – Fully agree)

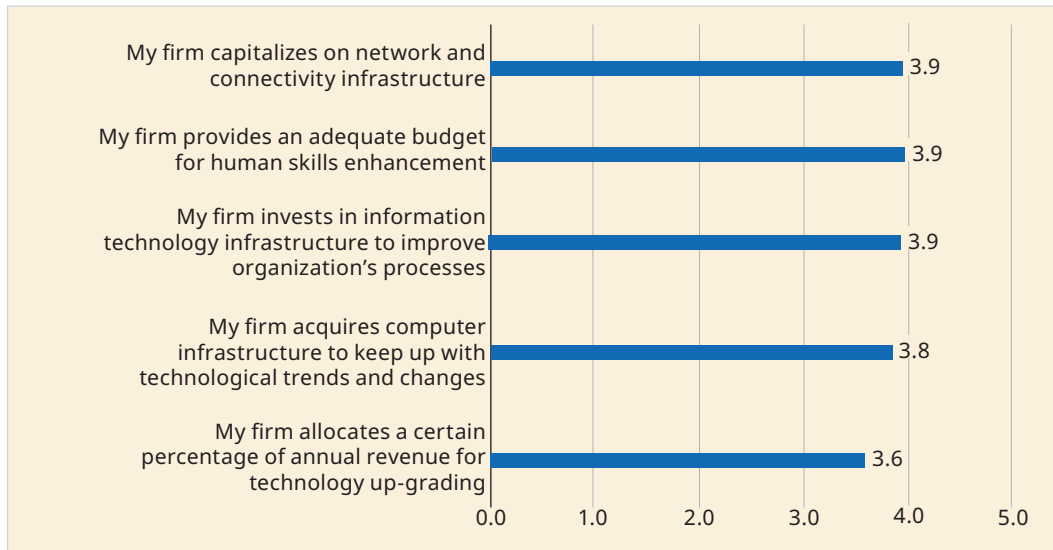


Figure 30 shows the respondents' feedback on their firm's investment in technology. The responses are consistent with the respondents' views about the adoption of technology and the need for technological upskilling.

The findings suggest that the respondents are willing to invest in technology infrastructure and may have undertaken actions and framed strategies to raise the firms' capability in technology.

f. Planned behaviour towards technology adoption

The respondents were further requested to provide responses to statements that help to assess the planned behaviour of respondents toward technology adoption. The planned behaviour covers four key aspects: attitude, subjective belief, perceived behavioural control and intention to engage.

Attitude

Figure 31: Attitude towards technology

(1 – Fully disagree and 5 – Fully agree)

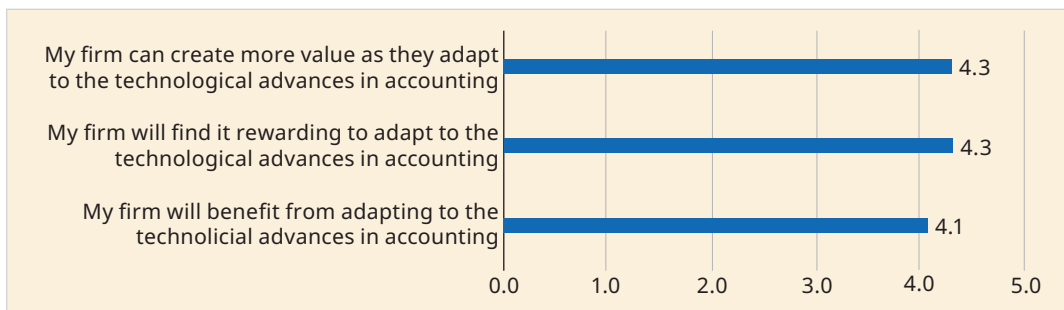


Figure 31 provides very positive responses from the respondents on their attitude towards technology.

There is a very strong belief that their firms will benefit from adapting to the technological advances in accountancy and this positive belief is expected to result in more value creation.

The respondents believe that they will be rewarded for adapting to technological advances.

Subjective belief

Figure 32 summarizes the respondents' feedback on their subjective belief of the management concerning the profession, staff and regulator's view about adapting to the technological advances in accounting.

Figure 32: Subjective belief about technology

(1 – Fully disagree and 5 – Fully agree)

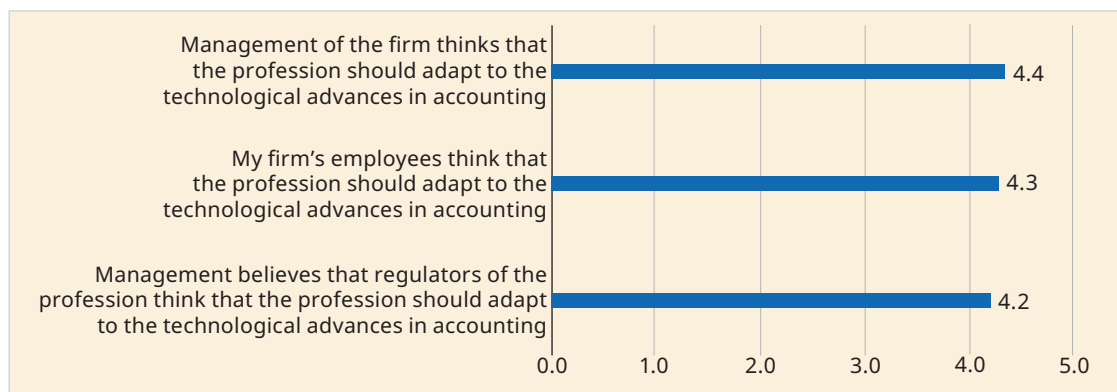


Figure 32 shows that there is a very strong subjective belief that regulators, accountancy professionals and staff think that the adoption of technological advances in accounting is imperative to the accountancy profession.

It seems that there is a subjective belief that the technology advancement cannot be stopped, and firms must adapt to survive.

Perceived behavioural control

Figure 33 shows the planned behaviour of the respondents in adopting technology advances in accountancy for their firms.

Figure 33: Planned behaviour for technology adoption

(1 – Fully disagree and 5 – Fully agree)

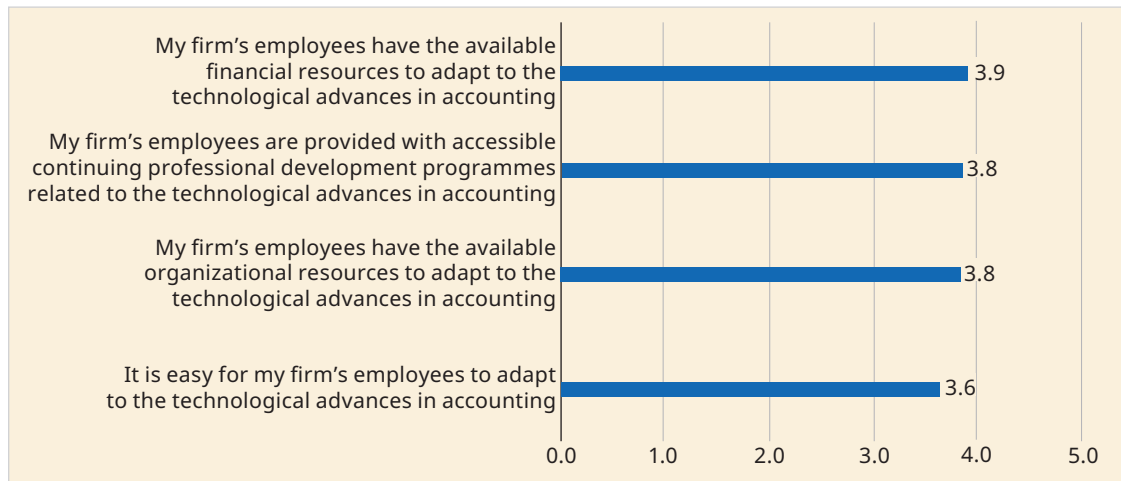


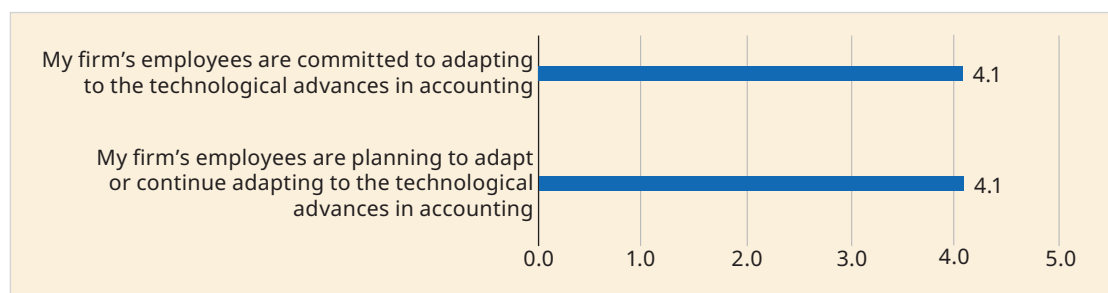
Figure 33 shows that the respondents articulate their planned behaviour in a positive and affirmative manner. There is a general positive agreement on the planned actions. The most important actions are seen to be the necessary provision of support to employees in terms of financial resources, access to technology and professional development to enable employees to upskill to face technological challenges. However, the level of affirmation of planned behaviour is much lower than the attitude and subjective belief towards the technologies.

Intention to engage

Figure 34 summarizes the respondents' inputs on their intention to engage or take actions in adopting technology in their business.

Figure 34: Intention to engage technology

(1 – Fully disagree and 5 – Fully agree)



The findings in Figure 34 are very assuring as they show a positive attitude toward adopting technology, a strong subjective belief that technology is crucial to the accounting sector, and planned behaviour to engage technology. This is affirmed by positive sentiment about the employees' intention to engage technology. The positive sentiments are as strong as those for all the other 3 components: attitude, subjective belief, and perceived behavioural control.

g. Expected benefits of technology adoption

The respondents were asked about the expected benefits of technology adoption. The list of benefits was curated from the accounting literature and industry dialogues.

Figure 35 provides a summary of the respondents' feedback on articulated expected benefits.

Figure 35: Expected benefits of technology adoption
(1 – Fully disagree and 5 – Fully agree)

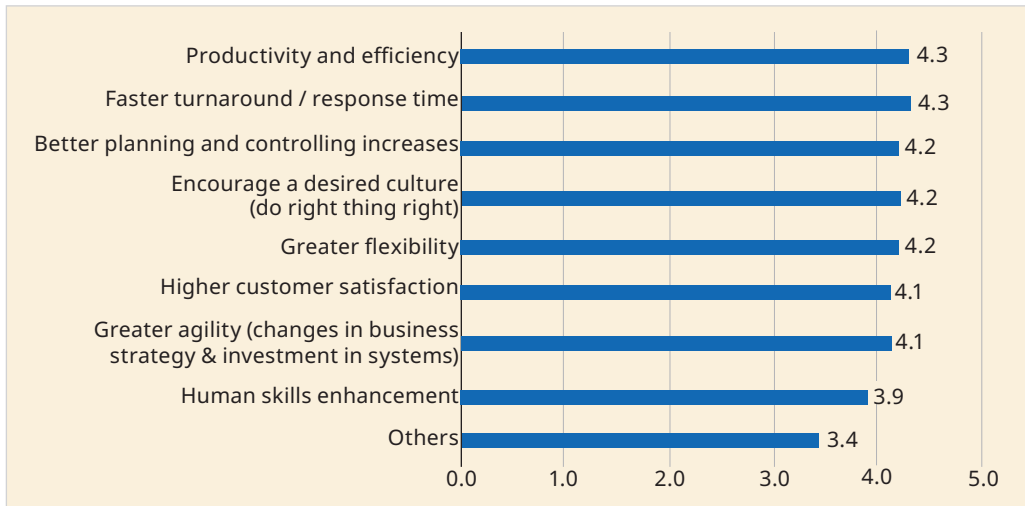


Figure 35 shows that there is strong endorsement by the respondents of the well documented benefits of technology adoption. The most compelling reason behind such backing is productivity and efficiency gains and faster turnaround / response time in the workplace. Other reasons offered for the adoption of technology include human skills enhancement.

h. Challenges to adoption of technology

The respondents were asked a final question on the challenges faced by accountancy firms in their adoption of technology. Figure 36 provides a summary of the responses.

Figure 36: Challenges to adoption of technology

(1 – Fully disagree and 5 – Fully agree)



Figure 36 shows that the top 3 challenges are the lack of standards, regulations or certifications in technology adoption.

This could mean unclear economic benefits, high investment costs, and the lack of cultural readiness.

These barriers seem to suggest that there is significant resistance to change or the adoption of technology.

The difficulties are compounded by a shortage of skilled and knowledgeable employees.

There may be a business case for the better articulation of the economic benefits of technology adoption especially when accompanied by a good and proper framework setting out standards and certification criteria.

There must also be a relook at the cost of investment in technology.

Conclusion

Based on an analysis of the survey results, it is concluded that the adoption of technology by the accountancy profession including higher educational institutes, PAOs and accountancy practitioners in Indonesia falls somewhere in the middle of the digital transformation process.

All respondents are aware that it is important to adopt technology. All of them already use and are familiar with some emerging technologies not only in accountancy but also in other fields.

IHLs confirm that they should accommodate technology in their curricula despite facing some barriers to technology adoption.

Practitioners believe that adopting technology can sharpen their competitive advantage, and result in a positive impact on their firms' performance.

PAOs believe that technology adoption offers many benefits to their members, and they are committed to conducting training to elevate their members' technological skills.●

Appendix 7: Malaysia

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Ruhaya Atan, Accounting Research Institute (ARI) UiTM

Preamble

This study is commissioned by the ASEAN Accounting Education Workgroup (AAEW) and is sponsored by the ASEAN Federation of Accountants (AFA). This study was carried out in various ASEAN countries.

AAEW exists to provide input to and empower higher education accountancy programmes across ASEAN. It has the vision to foster the development of ASEAN higher education accountancy programmes, enhancing their abilities to produce graduates who can compete in the global accountancy markets. It further supports business and the accountancy profession in the ASEAN Economic Community through advice on matters relevant to accounting education.

AAEW is interested in understanding the views and perceptions of how accountancy schools in higher education institutions in ASEAN are adopting emerging technology and tackling technological disruptions. The findings from this study are very important to the accountancy profession and accountancy education in ASEAN in meeting rising demand for technology savvy accountants.

Organization of report

This report is divided into the following sections:

- Preamble
- Introduction
- Literature Review
- Methodology of investigation
- Data Collection and Findings and Discussion
- Conclusion and Recommendation
- References

Abstract

The purpose of this paper is to present the findings of a study on the level of adoption and utilization of emerging technologies in the accountancy profession and accountancy schools in Malaysia. Basically, the study aims to assess the current landscape and explore the insights associated with adopting emerging technologies in these domains.

One objective is to identify the extent to which emerging technologies, such as artificial intelligence, data analytics, blockchain, and cybersecurity, are being embraced and effectively utilized. By examining this aspect, the study seeks to understand the level of awareness, use and incorporation of technologies in accounting education and curriculum development as well as from the perspectives of accountancy practice.

This study is divided into three different groups of respondents, namely, accountancy schools, the accountancy profession and the professional accounting organization, which is the Malaysian Institute of Accountants.

It can be seen that there is a fair level of awareness and interest in incorporating technologies among the respondents and their organizations. In fact, some have already integrated blockchain in their systems. In contrast, the level of competency in teaching emerging technologies in the accountancy schools is still low, but efforts are underway for training and skill development.

It is hoped that the findings of this study will help readers identify gaps or barriers that may hinder the successful integration of technology and provide insights into strategies for promoting technology adoption. In addition, this will also help to develop ideas and foster innovation, whilst preparing ‘fit for purpose’ accountancy professionals. The approach should be forward looking in order for these talents to play a more fruitful role in the evolving digital era and for organization development and future-ready purposes.

Introduction

The technological disruption to the accountancy profession has significant implications for accountancy education, and this has been documented in a broad spectrum of accounting studies. Today, this is still an issue to address, hence a topic of our study (CPA Aust., 2023).

This study seeks to identify the levels of technology adoption by accountancy schools of higher education institutions in ASEAN, in this case, Malaysia. The aim is basically to seek an understanding of the level of technology adoption, and issues and challenges faced by accountancy schools in adapting and adopting various technologies. In addition, the study seeks to find out how these technologies should be adopted.

To enhance the effectiveness of accounting education and the accountancy profession in Malaysia, it is important to embrace technology. This can be achieved through various measures that align with the evolving industry landscape. This would involve the integration of accounting software into the curriculum, such as popular platforms for financial management and tax preparation. These measures can provide students with practical skills and familiarity with industry-standard tools. The increasing availability of data presents opportunities for accountants to leverage data analytics in their work. By incorporating data analytics courses and techniques into the accountancy curriculum, students can develop the necessary skills to analyse and interpret data, identify patterns,

and make informed decisions.

At the same time, as artificial intelligence (AI) and automation technologies continue to advance, it is crucial for accountancy professionals to understand their implications. Accounting education should cover topics such as AI-powered financial analysis, automated reporting, and the ethical considerations surrounding these technologies (Source: Industry reports).

Cybersecurity awareness is of utmost importance in today's digital landscape. Educating accountancy professionals about cybersecurity threats, best practices, and risk management strategies is essential to protect sensitive financial information and ensure compliance with data protection regulations.

The COVID-19 pandemic has accelerated the adoption of remote work practices. Integrating collaboration tools, project management software, and remote work skills into accounting education can equip graduates with the necessary competencies for a modern work environment. Promoting a culture of continuous professional development is vital. Encouraging accountancy professionals to engage in ongoing learning, attend workshops and seminars, pursue online courses, and obtain professional certifications focused on technology and its applications in accountancy, can foster their growth and adaptability to future technological advances.

Objectives

The key objectives of the study include:

1. To understand the views and perceptions of professional accountancy organizations (PAOs) in ASEAN of digital disruption to the accountancy profession.
2. To document the kind of digital technologies PAOs in ASEAN are most concerned with.
3. To identify the key concerns and types of digital skills required of future accountants.
4. To understand what PAOs and accountancy schools are, or will be, doing to tackle technological disruption in accountancy.
5. To capture, in case studies, technology adoption by accountancy schools.
6. To propose generic roadmaps for technology adoption by PAOs and accountancy schools in ASEAN, with linkages to relevant job roles or areas of work.

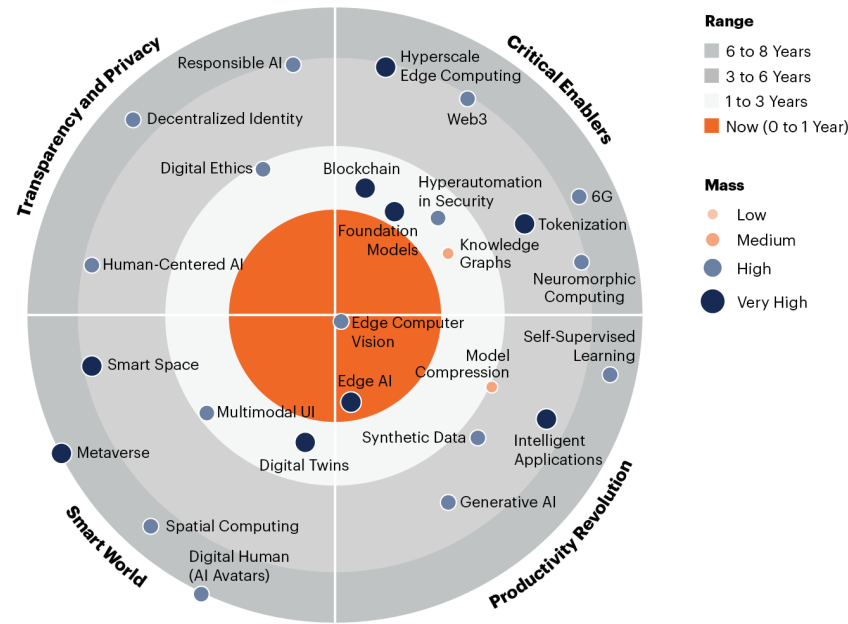
General view of emerging technologies

According to Gartner (2023), there have been significant developments in the technology space across the world, in emerging economies and developed countries, with the third world following closely. The various emerging technologies with unique names that we are now familiar with are deployed as critical enablers in the productivity revolution and as tools for the smart world.

From Figure 1, the Gartner radar shows the impact of technologies measured in terms of mass and range over the next 8 years.

Figure 1: Gartner emerging technologies and trends impact radar

2023 Gartner Emerging Technologies and Trends Impact Radar



gartner.com

Note: Range measures number of years it will take the technology/trend to cross over from early adopter to early majority adoption. Mass indicates how substantial the impact of the technology or trend will be on existing products and markets.
 Source: Gartner
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ASEAN’s approach to science, technology & innovation

Science, Technology & Innovation (STI) plays a vital role in all ASEAN economies, regardless of their economic status. It prevails in various sectors like agriculture, energy, education, finance, manufacturing, and tourism. The integration and cooperation agenda for STI in ASEAN is driven by the common vision of member states to leverage STI for knowledge sharing, research development, and practical solutions to real-life problems (<https://asean.org/our-communities/economic-community/asean-science-technology-and-innovation/>). In addition, cooperative efforts have been launched to encourage knowledge exchange and inclusiveness, such as fellowships and prizes for female scientists. The process of bringing research outputs to market involves collaboration between the private sector, public sector, and end-users. This emphasis on STI focuses on facilitating technology transfer, commercialization, and protecting intellectual property rights. These efforts contribute to the Gross Domestic Product (GDP) and attract foreign direct investment, supporting business formation and job creation.

Establishing protocols for the protection and enforcement of intangible assets, including trademarks, geographical indications, and indigenous knowledge, provides businesses with security and fosters economic growth. The impact of STI extends from ideation to implementation. It also encompasses the economy, creating opportunities and driving upward social, skills and economic mobility. STI acts as an enabler throughout the three stages of ideation, implementation, and impact. It seeks to promote integration and

cooperation for maximum effectiveness. The ASEAN Permanent Committee on Science & Technology (PCOST), established in 1971, was among the first ASEAN committees. Over the years, additional member states joined, and PCOST was rebranded as the ASEAN Committee on Science & Technology (COST). The committee's work is guided by the ASEAN Plan of Action on Science, Technology & Innovation (APAST), which has been revised several times, with the most recent version covering 2016 to 2025. The plan focuses on public-private collaboration, talent mobility, enterprise support, and public awareness to enhance cooperation.

ASEAN organizes events like ASEAN NEXT and ASEAN Science, Technology & Innovation Week to facilitate partnerships, collaborations, knowledge sharing, and business development. These activities align with the goals of the ASEAN Plan of Action on STI. The ten-year Action Plan is currently in its fifth year, and regular stock takes were conducted to evaluate progress and identify areas for improvement and future planning. Efforts are being made to engage more stakeholders, including universities, policy research centres, international organizations, and the private sector, to strengthen collaboration and impact. It can be seen that in terms of Digital Transformation, ASEAN countries are actively embracing digital transformation across various sectors, including finance, healthcare, manufacturing, and agriculture. This includes the adoption of technologies such as cloud computing, Internet of Things (IoT), and big data analytics.

As for FinTech Innovation, the ASEAN region has seen significant growth in financial technology (FinTech) innovation. Mobile payments, peer-to-peer lending, and digital banking solutions are gaining popularity, driven by a rising number of digital-savvy consumers and supportive regulatory environments. Artificial Intelligence (AI) is being increasingly utilized in ASEAN countries to automate processes, enhance customer experiences, and improve decision-making. Applications include chatbots, virtual assistants, predictive analytics, and personalized recommendations. Many ASEAN cities are also undertaking smart city initiatives, leveraging technology to enhance urban living. This involves the deployment of IoT sensors, smart infrastructure, efficient energy management, and data-driven urban planning.

The digital economy is rapidly growing in ASEAN, driven by the rise of e-commerce platforms, digital marketplaces, and cross-border trade. Governments are implementing policies to support digital entrepreneurship and remove barriers to e-commerce.

Malaysia's approach to technology development

From Malaysia's perspective, the country's Digital Economy Blueprint (DEB) was unveiled on February 19, 2021. The DEB aims to drive digital transformation and foster innovation. The DEB focuses on areas such as e-commerce, digital infrastructure, data analytics, and talent development. Industry 4.0: Malaysia is actively embracing Industry 4.0, the fourth industrial revolution characterized by automation, IoT, and data exchange. The government encourages the adoption of advanced manufacturing technologies, robotics, and smart factories.

Blockchain adoption: Malaysia has shown interest in blockchain technology and its potential applications. Initiatives include exploring blockchain for supply chain

management, digital identity verification, and financial services.

Cybersecurity focus: The Malaysian government emphasizes the importance of cybersecurity, given increasing digital threats. Efforts are being made to strengthen cybersecurity infrastructure, establish the regulatory framework, and promote cybersecurity awareness.

Digital payments: Malaysia has witnessed a surge in digital payment solutions, including mobile wallets and contactless payments. The government has introduced initiatives to drive cashless transactions and promote financial inclusion.

The DEB projected a substantial contribution of 22.6% to the Gross Domestic Product and attracting significant investments amounting to over RM70 billion, both domestic and foreign. This surge in the digital economy, combined with the impact of the COVID-19 pandemic, has led to remarkable growth in artificial intelligence (AI), data science, blockchain, and cybersecurity applications across various industries, including accountancy. In response to these advances, accountants are embracing technologies that streamline data acquisition and manipulation, and reduce labour-intensive tasks. Millennials are bringing about transformative changes in the accountancy sector, challenging traditional hierarchical corporate models and spurring the rise of niche practices. As a result, the survival of traditional accounting firms may face challenges in the coming decade, as outdated business models are becoming less viable.

Technological innovations like AI, data analytics, and cybersecurity are increasingly integrated into applications and software platforms at a steady pace. AI's potential in helping decision making when evaluating financial and accounting records is becoming evident. Following comprehensive discussions by the various working groups, surveys, and roundtable discussions, certain emerging technologies have been identified as essential components to be incorporated into the accountancy curriculum. They are considered vital for the preparation of future accounting graduates.

Methodology

This study employed a mixed-method approach consisting of a survey questionnaire and interviews. The survey questionnaire is semi-structured, that is, designed to collect quantitative and qualitative data, and was distributed to a diverse sample of participants, namely:

1. Accountancy schools
2. Accounting practitioners
3. Professional Accounting Organizations (PAOs).

The questionnaire included structured questions to assess participants' perceptions, experiences, and attitudes regarding the research topic. A Likert scale of 1 – 5 is generally given to the questions to indicate respondents' claims to the influencing factors concerned. Simultaneously, interviews were conducted to obtain qualitative insights from a smaller subset of participants.

The interviews followed a semi-structured format, allowing for open-ended responses and probing to gain a deeper understanding of participants' perspectives.

The combination of the survey questionnaire and interviews enabled triangulation of

data, providing a more holistic view of the research topic by capturing both quantitative and qualitative information. The collected data were then analysed using appropriate statistical techniques for the survey questionnaire responses, and thematic analysis was employed to identify recurring patterns and themes in the interview transcripts.

Data collection and findings

This section is an interpretation sourced from our data collection which is based on a summary of the frequency counts on the responses collected. This is divided into accountancy schools and accounting practitioners, from the survey questionnaire. Finally, we managed to meet up with our PAO, Malaysian Institute of Accountants (MIA).

It should be noted that the sample size is rather small with 12 respondents from accountancy schools and 14 from accounting practitioners. As such, further analysis to cross-tabulate and examine the cause-and-effect relationship is not plausible in this case. Therefore, descriptive analysis of frequency counts is used to gain an understanding of the perceptions of the participating respondents. Neither statistical nor analytical generalization can be made due to the limited sample size.

Accountancy schools

From our current study, this section's findings cover demographic data, with pie charts presented in Appendix A.

It should be noted that we could not get a good number of responses as MIA had conducted a similar survey previously (MIA, 2021). As such, the approach to collecting responses was more on a personal contact basis by the researchers. There is a total of 12 respondents.

All respondents were from universities, none from colleges or university colleges. Of the 12 respondents, 41% represent private universities with the remainder from public universities. The universities are located all over Malaysia, with a fair concentration in Klang Valley. The histogram of the threshold is given in Appendix A. It can be seen that most of the universities are accredited by MQA (Malaysian Qualifying Agency), with several also recognised by various professional accountancy bodies, mainly overseas. The accountancy programmes in the universities have been offered for a number of years ranging from 10 to more than 50.

66.7% of the respondents are Teaching Faculty members, with a small percentage being deans and those holding management positions in the schools. The universities are all local, as shown in Appendix A. The enrolment of accountancy students is from 120 to about 13,000.

In the next section, an interpretation is given before each bar chart is presented.

The respondents were asked about their level of awareness of the types of emerging technologies. On a scale of 1 which is 'not at all' and 5 which is 'fully aware', it can be seen from the multiple bar charts in Figure 1 below, that the respondents are at least moderately aware of the technologies, especially cybersecurity (4.2), as well as data analysis/big data (4.1), cloud computing (4.1) and artificial intelligence (4.1).

Figure 1: Level of awareness of the selected emerging technologies
(1 – Not at all to 5 – Extremely aware)

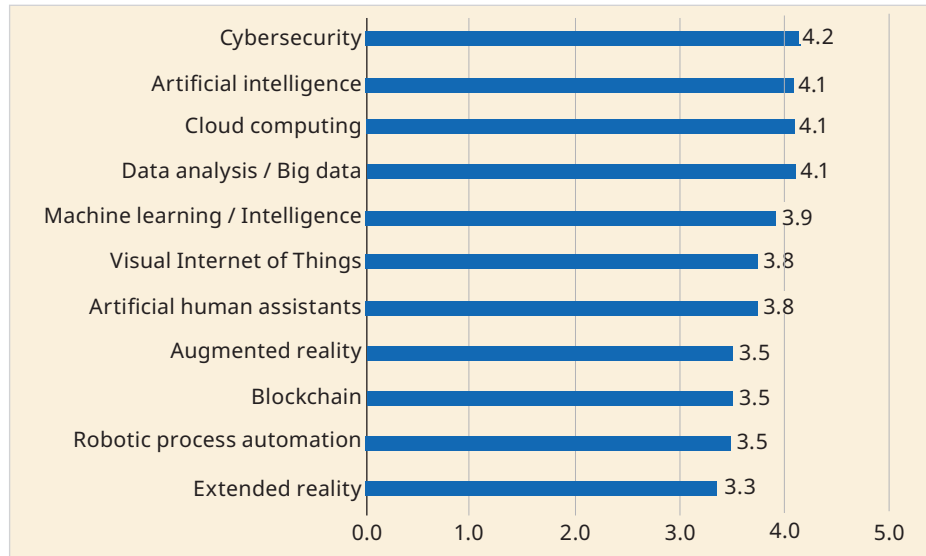


Figure 2 indicates the respondents' scores for the level of competency to teach emerging technologies. It can be seen that the respondents are basically nowhere near advanced and are rather skewed towards the Foundation to Intermediate level. The lowest score is 1.5 indicating that robotic process automation and augmented reality are rather new to accountancy schools. On the other hand, cloud computing (2.4) and data analysis/big data (2.1) are at the Foundation level indicating there is growing competency in these two emerging technologies.

Figure 2: Level of competency to teach the selected emerging technologies
(1 – None, 2 – Foundation, 3 – Intermediate, 4 – Advanced)

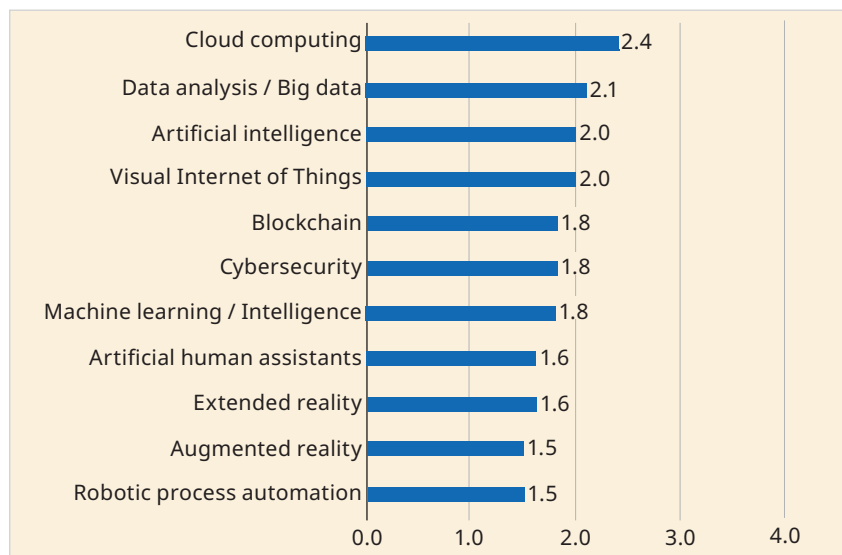
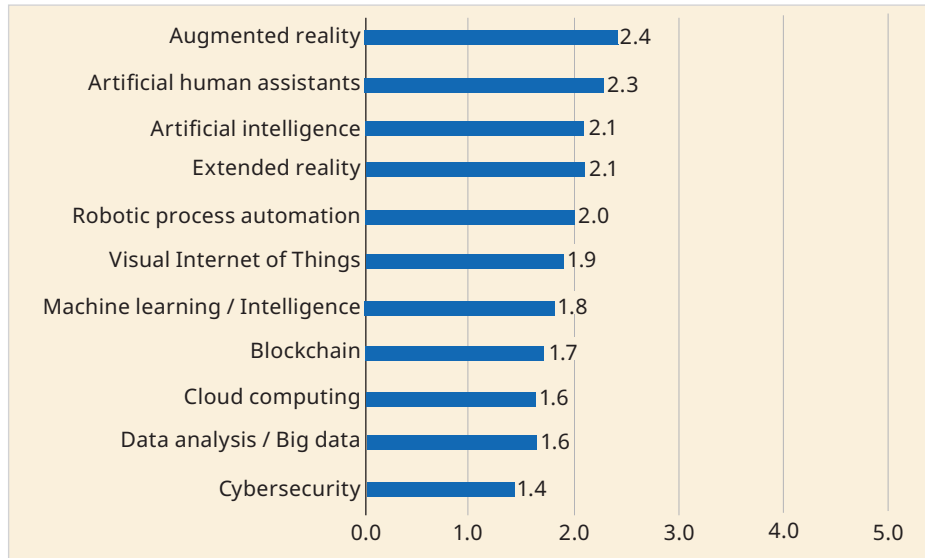


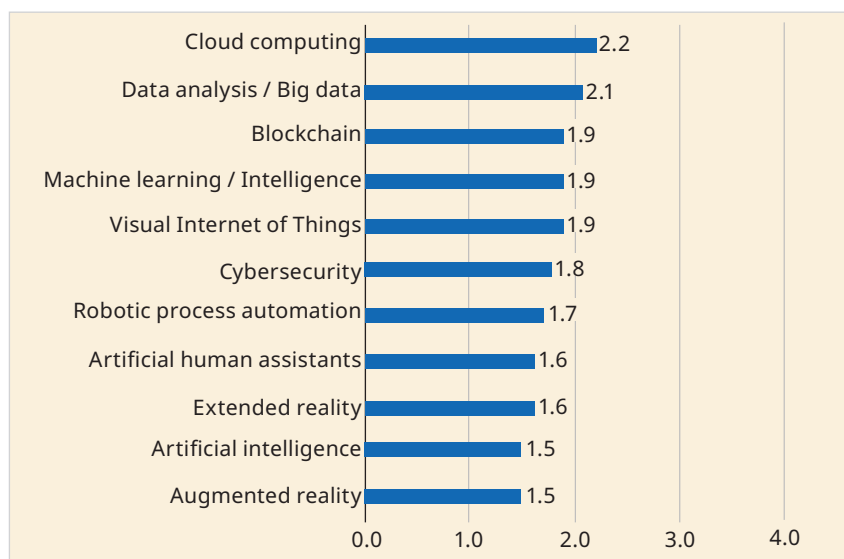
Figure 3 shows the responses by the respondents as to which of the emerging technologies are crucial to accountancy courses. The highest is a rating of 2.4 for augmented reality, while the lowest is 1.4 which is for cybersecurity. The range of responses is seen to be on the low side, indicating that the respondents tend to think that emerging technologies are not that crucial to be incorporated into the accountancy curriculum.

Figure 3: Level of importance of the selected emerging technologies
(1 - None to 5 - Advanced)



As for the extent to which the emerging technologies have been incorporated into the accountancy curriculum, Figure 4 shows average scores of 2.0 and below, indicating that there is not much emphasis placed on technology in the curriculum yet.

Figure 4: Level of incorporation of selected emerging technologies in the accountancy curriculum
(1 – None, 2 – Foundation, 3 – Intermediate, 4 – Advanced)



Regarding technological tools currently used or embedded in the last 3 years in accountancy schools, Figure 5 below shows the trend indicated by the respondents, who use more video conferencing and group collaboration tools (4.4) as well as Microsoft applications (4.5) than other tools.

The usage of other tools is low, except for cloud applications and accounting software which score an average of 2.8 – 3.7.

Figure 5: Use of selected technologies
(1 – None to 5 – Advanced)

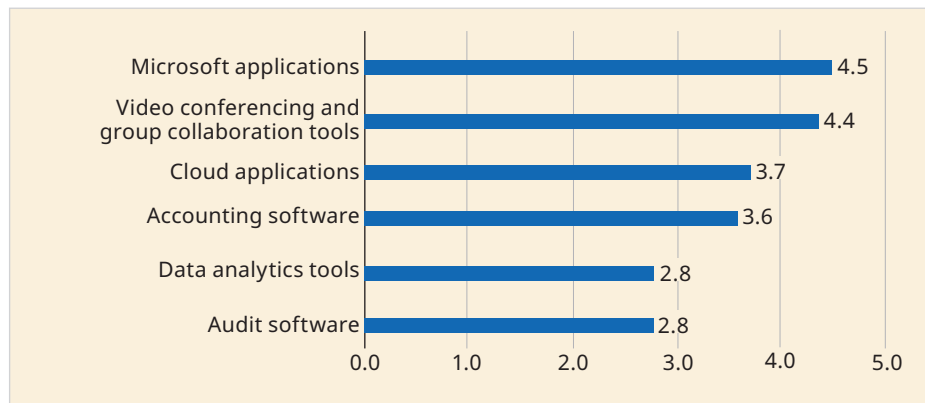
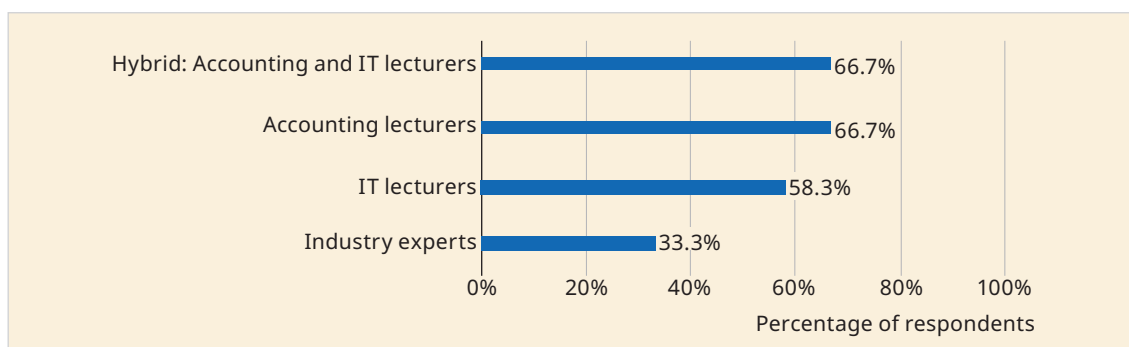


Figure 6 shows the views of the respondents on who should teach the technology component in accounting programmes.

The respondents can choose more than one type of response. 66.7% of responses (8) of respondents indicate that the technology component should be taught by accounting lecturers.

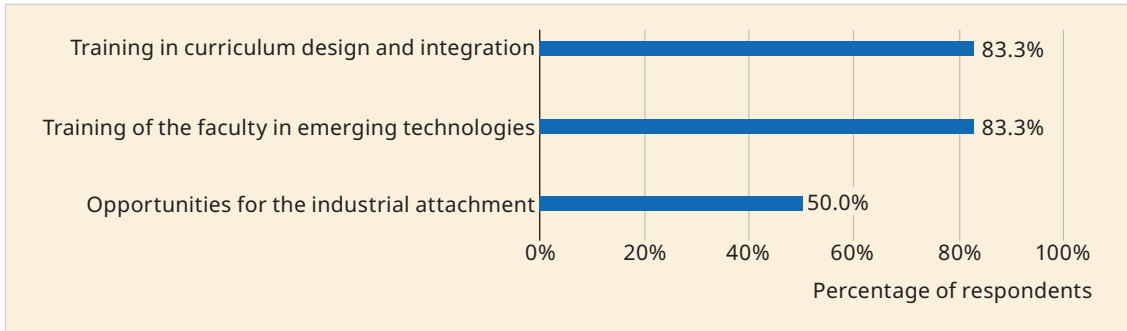
A similar proportion, 66.7%, says that the teaching staff should be a hybrid of accounting and IT lecturers. 58.3% (7) of the respondents choose IT lecturers to be the ones who should teach technology while 33.3% (4) say industry experts should undertake the teaching.

Figure 6: Responses to who should teach the technology component



The respondents were also asked what assistance is needed to incorporate emerging technology in existing courses. More than one response can be made. It can be seen from Figure 7 below that 83.3% (10) of the respondents choose “training in curriculum design and integration” and “training in these emerging technologies”. In addition, 50.0% (6) of the respondents chose “opportunities for industrial attachment”.

Figure 7: Level of assistance needed for teaching emerging technologies



In response to a question regarding the barriers faced when instructors try to include emerging technologies in the accountancy curriculum, respondents were allowed to select multiple barriers, as shown in Figure 8.

The most common barrier chosen by respondents is “lack of experts” (75.0% or 9 respondents). This is followed by “lack of funding for the establishment of facilities in the emerging technology” (58.3% or 7 respondents), “tedious process for approval” (50.0% or 6 respondents) and “lack of flexibility of the accounting programme standards” (50.0% or 6 respondents). Interestingly “lack of support from top management” (25.0% or 3 respondents) is the least chosen response.

Figure 8: Barriers faced to include emerging technology in the accountancy curriculum

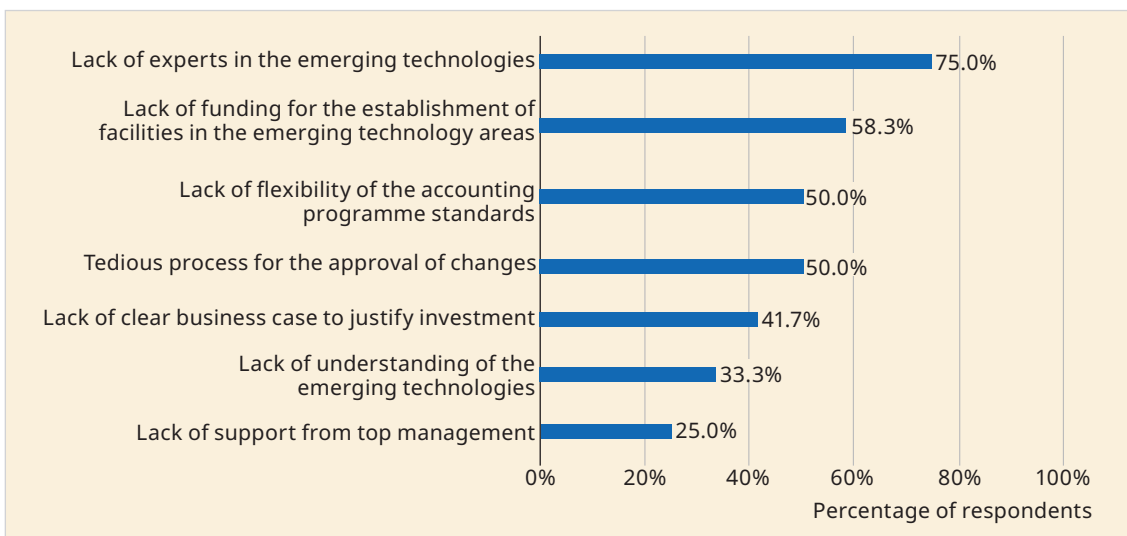
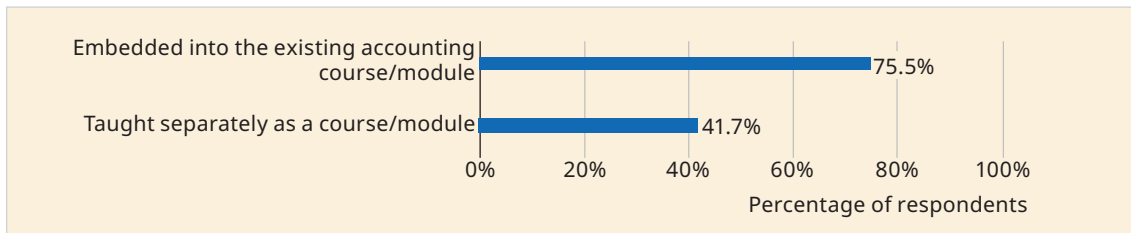


Figure 9 below illustrates the ways in which emerging technologies can be integrated into the accounting programme.

Of the respondents, 75.5% (9 respondents) indicate that the best approach is to embed these technologies into existing accounting courses or modules. On the other hand, 41.7% (5 respondents) suggest that emerging technologies should be taught separately as dedicated course modules.

Figure 9: How should emerging technology be integrated into the accountancy programme?



Respondents were asked the best approach to incorporate emerging technologies into the accountancy curriculum. It is worthwhile to note that respondents were allowed to select more than one 'best approach'.

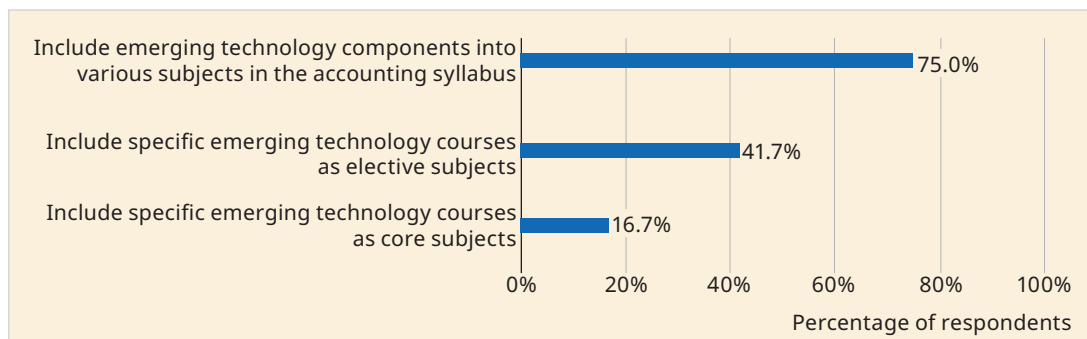
Figure 10 shows the responses to three main approaches considered the best for embedding emerging technologies into the accounting programme.

Firstly, 75.0% (9) of the respondents believe that the best approach is to incorporate emerging technologies into various subjects throughout the accountancy curriculum.

Secondly, for specific elective courses, 41.7% (5) of respondents suggest that emerging technology courses should be offered as specific electives, thereby allowing students to choose which to learn based on their interests and career aspirations.

Finally, only 16.7% (2) of the respondents express the view that emerging technology courses should be treated as core subjects, implying that they should be mandatory for all accounting students and be standalone courses in the accountancy curriculum.

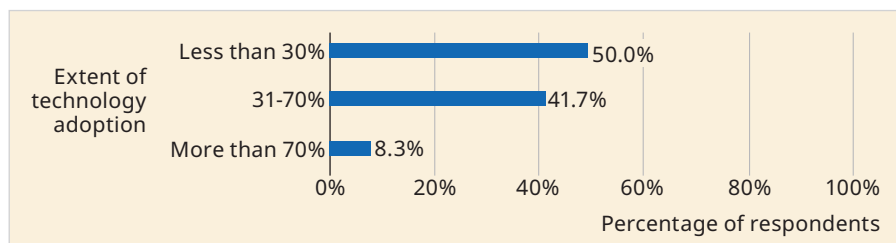
Figure 10: Best approach to incorporate emerging technology into the accountancy curriculum



The respondents were further asked about the state of adoption of emerging technologies into the accountancy curriculum.

Figure 11 provides a summary of their responses. 50.0% of the respondents say that the adoption rate in their schools is lower than 30% while only 1 respondent (8.3%) reports an adoption rate of more than 70%.

Figure 11: State of adoption of emerging technology



As a summary, from the perspective of accountancy schools, recognizing the vital importance of emerging technologies necessitates addressing specific issues and facilitating appropriate actions.

These include resolving questions on various matters and implementing necessary changes in the accountancy curriculum and the structure of accounting programmes and courses.

Moreover, providing easier access to training, securing funding, and offering support for essential resources are crucial steps that should be taken to effectively embrace and integrate emerging technologies within accounting education.

Accountancy practitioners

This section presents the perspectives and responses from another group of respondents in the survey, namely, the accounting practitioners. It can be inferred that these practitioners are actively engaged in their profession and, consequently, are in a better position and have a greater capacity to utilize emerging technologies in their workplace compared to those in accountancy schools.

Figure 12 below illustrates the participation of 14 respondents in the survey, categorized by their legal status. Among the respondents, 4 are state-owned entities, 3 are listed firms and another 3 are limited liability partnerships. Additionally, 2 respondents are partnerships, and another 2 operate as sole proprietors.

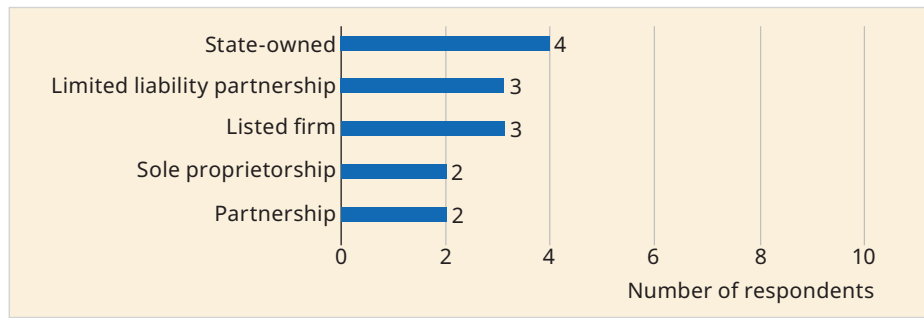
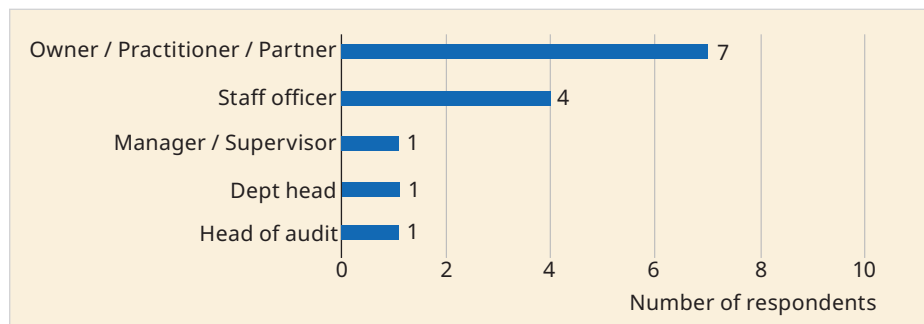
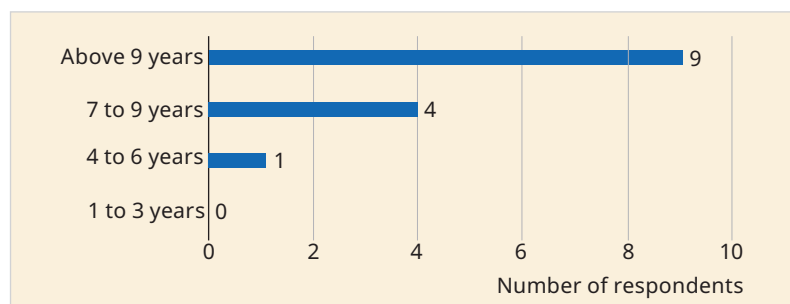
Figure 12: Legal status of the firm

Figure 13 provides insights into the corporate positions held by the respondents. Out of the total, 7 respondents identify themselves as ‘owner, practitioner, and partner’. Additionally, 4 respondents hold staff officer positions, while one respondent each holding the titles of Head of Audit, Head of Department, or Manager.

Figure 13: Position in the firm

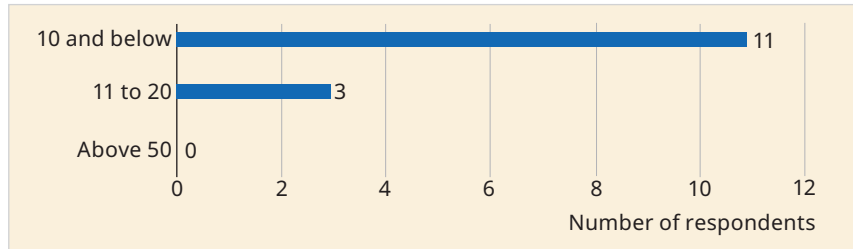
In relation to the age of the organizations with which the respondents are affiliated, Figure 14 illustrates that the majority (i.e., 9 respondents) have been in existence for more than 9 years.

Additionally, 4 respondents indicate their organizations have been operating for 7 to 9 years, while one respondent’s organization falls within the 4-to-6-years range. There were no respondents from establishments that have been in existence for 3 years or less.

Figure 14: Age of organization

In Figure 15, it is evident that the largest proportion of respondents, numbering 11, mention that their respective companies have 10 or fewer partners and accountants. The data also indicate that due to the size of the companies surveyed, none of the respondents belong to an organization with more than 50 partners and accountants.

Figure 15: Number of partners/accountants in the organizations



In terms of planning and commitment to adapt to technological advances, the respondents rate the planning function slightly higher than the commitment to adapt, as shown in the Figure 16. This means that there should be both planning and commitment for adaptation to succeed.

Figure 16: Planning and commitment to adapt to technological advances

(1 – Fully disagree and 5 – Fully agree)

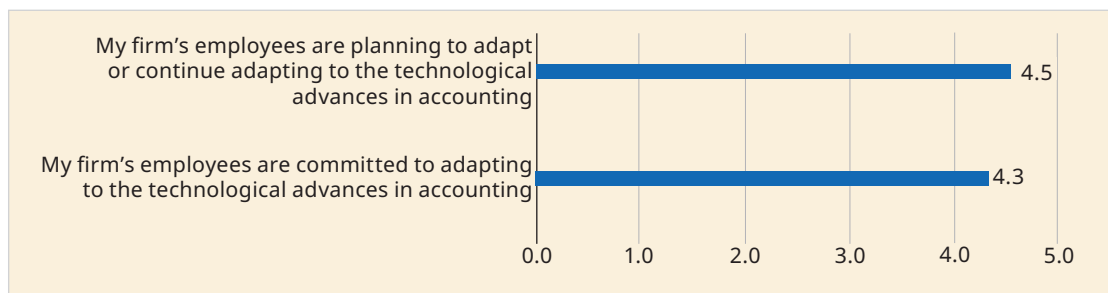
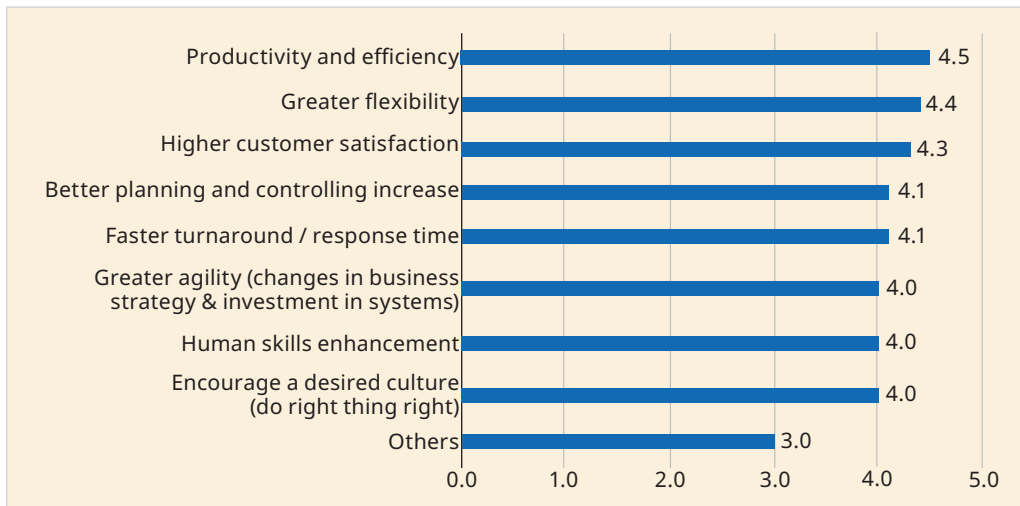


Figure 17 shows the benefits expected of technology adoption in terms of importance to respondents. The biggest expected benefit is productivity and efficiency gains with a score of 4.5 out of 5, followed by greater flexibility (4.4), and higher customer satisfaction (4.3). In addition, the rest of the expected benefits chosen by the respondents were also given high ratings.

Figure 17: Expected benefits of technology adoption

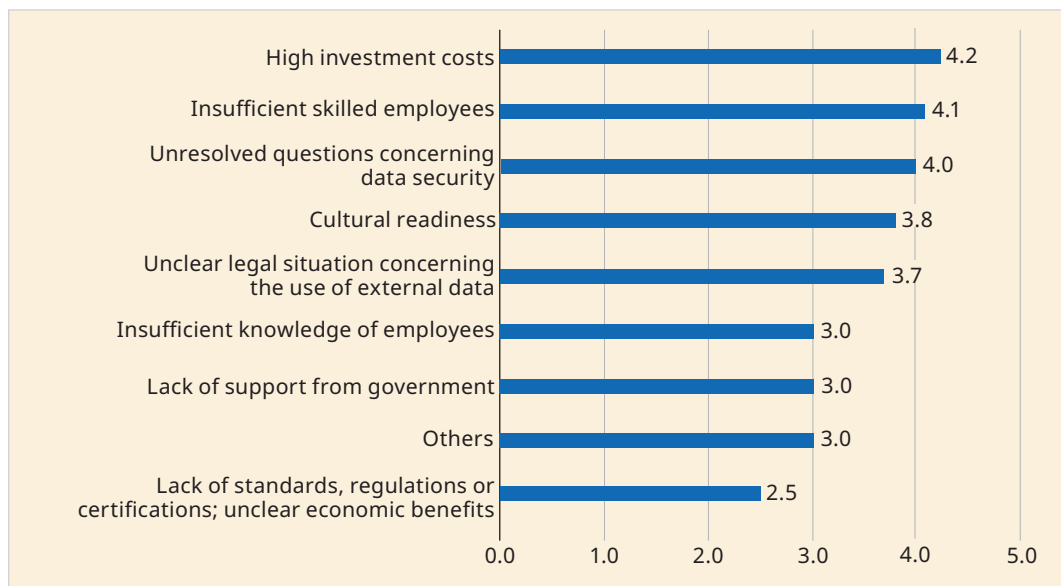
(1 – Fully disagree and 5 – Fully agree)



In terms of challenges faced by the respondents to adoption of technology, Figure 18 shows that high investment costs are rated the biggest obstacle with a score of 4.2 out of 5 on the Likert scale. Insufficient skilled resources are rated as the second highest challenge (4.1) and the unresolved questions relating to specific adoption practices (4.0), are the third highest. Surprisingly, there seems to be not much of an issue in terms of standards and the regulatory authorities (2.5), indicating that there is support for the law and rules of the country relating to the adoption of emerging technology.

Figure 18: Challenges to technology adoption

(1 – Fully disagree and 5 – Fully agree)



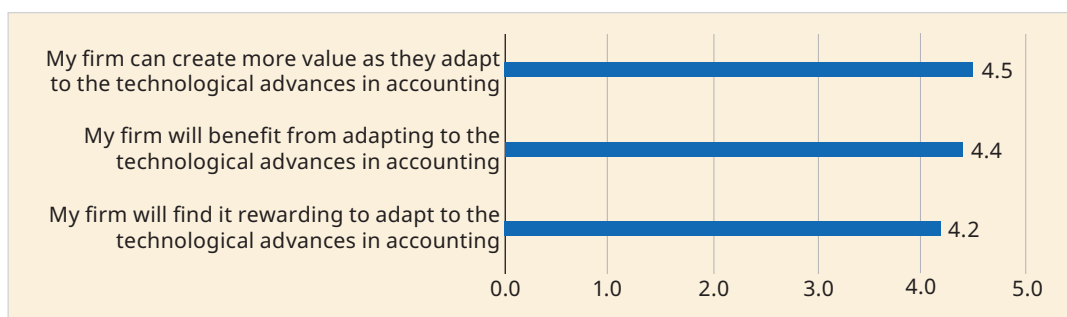
This study used the Theory of Planned Behaviour to understand the attitudes and beliefs about behaviour relating to the adoption of emerging technologies.

In terms of examining the attitude of the respondents, it is evident that they hold a positive outlook on technological advances in accountancy. They say that their organizations (or firms, as indicated) find it rewarding to embrace and adapt to technological advancement.

Additionally, respondents believe that their organizations can create more value by aligning with these technological changes. With a positive attitude, they anticipate benefiting significantly from adopting technological advances in accountancy. The scores given are in the high range of 4.2 to 4.5 out of a 5-point Likert Scale, as presented in Figure 19 below.

Figure 19: Attitude towards technological advances

(1 – Fully disagree and 5 – Fully agree)

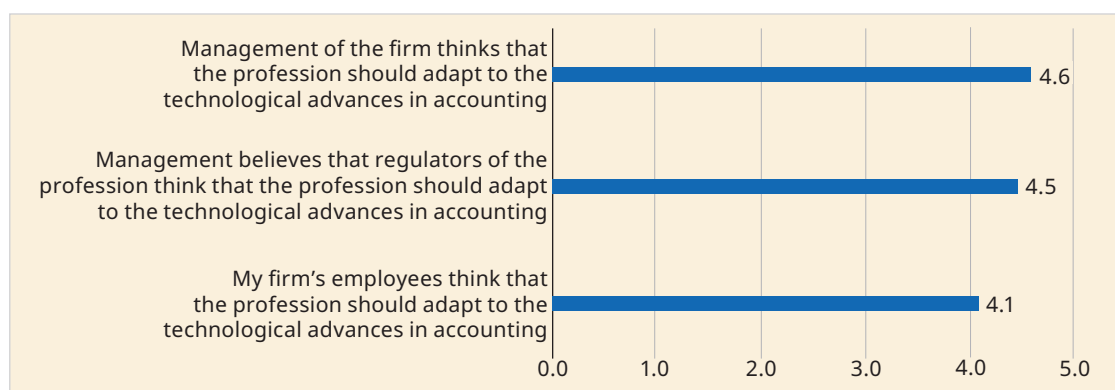


The Theory of Planned Behaviour addresses the subjective norm and the beliefs held by individuals, influencing their intentions. Figure 20 displays the respondents' high ratings (4.1 to 4.6) on three statements of belief related to technological advances in accountancy.

First, the management of the firms believes that the accountancy profession should embrace and adapt to technological advances. Secondly, they are of the opinion that regulators of the profession should actively encourage technology adoption. Lastly, the respondents themselves feel that employees within their organizations should also adopt and embrace technological advances in accountancy.

Figure 20: Subjective norm/belief in technology adoption

(1 – Fully disagree and 5 – Fully agree)



In terms of perceived behaviour and the respondents' perception of their own ability to perform, Figure 21 below depicts their responses. The respondents report a relatively average perception of the belief of their firms' employees that there are available organizational resources to adapt to technological advances in accountancy (3.2). This perception is followed by the belief that employees have access to continuous professional development (CPD) opportunities (3.1). However, the perception is lower regarding the claim that employees have sufficient funding to participate in these technological changes (2.8). The respondents also express concern that employees in their firms may find it challenging to adapt to technological advances in accountancy (2.7). More importantly, the perceived behaviour has a much lower rating than the attitude and subjective norm ratings.

Figure 21: Perceived behaviour – perception of the individual's own ability to perform the behaviour
(1 – Fully disagree and 5 – Fully agree)

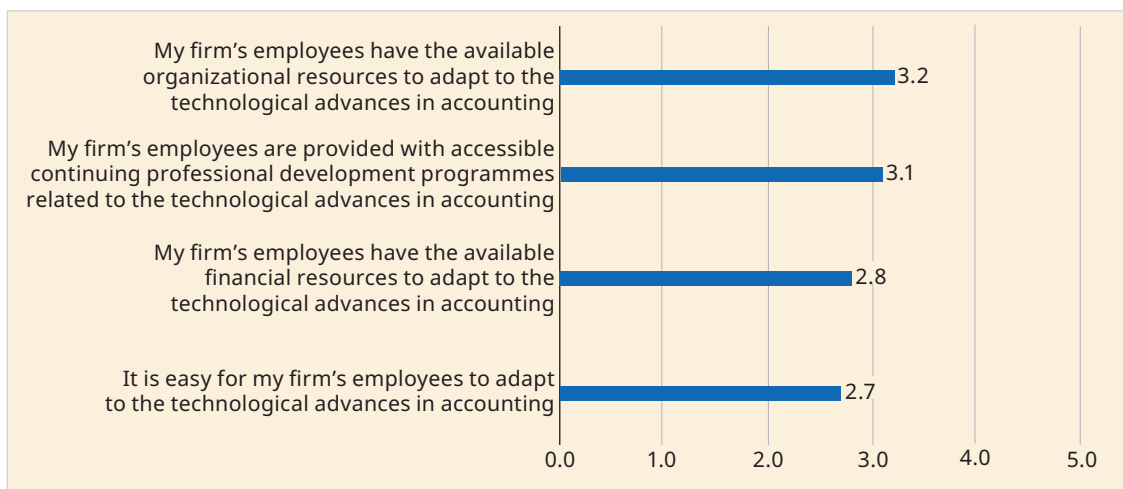
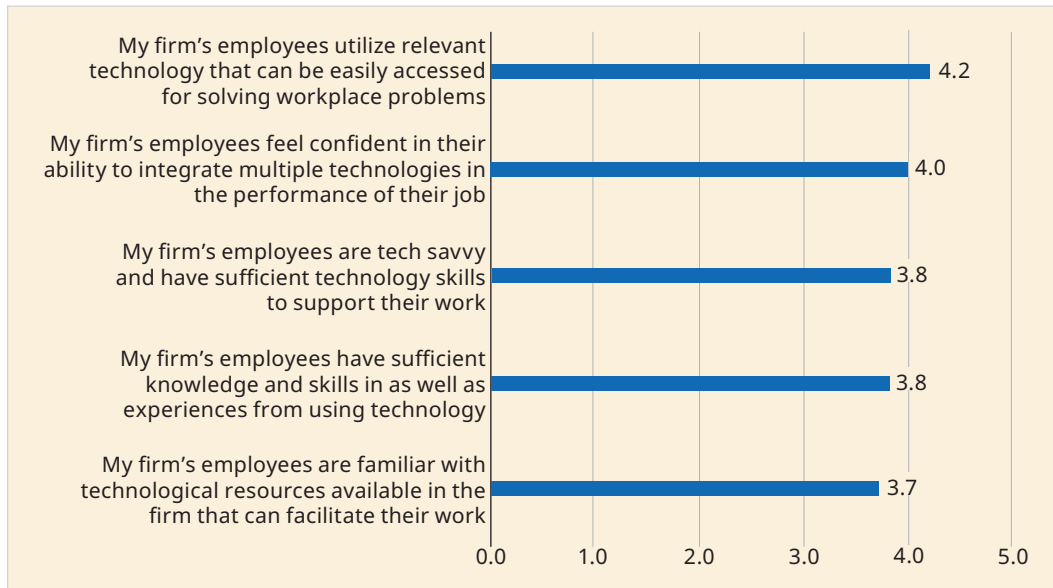


Figure 22 illustrates the level of manpower skills and knowledge perceived by the respondents regarding their employees. According to the respondents, their employees have easy access to technology, and are confident in their ability to integrate multiple skills in practice. Additionally, the respondents report that their employees possess a sufficient level of knowledge, are tech-savvy and familiar with the technological resources at hand. The ratings range between 3.7 to 4.2.

Figure 22: Manpower skills and knowledge

(1 – Fully disagree and 5 – Fully agree)



Questioned on the level of investment in technology, respondents provide their responses concerning both their organizations and employees as shown in Figure 23 below.

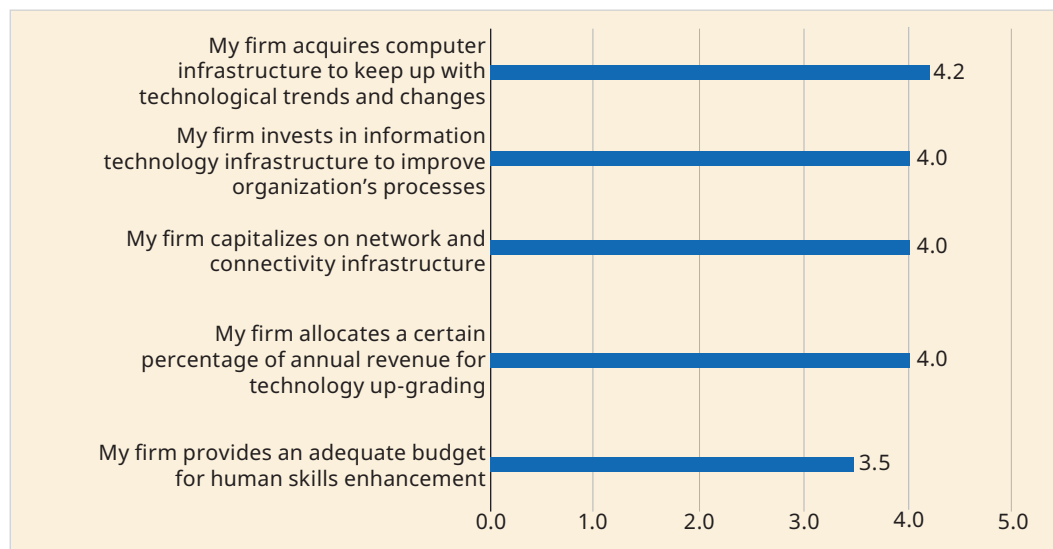
The highest-rated response pertains to the organization's ability to acquire computer infrastructure to keep up with technological trends and changes (4.2).

This is closely followed by the firm's ability to invest in information technology infrastructure to improve the organization's processes (4.0) and capability to capitalize on network and connectivity infrastructure (4.0).

On the matter of the annual budget, respondents indicate that there is an allocation for technology upgrading and infrastructure improvement (4.0). Moreover, the budget allocated for enhancing human skills (3.5) is regarded as adequate.

Figure 23: Investment in technology

(1 – Fully disagree and 5 – Fully agree)



It appears in Figure 24 that when the respondents were asked about their level of awareness of various emerging technologies, and with their responses measured on a Likert scale of 1 to 5, the results indicate that there is a relatively high level of awareness of some technologies but a lower level of awareness of others.

The scores given range from 3.3 to 4.5. The technology with the highest level of awareness is cybersecurity (4.5). Following cybersecurity is cloud computing (4.4) which also has a relatively high level of awareness among the respondents. Blockchain (4.0) appears to be the third most recognized by the respondents. It is on the same level as Visual Internet of Things (IoT) and data analysis/big data.

However, there are other emerging technologies that fall below the threshold of 4.0 on the Likert scale, indicating a lower level of awareness among the respondents. These technologies may include various other innovations that were surveyed, but their specific names are not mentioned in the provided list.

Figure 24: Level of awareness of selected emerging technologies

(1 – Not at all to 5 – Extremely aware)

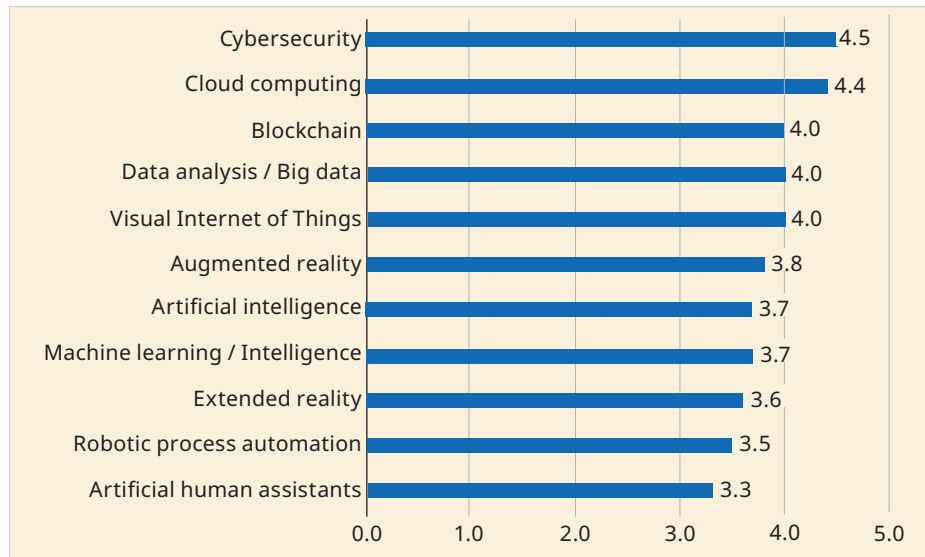


Figure 25 indicates the level of utilization of emerging technologies as reported by the respondents. The highest-rated choice is cybersecurity (4.2), indicating its importance in the respondents' organizations. Following closely is data analysis and big data (3.6), which also hold substantial prominence. Machine learning/intelligence and robotic process automation receive an average rating of 3.2.

On the other hand, cloud computing (3.1) receives a lower rating. While other technologies were chosen as well, they did not rank high in preference in the respondents' responses. An important observation is that the utilization scores in Figure 25 are all lower than the awareness ratings in Figure 24. This suggests that it is one thing to be aware of a technology, it is another thing to utilize it.

Figure 25: Utilization of selected emerging technologies
(1 - Not at all utilized and 5 - Utilized all the time)

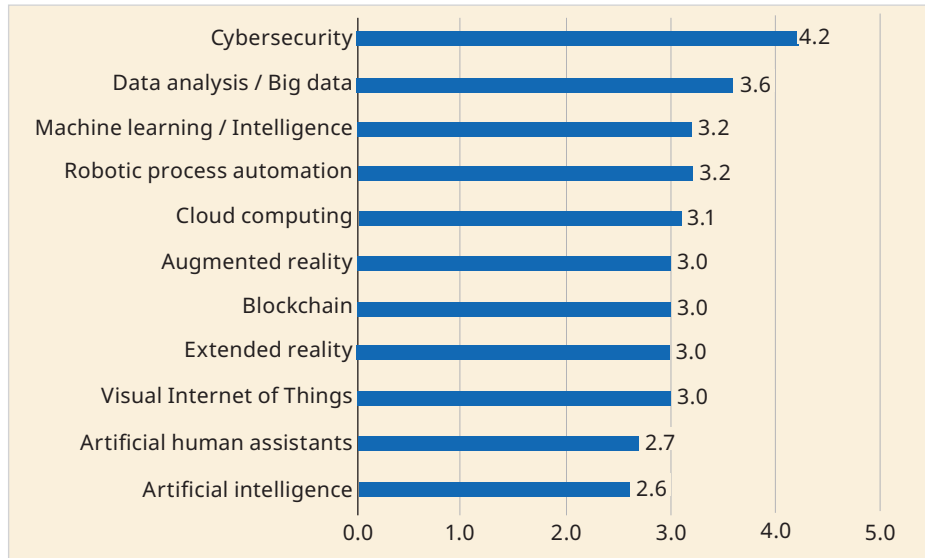
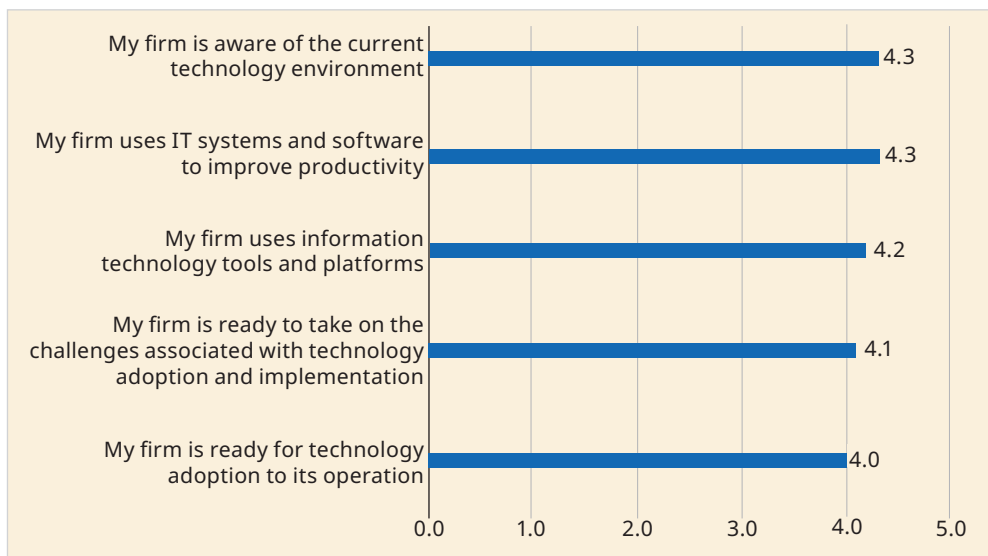


Figure 26 shows that the adoption of software and systems among the respondents is rated quite favourably. The cumulative ratings of between 4.0 and 4.3 suggest a high level of utilization, readiness for adoption, and awareness of the current technology environment. This indicates that the respondents generally have positive perceptions and attitudes towards adopting technology in their organizations, with most ratings leaning towards the higher end of the scale. Overall, the data suggests that the respondents are keen on embracing and integrating software and systems to enhance their operations and keep pace with the current technological landscape.

Figure 26: Technology adoption
(1 – Fully disagree and 5 – Fully agree)



In summary, the study focuses on examining the adoption of emerging technologies in Malaysia, specifically among two categories of respondents: accountancy schools and accountancy practitioners.

Using a Likert scale ranging from 1 to 5, the participants' level of awareness of various technologies is assessed.

The results show that certain technologies enjoy a relatively high level of awareness and adoption across both groups.

Notably, cybersecurity emerged as the most recognized technology, followed closely by cloud computing and blockchain, indicating a significant awareness among respondents from both accountancy schools and practitioners.

Visual Internet of Things (IoT) also receives noteworthy attention, suggesting a growing interest in this technology among the respondents.

On the other hand, the study reveals that several other emerging technologies did not pass the 4.0 threshold on the Likert scale, implying a lower level of adoption and awareness among the participants.

Response from representative of MIA's senior management

The following information is input from a survey on the PAO's response to technology disruption in the accountancy profession. The respondent is a representative of MIA's senior management. The membership size of MIA is around 50,000, and the staff strength is 100-200. MIA says that it has a digital technology roadmap to upgrade the accountancy profession.

In terms of awareness of technologies, the response given by the MIA representative is 5 out of 5 for cloud computing, cybersecurity and robotic automation processes. There is a rating of '4' for data analysis and big data.

With respect to the utilization of technologies, the response was a rating of '3' for artificial intelligence, '4' for data analysis and big data, and '5' for cloud computing. It should be noted that MIA is unable to provide responses to other technologies as they were not included as part of their options in the 2022 survey on Technology Adoption by the Accounting Profession in Malaysia.

Commenting on attitude, MIA claims that members will benefit and find it rewarding to adapt to technological advances in accountancy, and that they can create more value doing so.

On subjective norms, senior leaders of the MIA think that the profession should adapt to the technological advances in accountancy. They believe that members think too that the profession should adapt to the technological advances in accountancy..

On perceived behavioural control, the response is a rating of '2' regarding how easy it is for members to adapt to the technological advances in accountancy.

It is also observed that MIA believes that members have the available organizational resources to adapt to the technological advances in accountancy, with this awarded a rating of '3'.

The statement that members are provided with accessible continuing professional development programmes related to the technological advances in accountancy is rated a '5'.

As for the intention to engage with technology, MIA agrees that its members are committed to adapting to technological advances in accountancy. In fact, the view is that members are planning to adapt or continue adapting to technological advances in accountancy.

The following section reports on responses based on interviews with an MIA representative who is in charge of digitalisation.

Regarding challenges faced and how MIA manages them, there has been a change in the perception of barriers to technology adoption over the years. Lack of talent who are able to utilize technology effectively was ranked as the top barrier in 2022 compared to 2019 and 2017.

This is followed by a lack of understanding of the benefits of technology adoption and a lack of funding.

Although ‘lack of funding’ appears for the first time in 2022, it was only ranked as the third biggest challenge by respondents to the 2022 survey who indicated that in order to move forward, they would need to invest in technology.

How these challenges are addressed:

a) Lack of talent to utilize technology effectively

As lack of talent to utilize technology effectively has been among the top three barriers to technology adoption since the 2017 survey, the Institute carried out a study on technology adoption in the accountancy courses and programmes by the universities in Malaysia in 2019. A report documenting the study and its findings was issued in 2021. It put forward six recommendations, some of which have been incorporated in the revised curriculum of accounting degree programmes, i.e., Halatuju 4. The Report can be accessed here and a video summarizing the Report can be viewed here¹.

b) High business costs/lack of funding

There are a number of grants available to support Small and Medium Practitioners (SMPs) in their digital transformation journey. The Institute has identified and engaged with Malaysia Digital Economy Corporation (MDEC) on several grants, for which SMPs can apply.

To address the lack of understanding of the benefits of adopting technology, successful digital adoption cases are shared by fellow accountants during MIA Digital Month, webinars and conferences.

c) Benefits observed in adopting technological changes

Based on the MIA Technology Adoption by the Accounting Profession Survey 2022, when it came to an organization’s strategic posture towards technology, most of the respondents indicated that they would invest more in technology to obtain a competitive advantage.

1 Malaysia https://mia.org.my/wp-content/uploads/2022/09/Report_on_A_Study_of_Emerging_Technology_Adoption_within_the_Accounting_Programmes_by_the_Higher_Learning_Institutions_in_Malaysia.pdf and <https://youtu.be/jPl7hO-IAw?si=L88qp4tWKkrGAQIW>.

This is followed by other goals such as survival and sustainability, modernizing core technology capabilities and refocusing the entire business around digital technologies. The findings indicated that respondents embarked on digital transformation in order to stay relevant to the industry.

Based on the surveys conducted previously, MIA sums up the following:

- a) Compared to 2019 and 2017, the lack of funding or high business costs was no longer viewed as the top barrier to adopting technology in 2022. This indicates that members recognise that to move forward, they need to invest in technology. The 2022 survey shows that 90% of respondents allocated a budget for technology adoption. Members also indicated that it is critical to have talent who can utilize technology effectively to facilitate technology adoption.
- b) In the 2022 survey, 97% of respondents indicated that they were at various stages of technology adoption following their recognition of the importance of technology, particularly during the COVID-19 pandemic. In addition, MIA organized a webinar on 20 October 2022 to provide SMPs with an overview and a hands-on session for the Digital Competency Maturity Model (DCMM). MIA also launched its very own Digital Technology Adoption Awards (DTAA) in March 2023 through which it recognises remarkable achievements in technology adoption by the accounting profession in commerce and industry, public practice, and the public sector. The DTAA aims to promote technology adoption, raise awareness of the impact of digital adoption, and recognise the technology adoption efforts of the accounting profession and to encourage others to undertake their own digital transformation by sharing the case studies of the winners. The DTAA is currently at the adjudication stage and winners will be announced in 2024. For more details on DTAA, please go to <https://mia.org.my/knowledge-centre-resources/digital-economy/dtaa/>

MIA strongly advocates digital transformation to future-proof the accounting profession which is guided by the MIA Digital Technology Blueprint (the Blueprint).

This Blueprint outlines 5 driving principles that guide the accountancy profession in Malaysia in responding appropriately to digital technology.

The accountancy profession should then identify the action plans based on the following principles:

Accountant's Role

- **Principle 1 – Assess digital technology trends** – Be aware of digital technology trends and assess how they affect the role of accountants.
- **Principle 2 – Identify capabilities** – Identify capabilities, build differentiated skills and innovate in responding to the change.
- **Principle 3 – Harness digital technology** – Capitalize on the use of appropriate digital technology.
- **Principle 4 – Funding** – Determine funding needs and identify financing options.
- **Principle 5 – Governance** – Adhere to good governance practices through the adoption of industry and regulatory requirements.

In order to remain relevant, the profession must be cognisant of the changing needs of the business environment and leverage digital technology.

MIA has sought to answer questions such as what new priority technologies are required to future-proof the accounting profession, and how accountants should be equipped with these new technologies.

For this purpose, MIA has published a report on a study of emerging technology adoption within the accounting programmes of higher learning institutions in Malaysia.

Based on various discussions and polls conducted by a working group, the following emerging technologies were identified as crucial to be included in the accounting curriculum as these are considered essential to future accounting graduates:

- a. Artificial intelligence
- b. Blockchain
- c. Cloud computing
- d. Cybersecurity
- e. Data science / Data analytics

It should be noted that MIA has carried out various initiatives for the profession which include training and awareness of digital technologies, digital assessment, and implementation tools as well as guidance on technology adoption (<https://mia.org.my/knowledge-centre/resources/digital-economy/>).

Following the issuance of the Blueprint, MIA assembled a 3-year operational plan (2019 to 2022) followed by an additional 2-year operational plan where initiatives are planned in the following areas for its members:

- **Principle 1 – Assess digital technology trends** – Raise awareness of digital technology trends and assess how they affect members.
- **Principle 2 – Identify capabilities** – Provide training and relevant certification to members to enhance their capabilities.
- **Principle 3 – Harness digital technology** – Promote digital technology adoption and explore collaboration with relevant stakeholders.
- **Principle 4 – Funding** – Engage with policymakers on incentives and grants.
- **Principle 5 – Governance** – Develop and advocate good governance in digital technology usage and adoption.

On specific types of digital skills earmarked by MIA for grooming future accountants, the MIA Education Board has issued the MIA Competency Framework (CFM), which is a set of principles that defines the baseline competencies and skill sets of accountancy professionals.

Their proficiency is assessed and classified by levels, namely “Foundation”, “Intermediate”, and “Advanced” as defined by the framework issued by the International Accounting Education Standards Board (IAESB).

The IAESB framework is principle-based in nature, focusing on the proficiency requirements of accountancy professionals across the entire spectrum of the profession covering public practice, the public sector, commerce and industry, and academia.

The IAESB framework has incorporated learning and development for technologies and professional scepticism.

MIA acknowledges that collaboration among stakeholders such as professional bodies,

regulatory bodies, educational institutions, employers, and academicians, is essential to ensure accountants remain technologically adept in the future.

This can be accomplished through the provision of continuous education and training, curriculum enhancements, hands-on experience, cultivation of innovation, and many others.

The MIA report on a study of emerging technology adoption within the accounting programmes of higher learning institutions in Malaysia includes potential actions for consideration and recommendations for collaboration among stakeholders to ensure the readiness of accountants for the future.

Overall, the findings underscore the importance of further efforts to promote awareness and understanding of emerging technologies among accountancy schools, practitioners and the PAO in Malaysia.

Such initiatives could help accelerate their integration and adoption, fostering technological advancement and progress in the accountancy sector.

Conclusion

It should be noted that the sample size is too small to draw generalizations, whether on analytical or statistical grounds.

However, the study provides insight into the claims and responses made by the participating respondents on embracing emerging technologies.

While there is apparent interest, the indications given in the responses lean towards lack of knowledge, familiarity, access and training which could be among the reasons for the low utilization of emerging technologies.

Funding could be another factor, but the size of the organization may also indicate that stakeholders in the organization will use software whose cost is commensurate with the objective that they need to achieve.

Three sets of respondents are examined, the accountancy schools, the accounting practitioners and the PAO.

The universities are making attempts to embed technology into their courses. Accounting practitioners seemed geared up to technological developments and determined not to be left behind.

There are signs of accounting practitioners moving to ready themselves or to get up to speed to catch up with developments.

It can be seen that given the increasing frequency and severity of cyber threats, organizations may prioritize cybersecurity to safeguard their data and protect against potential breaches and attacks.

As for data analysis and big data, with the rise of data-driven decision-making, organizations may recognize the importance of analysing large volumes of data to gain insights and make informed choices for their business strategies.

Relative to these technologies, the lower preference for cloud computing might be due to factors such as concerns about data privacy and security in the cloud, or organizations might already have existing infrastructure that is not yet fully migrated to the cloud.

The lower preference for other emerging technologies could be attributed to limited

awareness, lack of proven business value, or uncertainty about their implementation and impact on the organization.

It is, however, essential to consider specific survey findings and the characteristics of the organizations and respondents to gain a comprehensive understanding of their preferences and the reasons for them.

As for the PAO, MIA claimed that there is no one-size-fits-all approach to adopting technology. MIA have different categories of members (i.e., academia, public practice inclusive of SMPs, the public sector, commerce, and industry) where different approaches are needed to cater to their digital transformation journey.

Hence, various initiatives have been carried out to address their needs. As a regulator of the accounting profession in Malaysia, MIA will continue to play a central role in supporting the ecosystem in the implementation of technology for its members.

Some general reasons may explain why the respondents' regard for technology adoption is high.

First, adopting software and systems can lead to increased efficiency in various functions, such as data management, analysis, and repetitive tasks.

This efficiency improvement is likely to be perceived positively by the respondents. As for competitive advantage, organizations that embrace technology tend to gain a competitive edge in their industry.

Respondents may recognize the need to keep up with competitors and be motivated to adopt technology to maintain or improve their market position.

Technology can provide valuable insights and data analytics can improve decision-making. Respondents may value the potential for data-driven insights to inform their strategies and improve overall performance.

Modern software and systems often offer scalability and adaptability to changing business needs. This feature allows organizations to stay relevant and adjust to market dynamics effectively.

Certain technology implementations can result in cost savings in the long run. Respondents may appreciate the potential for reduced expenses or optimized resource allocation.

If technology adoption is a prevalent trend in the industry, organizations may feel compelled to follow suit to remain competitive and up-to-date with the latest practices.

Technology can empower employees to be more productive and efficient in their roles, leading to higher job satisfaction and better overall performance.

Overall, the results suggest that while certain emerging technologies like cybersecurity, cloud computing, blockchain, and visual IoT are well-known among the respondents, there is still a significant gap in the awareness of other emerging technologies, which score below the 4.0 threshold on the Likert scale.

The research or survey would likely recommend further efforts to raise awareness and educate people about these lesser-known technologies to facilitate knowing and adopting them.

It is however imperative to understand that high ratings, for example, in Figure 25 (Utilization of Selected Emerging Technologies), would be dependent on the survey context,

the characteristics of the respondents, and the technology landscape in their respective organizations. On this note, this is also a general limitation of the other related questions posed to the respondents.

Recommendations

Accountancy-related organizations and the accountancy industry should take proactive actions, or even remedial steps, to address any issue surfaces based on the findings of this study.

They should also delve into the reasons for the difficulties and challenges encountered for solutions to be found.

As for future research, there should be a ‘tone from the top’ to attract more participation from the various organizations and to gain better representation of the population involved in the adoption of emerging technologies.

It is expected that a different perspective and outcome may be collected giving more general insights into the adoption of emerging technology.

Afterwards, what is required can be nailed down to widen and deepen technology adoption to the betterment of accountancy education, training and practices.

Further case studies within each organization, whether accountancy schools or firms, as well as the PAO, will improve the understanding of the real issues and challenges faced in the areas covered in the questionnaire.

At the same time, solutions could have been found to these issues and challenges. Thereafter the solutions can be shared.

A bigger sample size is recommended for more detailed descriptive analysis with the cross-tabulation of influencing factors. Independent and dependent variables can be examined further to cast more light on the adoption of emerging technologies.

It is hoped that this study has provided some simple insights on the level of adoption of emerging technology in the organizations indicated, for further actions and better understanding.●

References

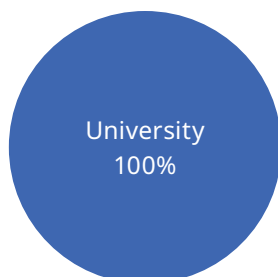
<https://www.cpajournal.com/2018/09/13/the-impact-of-disruptive-technologies-on-accounting-and-auditing-education/> (accessed 1 July 2023)

Appendix A

Demographic information

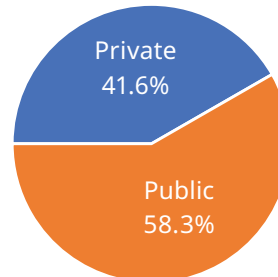
Type of academic institution

12 responses



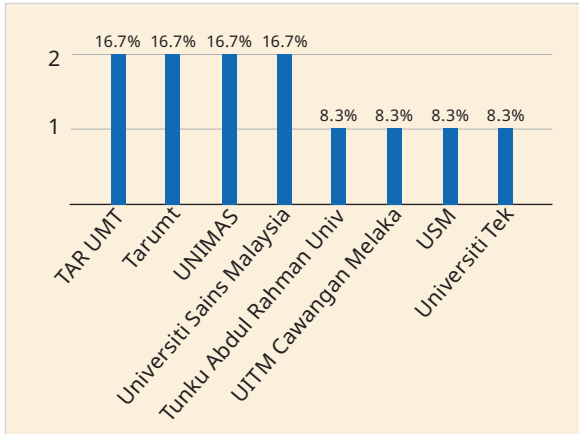
University status

12 responses



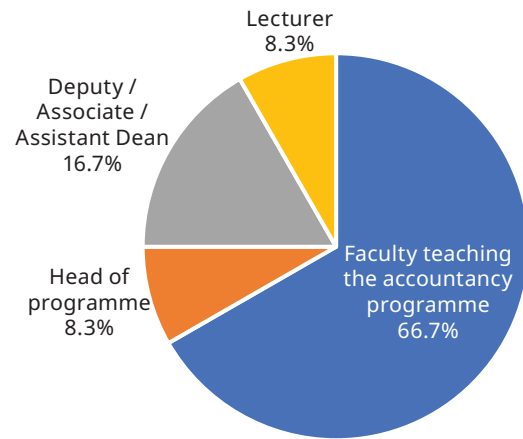
Name of university / institution

12 responses



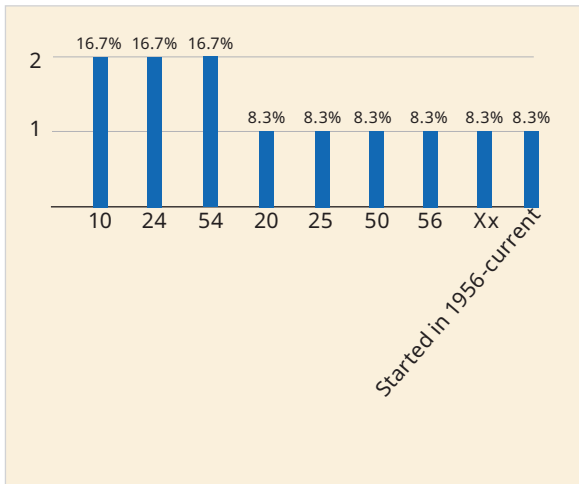
Management positions

12 responses



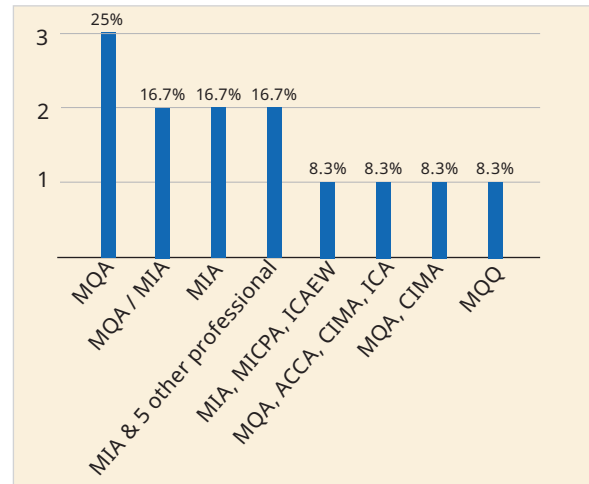
Number of years of establishment of the accountancy programme

12 responses



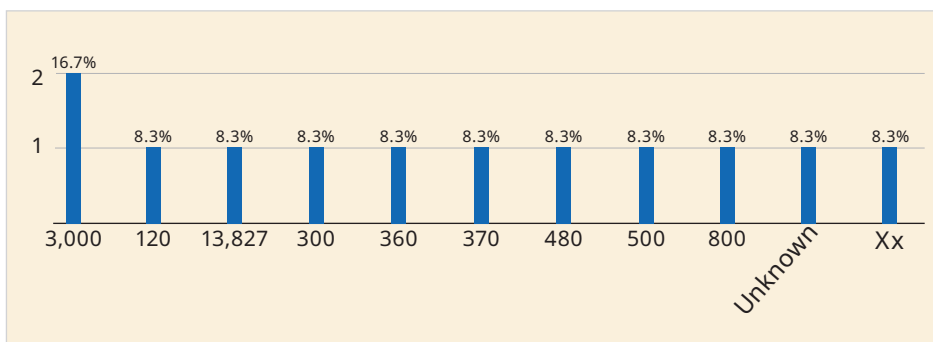
School accreditation

12 responses



Total number of enrolled accounting students in 2022

12 responses



Appendix 8: Myanmar

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Background

Given that Myanmar is a developing country, the number of respondents to our study on technology adoption by the accountancy profession is limited.

1. Professional Accountancy Organization

Myanmar Institute of Certified Public Accountants (MICPA) is the only national Professional Accountancy Organization (PAO) in Myanmar.

Established less than 20 years ago, MICPA has fewer than 10,000 members and its manpower headcount is less than 50.

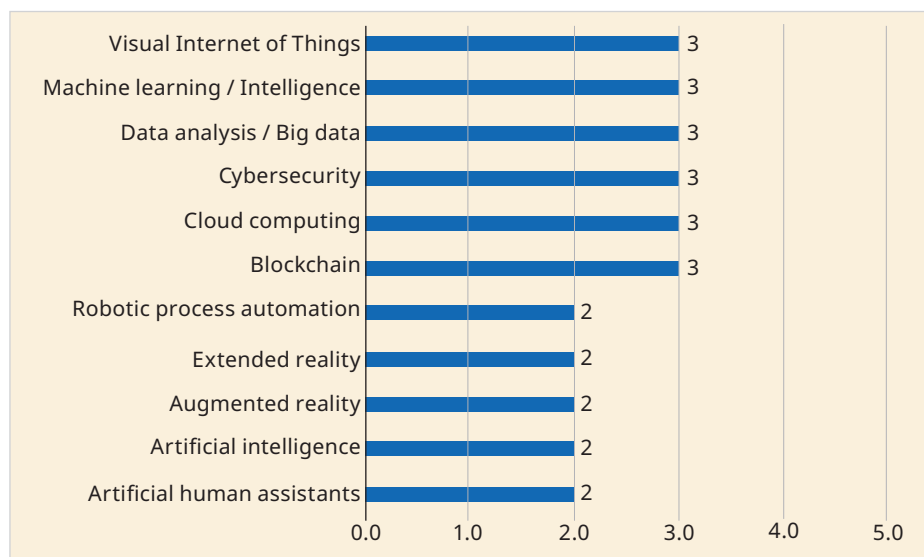
For the purpose of our study, a survey questionnaire was sent to the Myanmar Institute of Certified Public Accountants (MICPA) whose respondent is a board member of the PAO.

The respondent says that MICPA is still working on its digital technology roadmap.

Awareness of selected emerging technologies

The respondent confirms that MICPA is aware of all the emerging technologies listed in Figure 1.

Figure 1: Level of awareness of selected emerging technologies
(1 – Not at all and 5 – Fully aware)



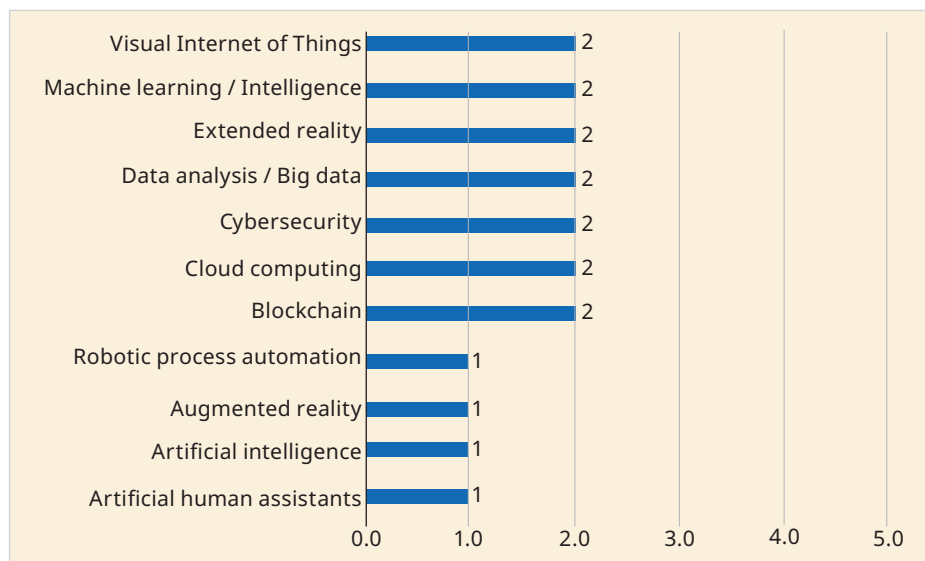
For some of the technologies, the respondent says that there is a low understanding of their usefulness.

This pertains to artificial human assistants, artificial intelligence, augmented reality, extended reality, and robotic process automation.

The respondent states that there is a “Fair” level of awareness of blockchain, cloud computing, cybersecurity, data analysis/big data, machine learning and visual Internet of Things.

Utilization of selected emerging technologies

Figure 2: Level of utilization of selected emerging technologies
(1 – Not at all utilized and 5 – Utilized all the time)



The respondent says that there is a very low level of utilization of all the technologies. This raises the issue that it is one thing to be aware of the technologies but a totally different thing to be utilizing them.

Theory of planned behaviour

The respondent agrees that the adoption of technology in accounting has many benefits, such as increasing a firm’s value or getting rewards from customers.

Moreover, the respondent fully agrees that senior leaders in MICPA and the profession should adopt technological advances in accounting.

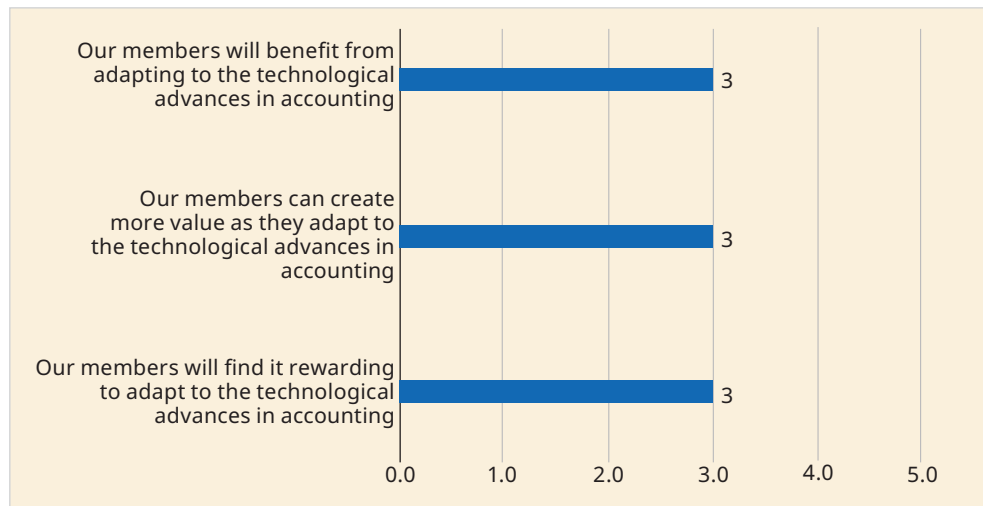
The respondent agrees that MICPA also encourages the profession to adopt technological advances in accounting to a “Fair” extent.

Unfortunately, he says that members are hesitant about committing themselves to adopting technological advances in accounting.

The responses are shown in Figure 3.

Figure 3: Attitude towards technological advances

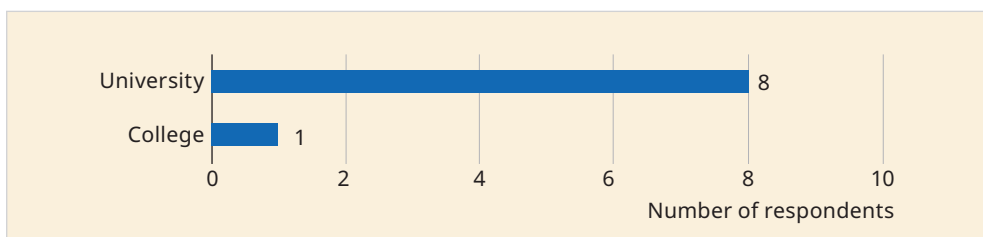
(1 – Fully disagree and 5 – Fully agree)



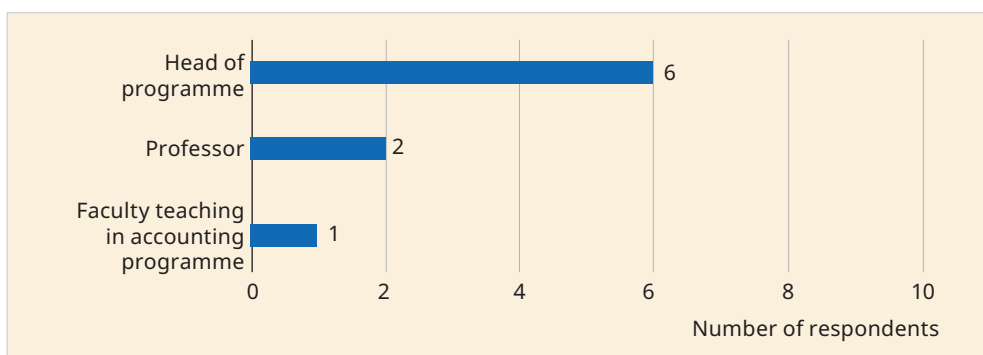
2. Accountancy schools of institutions of higher education

a. Demographics of the respondents

The number of respondents is 9, of whom 8 are from universities and one from college.

Figure 4: Respondents by types of institutions of higher learning (IHLs)

The survey questionnaire was completed by senior staff of the respective IHLs, and Figure 5 shows the positions taken by the respondents, most of whom are heads of programmes (67%).

Figure 5: Position of the respondents from institutions of higher learning

For the 9 respondents, their total combined enrolment is almost 30,000 students, averaging 1,151 students per cohort of students.

b. Awareness, competencies, importance and incorporation of selected emerging technologies

Figure 6: Level of awareness of the selected emerging technologies
(1 – Not at all and 5 – Fully aware)

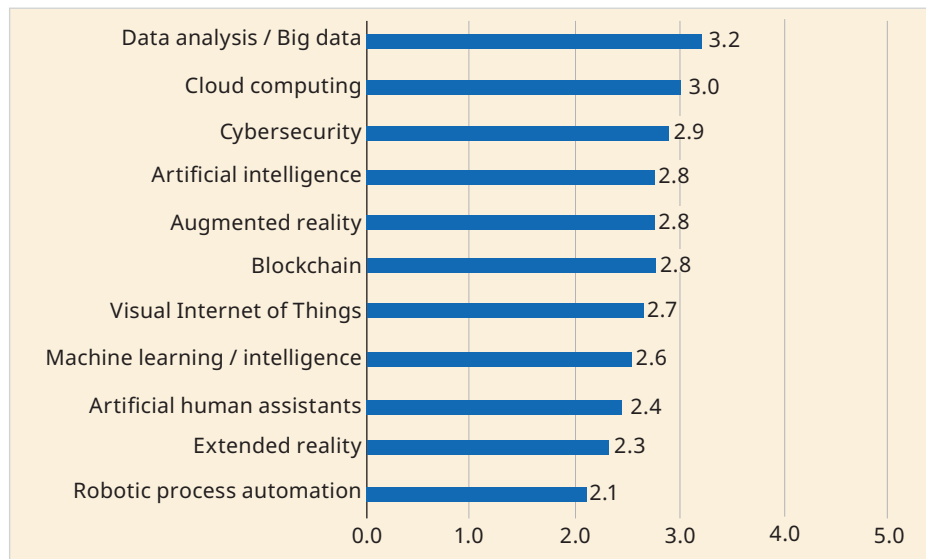
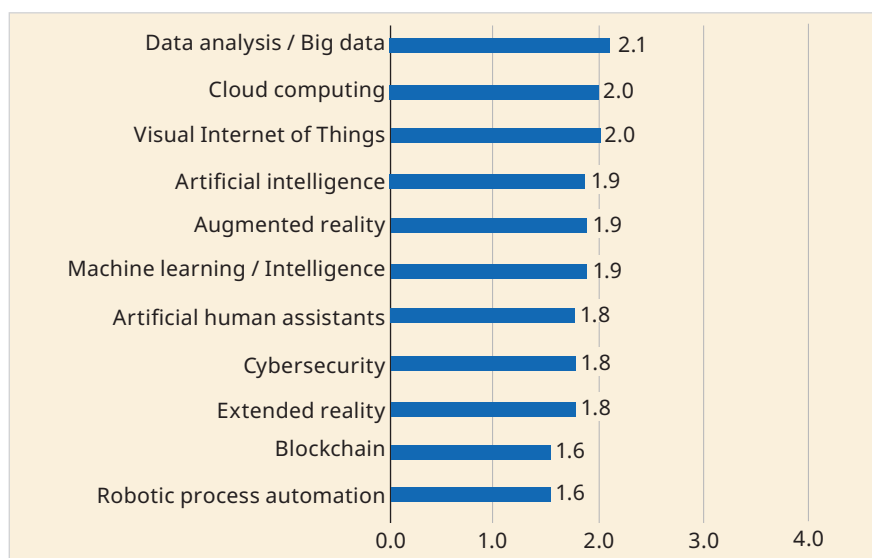


Figure 6 shows the level of awareness of the respondents of the selected technologies. The selection is based on a literature review and industry sensing of the more popular technologies employed in the accountancy industry.

Data analysis/big data and cloud computing are the emerging technologies with the greatest amount of awareness followed by 4 other technologies: blockchain, augmented reality, artificial intelligence and cybersecurity.

Figure 7: Level of competency in the selected emerging technologies
(1 – None, 2 – Foundation, 3 – Intermediate, 4 – Advanced)



For competency, most respondents choose data analysis/big data as the technologies in which they have the highest competency. The lowest competency rating goes to robotic process automation and blockchain.

The respondents were further asked about which emerging technologies are crucial to be incorporated into their accounting courses.

Figure 8 shows the summary statistics of their responses.

Clearly, robotic process automation and machine learning/intelligence are the two front runners.

Figure 8: Level of importance of selected emerging technologies to be incorporated into the accountancy curriculum

(1 – Least crucial and 5 – Most crucial)

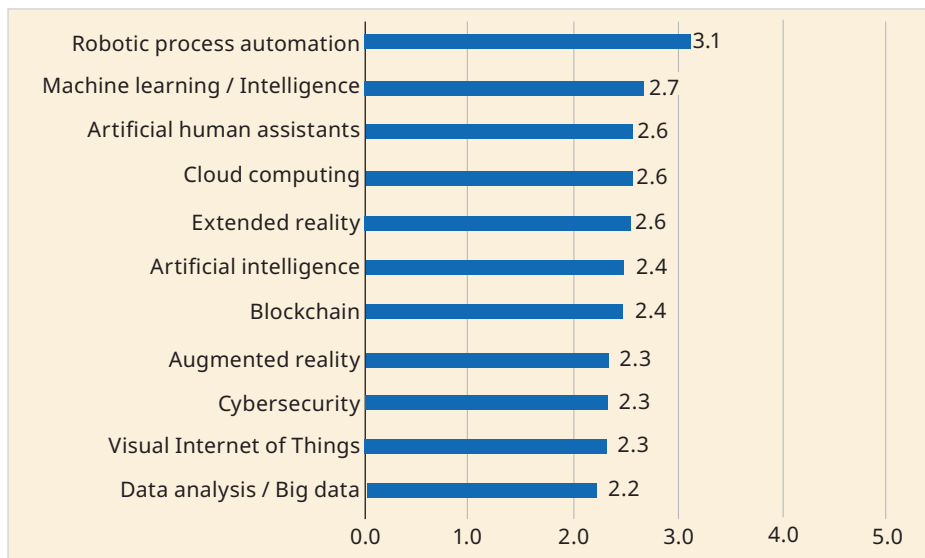


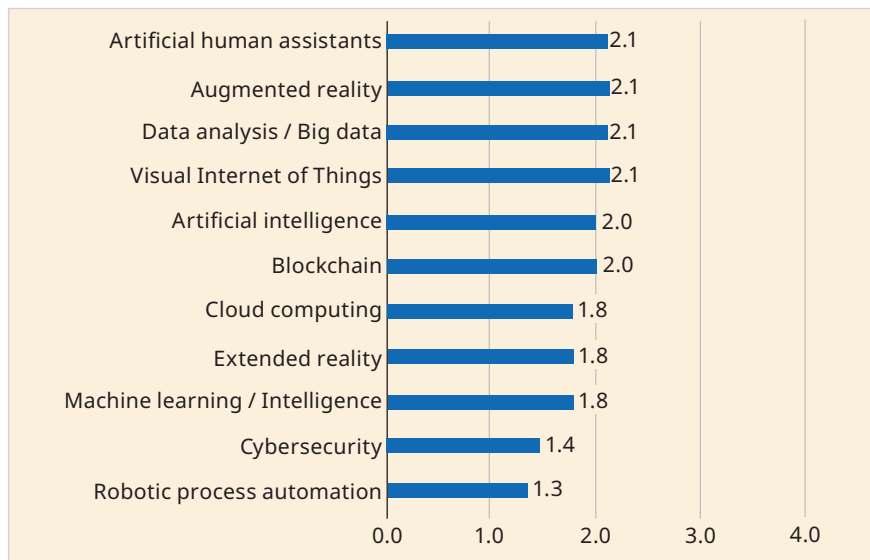
Figure 9 summarizes the respondents' statistics for the level of incorporation of the technologies into their current accountancy curriculum.

The respondents perceive that robotic process automation and cybersecurity are least incorporated into the accountancy curriculum.

Placing these results alongside the findings on the level of competency, it seems that much more robotic process automation and cybersecurity would have to be incorporated into the accountancy curriculum.

Figure 9: Level of incorporation of selected emerging technologies into the accountancy curriculum

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



Respondents seem to suggest that the emerging technologies and their implementation in the accountancy curriculum are challenging, and they are not getting enough of these technologies in the classroom.

They also suggest that, in Myanmar, emerging technologies are difficult to implement in a school, because of a lack of human resource capabilities.

Table 1 below recaps the findings in Figures 6 to 9, namely, getting feedback on the level of awareness of the technologies to their incorporation into the accountancy curriculum.

The table shows the ranking of the respondents with regard to each of the technologies in relation to awareness, competency, importance and incorporation into the accountancy curriculum.

Table 1: Ranking of responses by the 4 categories of awareness, competency, importance and incorporation

	Awareness		Competency		Importance		Incorporation		Average rank
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	
Cloud computing	3.0	2	2.0	2	2.6	3	1.8	7	3.5
Data analysis / Big data	3.2	1	2.1	1	2.2	11	2.1	1	3.5
Augmented reality	2.8	4	1.9	4	2.3	8	2.1	1	4.2
Visual Internet of Things	2.7	7	2.0	2	2.3	8	2.1	1	4.5
Artificial intelligence	2.8	4	1.9	4	2.4	6	2.0	5	4.8
Artificial human assistants	2.4	9	1.8	7	2.6	3	2.1	1	5.0
Machine learning / Intelligence	2.6	8	1.9	4	2.7	2	1.8	7	5.3
Blockchain	2.8	4	1.6	10	2.4	6	2.0	5	6.3
Extended reality	2.3	10	1.8	7	2.6	3	1.8	7	6.8
Cybersecurity	2.9	3	1.8	7	2.3	8	1.4	10	7.0
Robotic process automation	2.1	11	1.6	10	3.1	1	1.3	11	8.3

Data analysis ranks first in 3 of the 4 categories, namely, awareness, competency and incorporation into the accountancy curriculum. It ranks in 11th position, that is, last, in level of importance to be incorporated into the accountancy curriculum.

Cloud computing and data analysis/big data are the two technologies which have the best overall ranking tally.

There are four technologies which rank very low in terms of the importance of being incorporated into the accountancy curriculum, namely, data analysis/big data, augmented reality, visual Internet of Things and cybersecurity (i.e., where importance has a score between 8 and 11) but three of them are highly ranked in terms of being incorporated into the accountancy curriculum (i.e., data analysis/big data, augmented reality and visual internet of things). This is unusual.

Interestingly, robotic process automation has the highest rank in importance to be incorporated into the accountancy curriculum, but it has the lowest rank in awareness, user's competency and being incorporated into the accountancy curriculum.

It seems like much progress can be made in better understanding and incorporating robotic process automation into the accountancy curriculum.

This study seeks to find support for the above responses by the IHLs by examining their current accountancy curriculum in their programmes.

Table 2 shows the technology courses offered by respondents.

Table 2: Technology courses offered by respondents

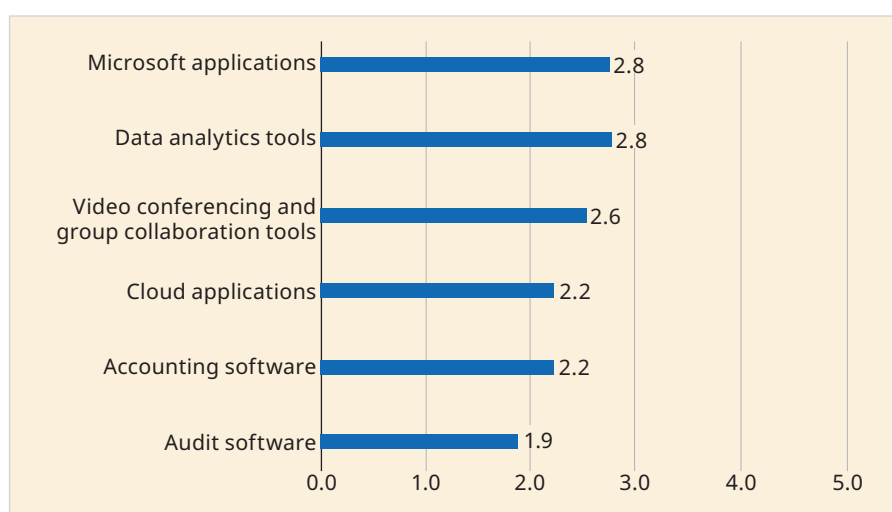
Data management courses	Fundamentals of Data Mining
Data analytics courses	Business Analytics Applications and Issues
Cybersecurity courses	Foundations of Cybersecurity
Machine learning / Artificial intelligence courses	AI in Accounting & Finance
	Data Analytics and Machine Learning
Specialised analytics courses	Audit Analytics

c. Software used in teaching technology courses

The respondents were also asked to name the software that they use to teach their courses. There is no response to this. The respondents were also asked how much of a selected suite of technology tools is currently used or has been embedded in the accountancy curriculum in the last 3 years. The responses are summarized in Figure 10.

Figure 10: Technology tools used in the accountancy curriculum

(1 – Never used and 5 – Frequently used)



From Figure 10, it seems like the most popular tools are the data analytics tools and Microsoft applications, followed closely by video conferencing and group collaboration tools.

This is consistent with the findings in the above sections on the importance of data analysis/big data.

d. Barriers to incorporating technologies into the accountancy curriculum

Respondents were asked to name some of the possible barriers to incorporating technologies into their accountancy curriculum.

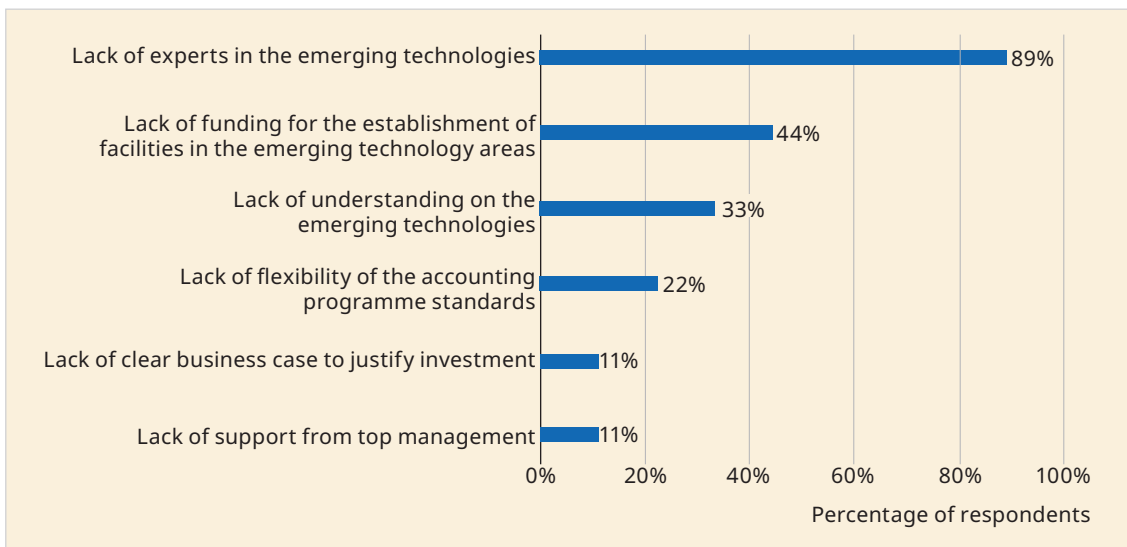
Figure 11 provides a summary of their responses.

The biggest barrier is the lack of experts in emerging technologies.

Interestingly, the barriers with the lowest response rate are a lack of support from top management and a lack of a clear business case to justify the investment in technology.

Nonetheless, 22% of the respondents said that the lack of flexibility in the accounting programme standards is a barrier.

Figure 11: Barriers to adoption of technology in accountancy curriculum



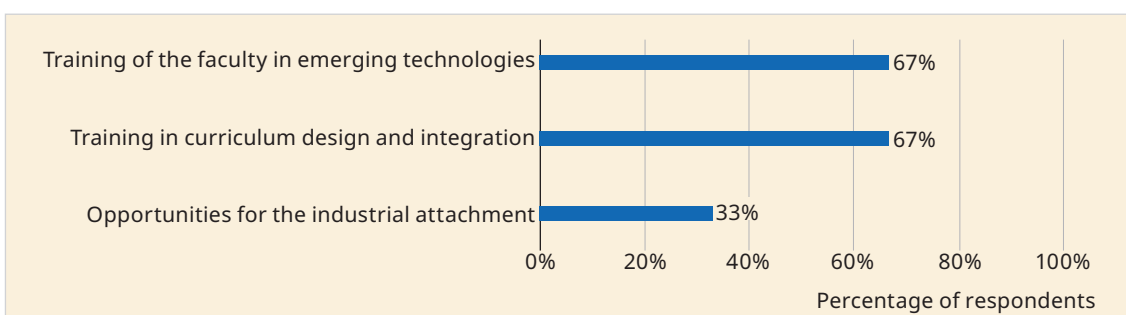
To sum up, it seems that the difficulty of finding experts to teach emerging technologies is the most important barrier to adopting technology in the accountancy curriculum.

e. Help needed for incorporating technology into the accountancy curriculum

With respect to the lack of experts in emerging technologies, respondents were further asked what kind of assistance they would like to have to integrate emerging technologies into existing courses/modules.

Figure 12 provides a summary of their responses.

Figure 12: Kind of help needed to incorporate technology into the accountancy curriculum



It is heartening to know that two-thirds of the respondents believe that training in emerging technologies for the faculty is the way forward to incorporate the technologies into the accountancy curriculum.

The training can be attained through industry attachment.

Interestingly too, the respondents believe that there is a need to train the faculty in curriculum design and integration in order to integrate effectively technologies into the accountancy curriculum.

f. How should technology courses be taught in accounting programmes

The discussion in the accounting literature is that, ideally, technology for accounting should preferably be taught by accounting instructors who are experts or very conversant with the technology.

However, there is a severe shortage of such technologically inclined accountants.

Alternatively, the technology could be taught by technology experts from the accounting industry. These are also short in supply.

Finally, a hybrid approach is proposed to have accounting instructors and IT instructors co-teach technology-related courses.

The objective of this approach is to overcome the shortage of capable instructors. However, the disadvantage of this hybrid approach is that the technology portion of the course could end up being taught without an accounting context and the course can become disjointed.

Respondents were asked the ways in which technology should be taught in accountancy schools, including who should be the main instructors. Figure 13 shows their responses with regard to who should teach the technology component.

Figure 13: Who should teach the technology component?

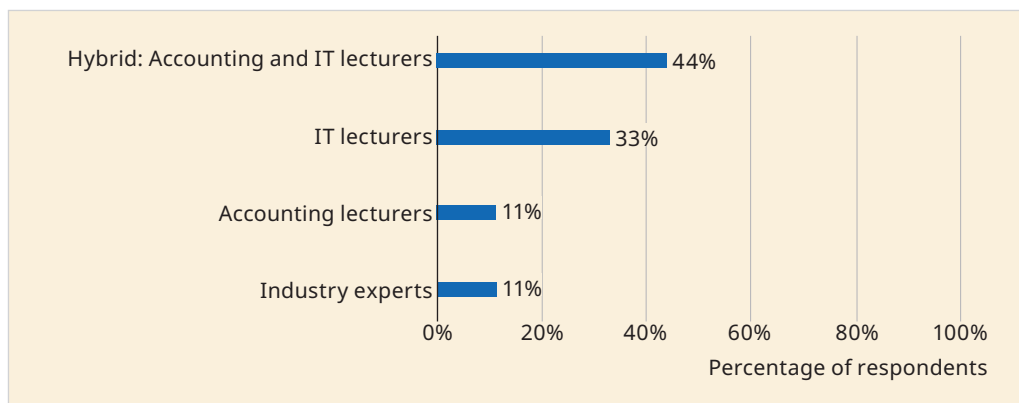


Figure 13 suggests that at this juncture, a hybrid approach would be ideal due to the limited number of accountancy experts who also have know-how of emerging technologies which would be sufficient to teach them.

The respondents were asked their preferred mode to employ to have lessons conducted on technology.

Should the technology course be taught as a stand-alone technology course, or should the technology be embedded into the accounting courses?

Both methods have their advantages and disadvantages. A stand-alone technology course allows the opportunity for instructors to drill deep into the technology.

However, the knowledge can be unrelated to accounting and suffers from a lack of integration with the accounting domain.

The other approach is to incorporate technology as part and parcel of the core accounting courses.

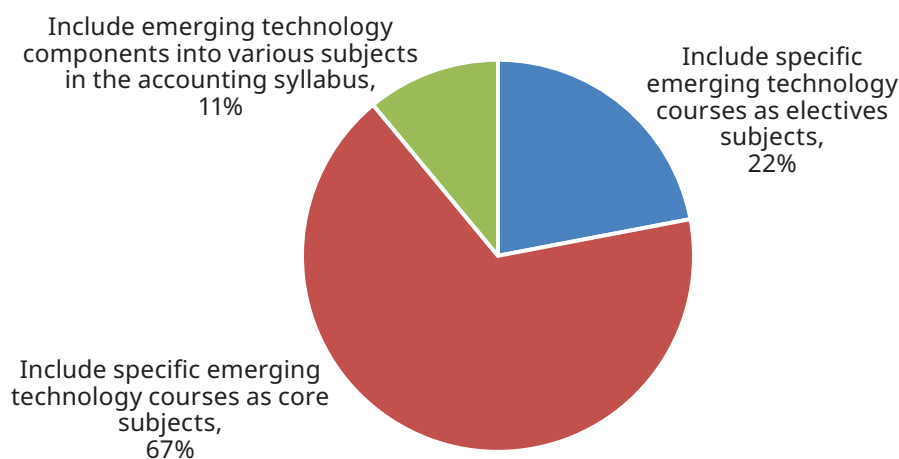
This is ideal but it suffers from two major weaknesses.

First, it is much harder to teach an accounting course with embedded technology and the danger is that the course may end up having insufficient depth and coverage in both the accounting and the technology.

Secondly, it is very difficult to get accounting instructors who can weave technology effectively into the accounting core courses.

Figure 14 summarizes the respondents' views towards teaching technology in the accountancy curriculum.

Figure 14: The way technology is to be taught in the accountancy curriculum



The majority of the respondents prefer to teach technology as core subjects, i.e., stand-alone technology course. 22% of the Respondents prefer to include emerging technology components as electives while only 11% prefer the emerging technology components to be incorporated into various subjects in the accountancy curriculum.

g. State of adoption of technology by IHLs

Respondents were further asked about the stage of adoption of technology in their accountancy curriculum.

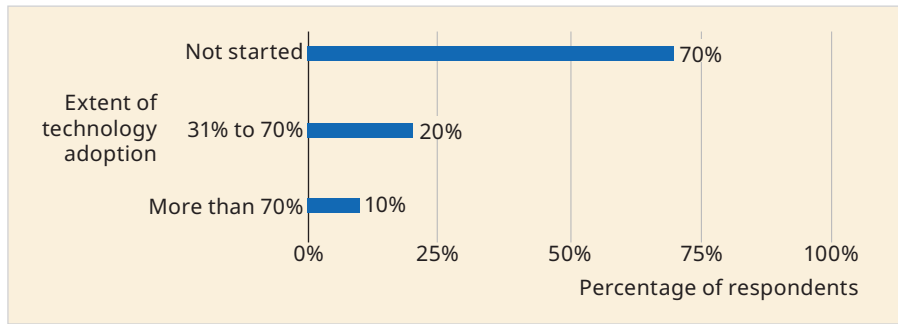
Figure 15 summarizes their responses.

The universities are all in different stages of technology adoption but most of them have not started to do so yet. 10% of the respondents say that the adoption rate is more than 70%.

The majority indicate that they have not even started to adopt technology in their curriculum (i.e., 70%).

This result shows IHLs in Myanmar are still grappling with technology in accounting programmes.

Figure 15: State of technology adoption in accountancy curriculum



3. Accountancy professionals

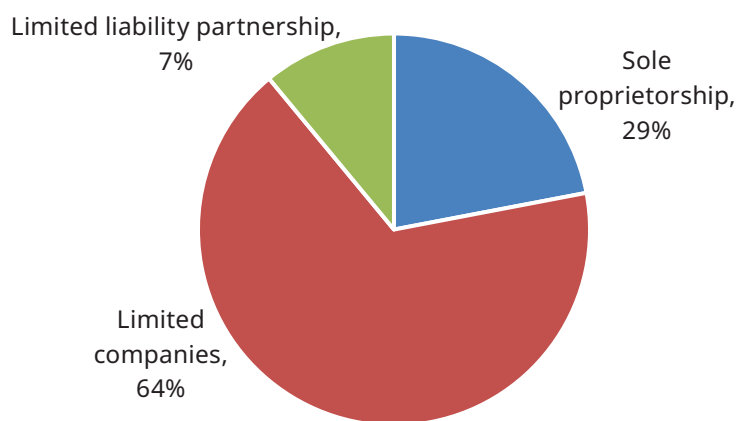
a. Demographics of the respondents

A survey questionnaire was sent to accounting practitioners for their responses.

There were altogether 14 respondents and the types of firms they represent are shown in Figure 16.

There were: 4 sole proprietorships, 9 limited companies and one limited liability partnership.

Figure 16: Profile of respondents



The corporate designations of the respondents are shown in Figure 17 where 92% of the respondents are owners, and 8% are CEOs.

Figure 17: Position of the respondents in their respective firms

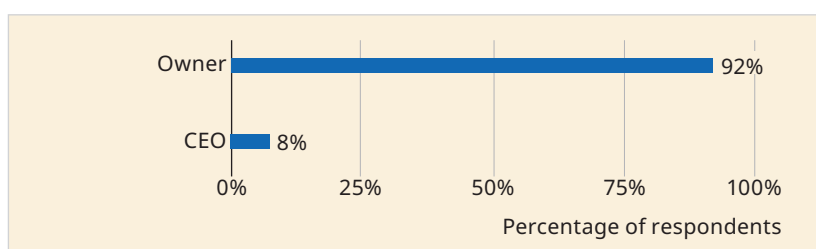
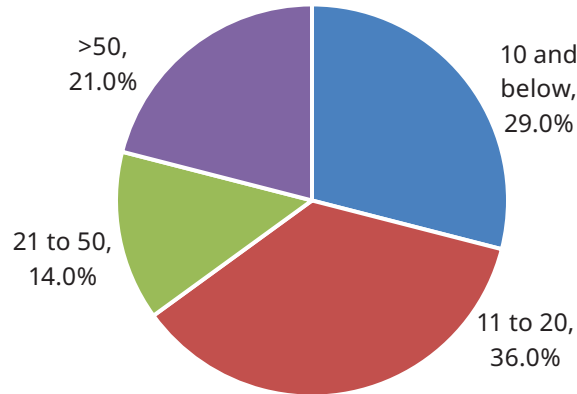


Figure 18 provides an indication of the size of the firms of the respondents. 21% (3) of the respondents hire more than 50 staff in their firm; 14% (2) of the respondents have 21 to 50 employees; the headcount of 36% (5) of the respondents ranges from 11 to 20; while 29% (4) of respondents have a staff strength of at most 10.

Figure 18: Number of employers in the respondent firms



Asked to disclose how long their firm has been in existence, ten out of the 14 respondents say that their firms have been in existence for more than 9 years; three firms have been in business for 1 to 3 years and one firm has operated for 7 to 9 years.

b. Awareness and utilization of selected emerging technologies

The respondents were asked to provide an indication of their level of awareness of advances in technology in the accountancy profession.

Figure 19 provides a statistical summary of their level of awareness of 11 selected emerging technologies.

The top emerging technologies of which the respondents have the highest level of awareness are data analysis/big data and cloud computing.

The 3 types of technology with the lowest level of awareness are extended reality, augmented reality and blockchain.

Figure 19: Level of awareness of the selected emerging technologies

(1 – Not at all and 5 – Fully aware)

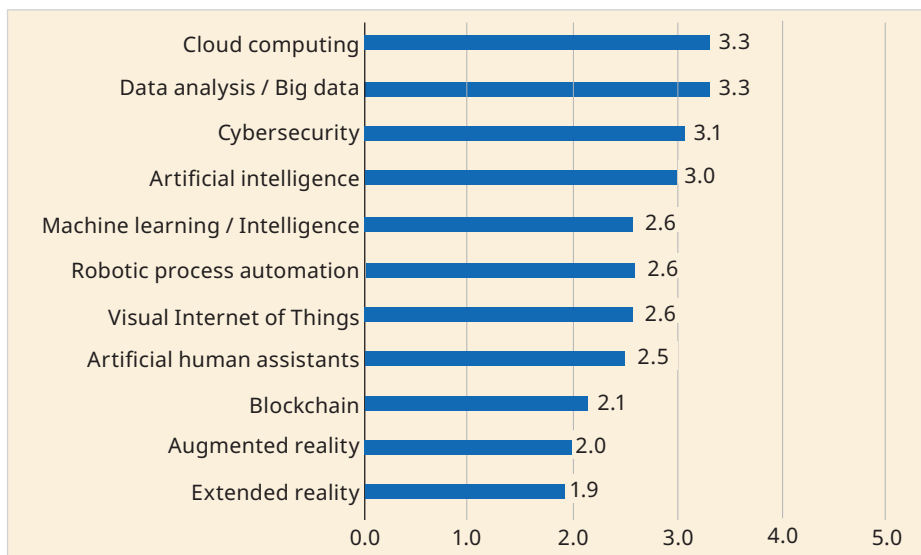


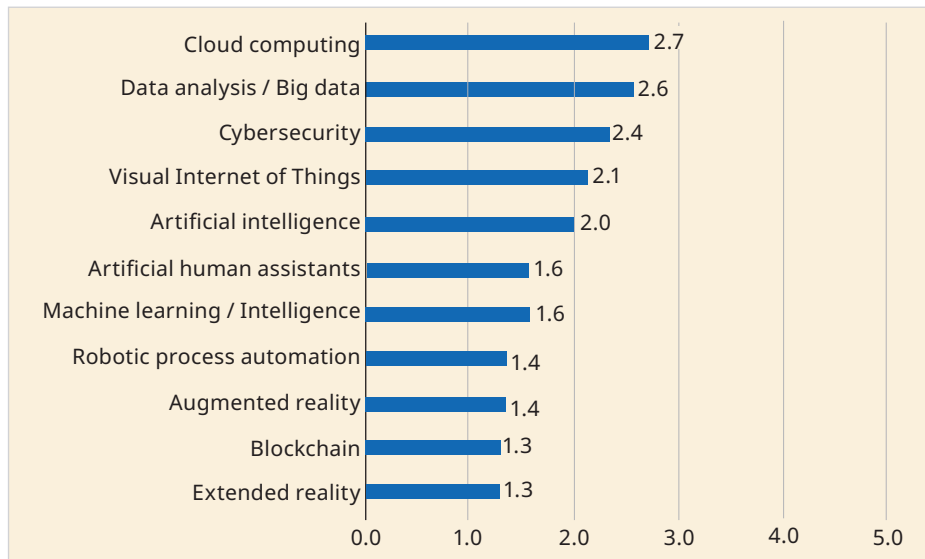
Figure 20 shows the level of utilization of the emerging technologies and the top 3 emerging technologies are cybersecurity, data analysis/big data and cloud computing.

However, the level of utilization on average is lower than the level of awareness.

This could mean that it is one thing to be aware of a technology, but it is another thing to be utilizing the technology.

This is particularly the case for those technologies with an average score of less than 2 in terms of the level of utilization.

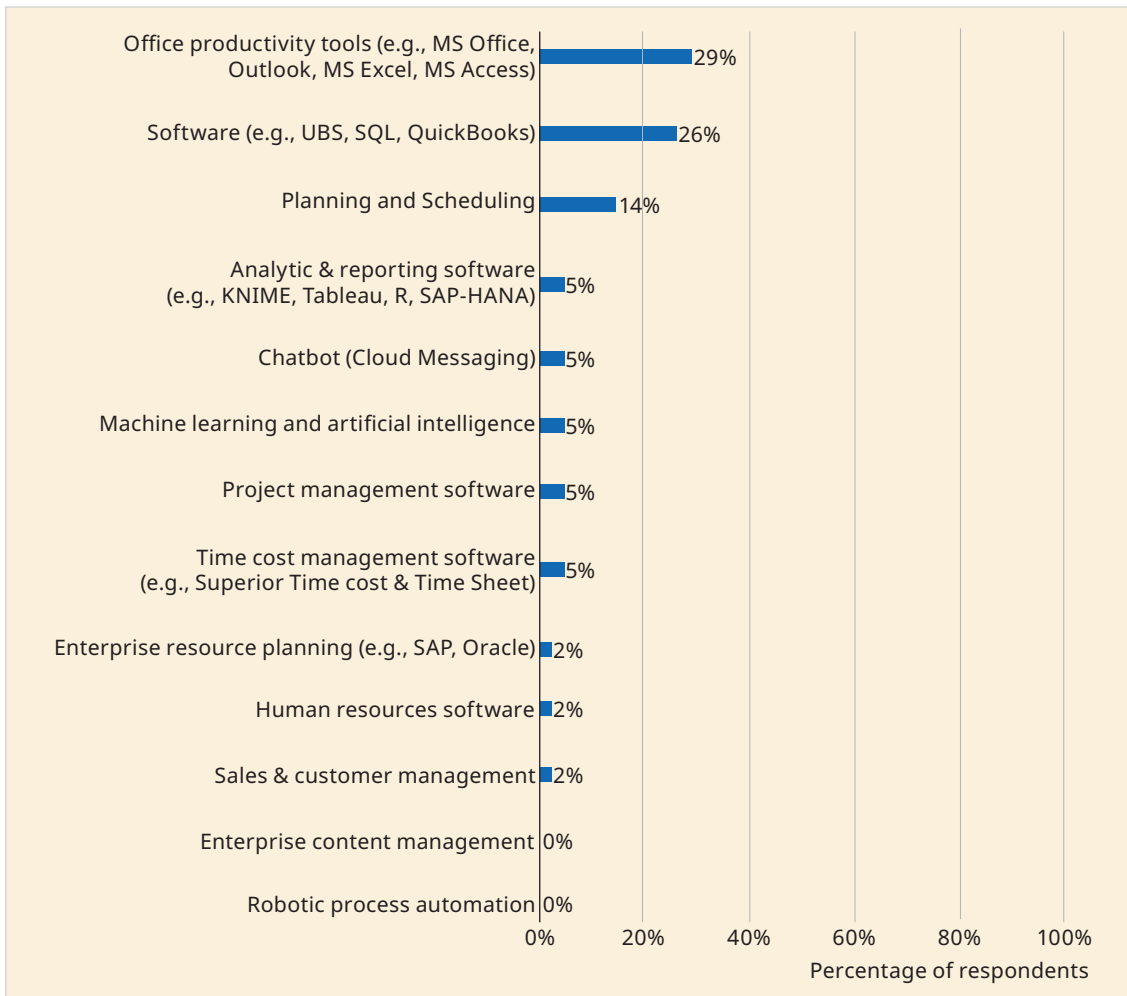
Figure 20: Level of adoption of the selected emerging technologies
(1 - Not at all utilized and 5 - Utilized all the time)



c. Systems and software adoption

The respondents were asked to provide their inputs on the type of systems and software which they currently adopt in their work.

Figure 21 shows the list of systems and software adopted by the respondents.

Figure 21: Types of systems and software adopted

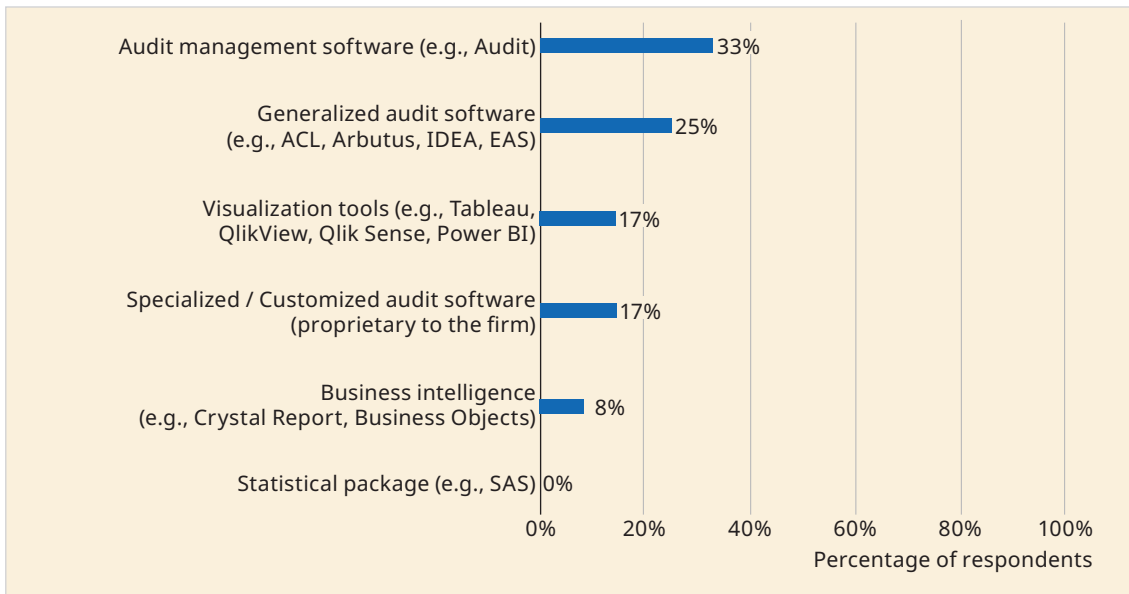
The top 3 most popular systems or software adopted are: planning and scheduling software, accounting software and office productivity software. Generally, the other kinds of software have a very low response rate.

d. Computer-Assisted Audit Technique (CAAT) adoption

The respondents were specifically requested to provide inputs on the adoption of computer-assisted audit techniques (CAAT).

Figure 22 provides a summary of the CAAT adoption.

Figure 22: Types of computer-assisted audit techniques (CAAT) adopted



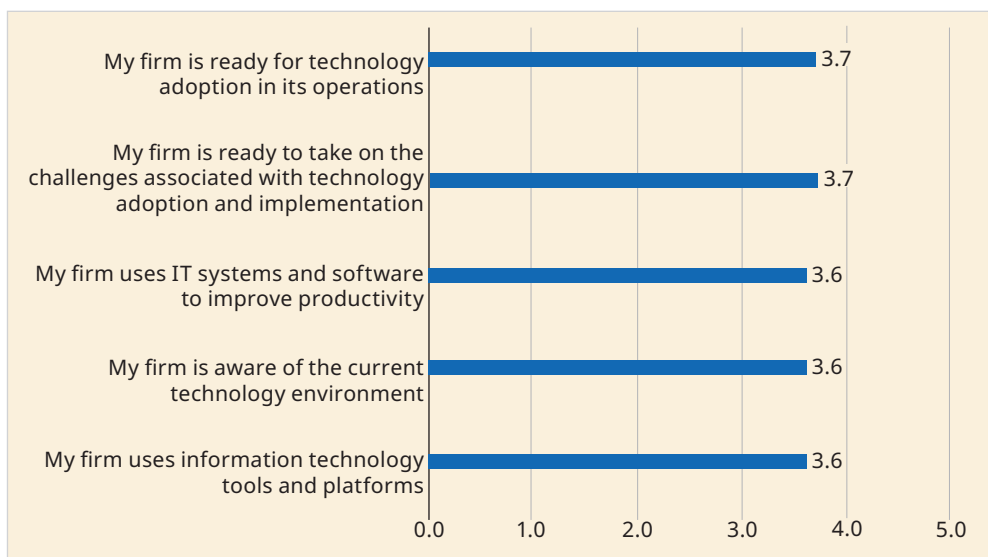
The findings are that 33% of the respondents use audit management software while 25% of them use generalized audit software in their operations. Specialised/customised audit software and visualisation tools were used by 17% of the respondents. Interestingly, the responses indicate a very low level of usage of software by the practitioners.

e. Technological preparedness

The respondents were asked about their preparedness for technology adoption from three different dimensions: the approach to technology, manpower skills and knowledge, and investment in technology.

Figure 23 shows the respondents’ responses to 5 statements regarding their approach to technology.

Figure 23: Approach to technology adoption
(1 – Fully disagree and 5 – Fully agree)

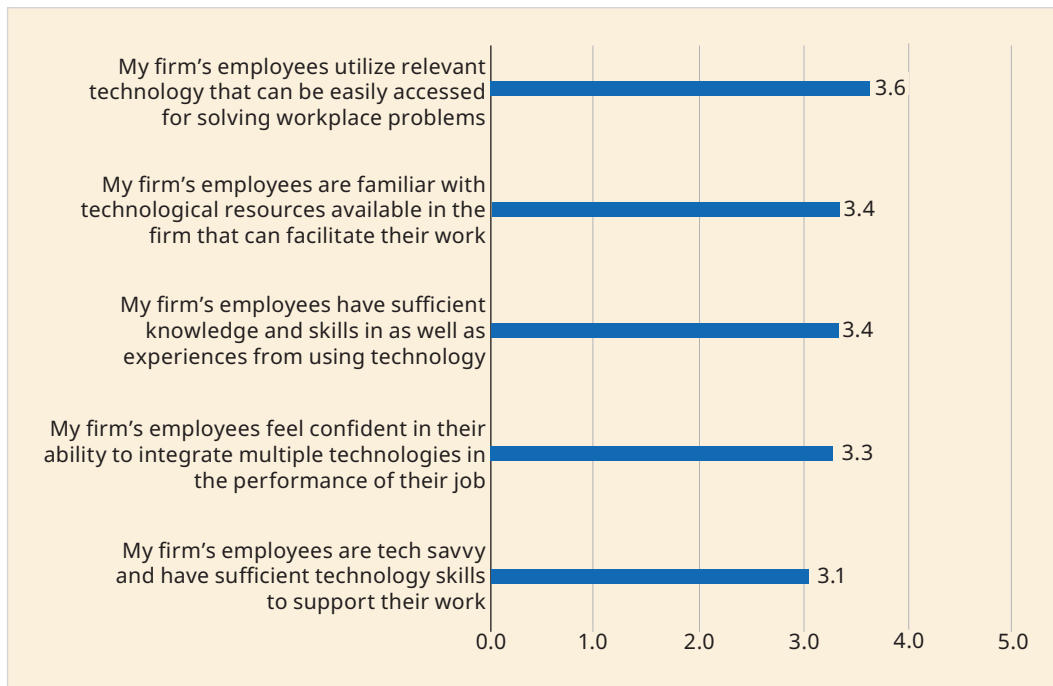


The respondents provided very positive responses to the five statements on their approach to technology. It can be concluded that the key motivation for the adoption of IT systems and software is to improve the readiness to adopt technology and then to adopt it. The increase in productivity will justify the adoption of the technology.

Figure 24 provides a summary of the feedback of the respondents on the technological skills and knowledge of their employees.

Figure 24: Manpower skills and knowledge

(1 – Fully disagree and 5 – Fully agree)



Respondents are very positive about the technological skills and knowledge of their manpower.

There seems to be above-average agreement on the ability of the staff to manage and handle technology effectively and appropriately.

This is affirmed by the firms' view that staff's skills and competency specifically depend on whether the technology is easily accessed to solve workplace problems.

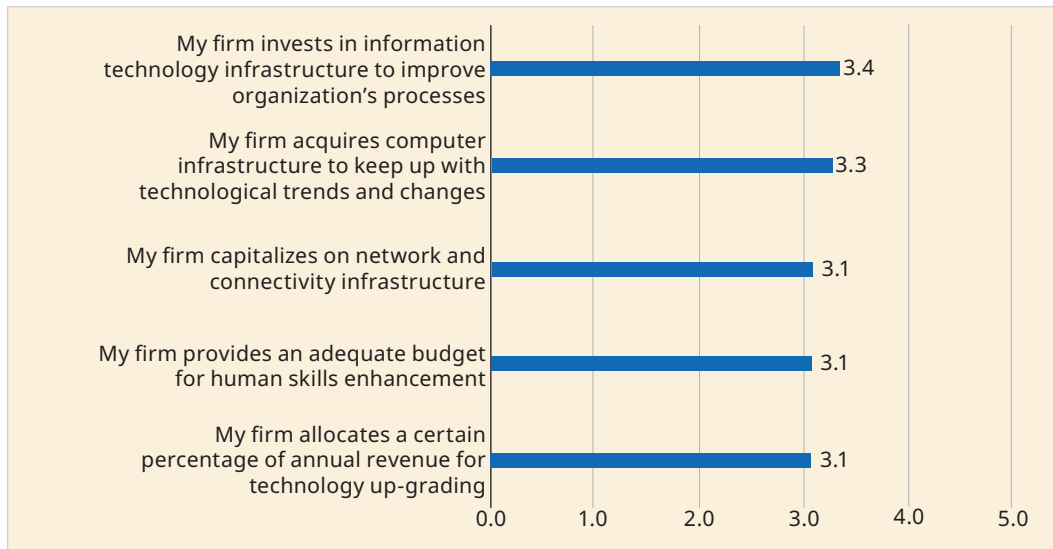
The findings may suggest that more can be done to upskill the staff through technology-related training.

Overall, there is significant positivism about the adoption of technology.

Figure 25 shows the respondents' feedback on their firm's investment in technology.

Figure 25: Investment in technology

(1 – Fully disagree and 5 – Fully agree)



The responses suggest an above-average positive response to investment in technology.

The responses are consistent with the respondents' views on the adoption of technology and the need for manpower development in technology.

The findings suggest that the respondents are willing to invest in technology infrastructure and may have undertaken actions and framed strategies to upskill the firm's technological capability.

f. Planned behaviour towards technology adoption

The respondents were further requested to provide responses to statements that help to assess the planned behaviour of the respondents toward technology adoption.

The planned behaviour covers four key aspects: attitude, subjective belief, perceived behavioural control and intention to engage.

Figure 26 summarizes the respondents' feedback on their attitude towards technology.

Figure 26: Attitude towards technology

(1 – Fully disagree and 5 – Fully agree)

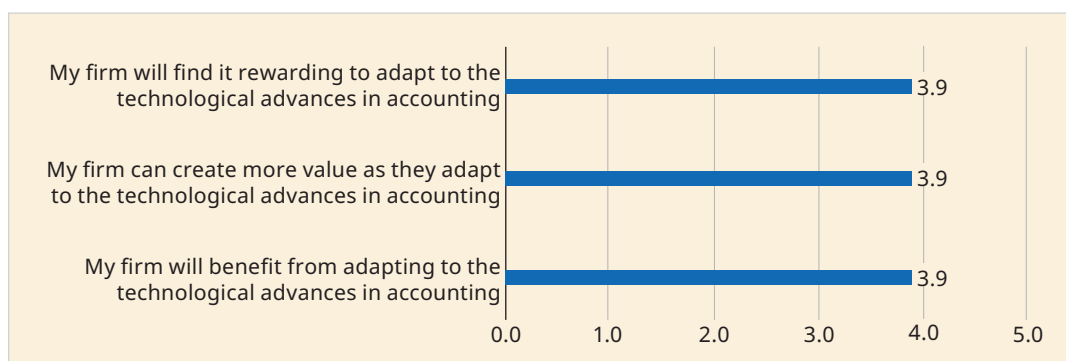


Figure 26 documents very positive responses from the respondents on their attitude towards technology.

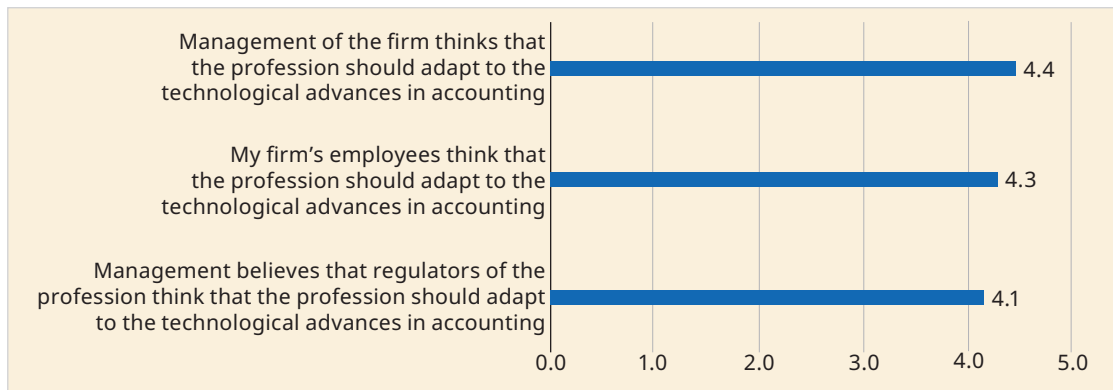
There is a strong belief that their firms will benefit from adopting technological advances in accounting and this positive belief is expected to result in more value creation.

The respondents believe that they will be rewarded for adopting technological advances.

Figure 27 summarizes the respondents’ feedback on the subjective belief of their management concerning the views of the profession, staff and regulators about adopting technological advances in accounting.

Figure 27: Subjective belief about technology

(1 – Fully disagree and 5 – Fully agree)



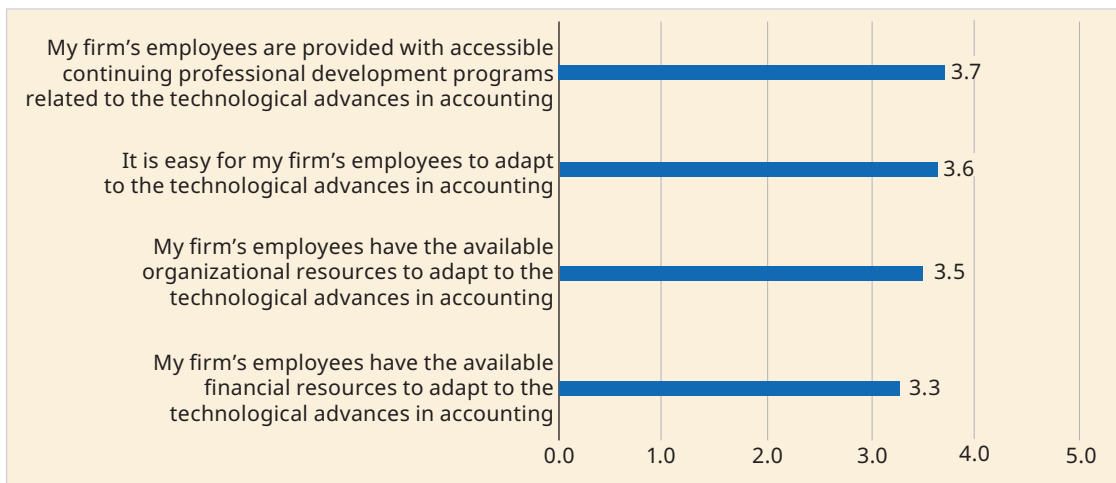
There is an even stronger subjective belief that regulators, the accountancy profession and staff think that the adoption of technology advances in accounting is imperative to the accountancy profession.

It seems that the respondents believe that technological advances cannot be stopped, and firms must implement them for progress.

Figure 28 shows the planned behaviour of the respondents in tackling the adoption of technology advances in their firm.

Figure 28: Planned behaviour for technology adoption

(1 – Fully disagree and 5 – Fully agree)

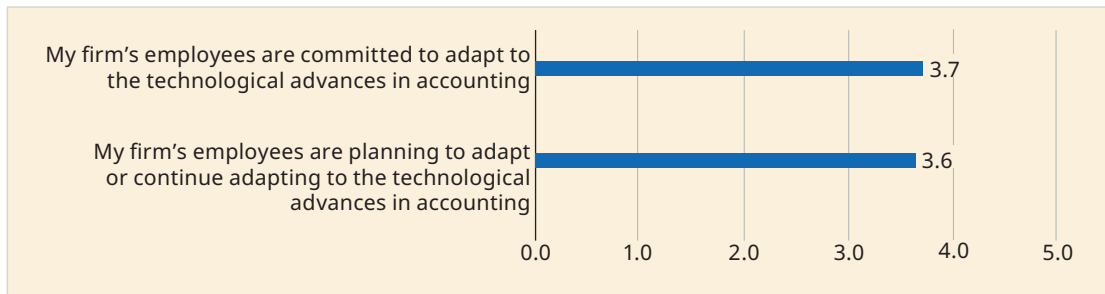


The respondents articulate their planned behaviour in a positive and affirming manner. There is general positive agreement on the planned actions. The most important of these is the necessary provision of support to employees in terms of access to continuing professional development programmes. However, the response to the level of planned behaviour is lower than the attitude and subjective belief towards the technologies.

Figure 29 summarizes the respondents' inputs on their intention to adopt technology in their business.

Figure 29: Intention to adopt technology

(1 – Fully disagree and 5 – Fully agree)



The findings in Figure 29 are interesting: even though there are positive attitudes toward adopting technology, a strong subjective belief that technology is crucial to the accounting sector, and planned behaviour to engage technology, there are relatively lower positive sentiments about their employees' intention to use technology.

This could reflect the lack of technologically inclined employees and the difficulties in upskilling employees.

On the positive side, employees are willing to learn new skills; while on the negative side, there may be a lack of opportunities to acquire new skills.

g. Expected benefits of technology adoption

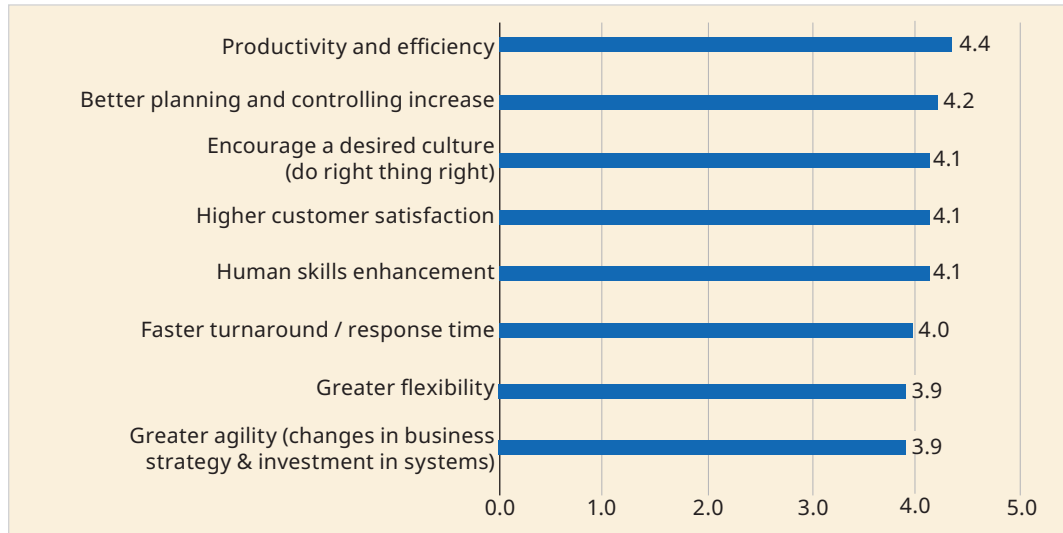
The respondents were asked about the expected benefits from technology adoption.

The list of benefits was curated from the accounting literature and industry dialogues.

Figure 30 provides a summary of the respondents' feedback on the articulated expected benefits.

Figure 30: Expected benefits of technology adoption

(1 – Fully disagree and 5 – Fully agree)



There is strong agreement among the respondents on the well documented benefits of technology adoption.

The most compelling advantage is productivity and efficiency gains in work.

A few of the respondents name other benefits to the adoption of technology.

They include better planning and control and the encouragement of a desired culture (i.e., do the right thing).

h. Challenges to adoption of technology

The respondents were asked to name the challenges to the adoption of technology. Figure 31 provides a summary of the responses.

Figure 31: Challenges to adoption of technology

(1 – Fully disagree and 5 – Fully agree)

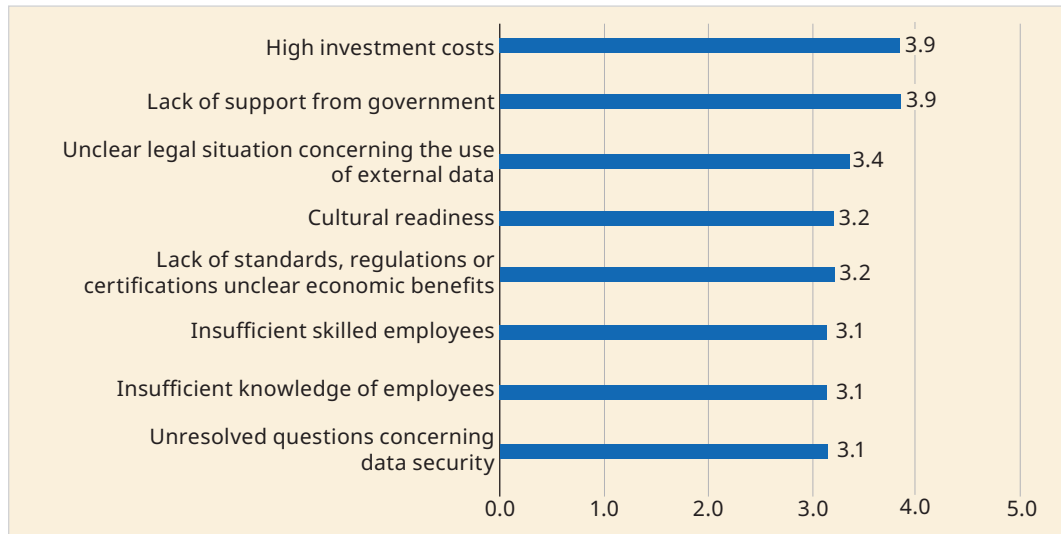


Figure 31 shows that lack of support from the government ties alongside high investment costs as the top challenges.

The next most mentioned challenge is the unclear legal situation concerning the use of external data.

Insufficient skills and inadequate knowledge of employees are challenges which are well documented.

However, the various challenges can be overcome with proper attention and resources, for instance, through training.

Conclusion

Technology adoption in Myanmar seems to be at the infancy stage.

There is a certain degree of awareness of technology among the PAO, IHLs and accountancy professionals.

In addition, the articulated benefits and belief in the usefulness and importance of technology adoption seem to be well accepted.

However, implementation and adoption on the ground is a challenge.

The fact that there is a lack of a technology adoption roadmap will further impede development.

The IHLs are doing their part to upskill students but there is a great shortage of experts in emerging technology, a factor which hinders the development of students who could otherwise be more technologically savvy.

Much work and investment will have to be put into the adoption of technology for the accountancy profession in Myanmar.●

Appendix 9: The Philippines

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Emerging technologies have been re-shaping the practice of accounting across the globe.

These emerging technologies include artificial human assistants, artificial intelligence, augmented reality, blockchain, cloud computing, cybersecurity, data analysis / big data, extended reality, machine learning / intelligence, robotic process automation, and visual Internet of Things.

Consequently, such emerging technologies pose both opportunities for and threats to the practice of accounting.

The current study aims to explore the perceptions of professional accountants in the Philippines as regards the said emerging technologies.

Using a sequential explanatory design, the current study identifies the primary drivers of professional accountants' technological adoption intention.

Using bootstrapped mediation analysis, personal (positive attitude) and organizational (i.e., preparedness) factors provide a mechanism for why perceived challenges and awareness, respectively, drive professional accountants' intention to adopt the emerging technologies.

Using the Theory of Planned Behaviour as a reference frame, a structural equation model explains how subjective norms and perceived behavioural control are able to drive Filipino professional accountants' intention to adopt emerging technologies.

Focus group discussions across stakeholders were able to confirm the role played by personal (e.g., attitude), social (e.g., subjective norm), and utility/systemic (e.g., benefit perception) factors in shaping the professional accountants' perception of the emerging technologies, including their intended adoption.

Finally, combining the quantitative and qualitative results, an emerging model and a roadmap for technology adoption are identified, both being reflective of the Filipino social reality of collectivism vis-a-vis the technological adoption phenomenon.

Introduction

Several seminal events and nascent practices have been seen to drive the emerging relationship between technology and the future of accountancy work (e.g., Fulop et al.,

2022; Raghavan, 2021; Zhang et al., 2020).

Specifically, events such as Industry 4.0 and the COVID-19 pandemic have shaped the need for accountants to adapt to technological changes (Raghavan, 2021; Fulop et al., 2022).

As a result of these events, certain technologies pose both opportunities and threats to accountancy professionals (e.g., Zhang et al., 2020).

Primarily, Artificial Intelligence (AI) is identified as a possible prime enabler of accounting's technological transformation (e.g., Mohammad et al., 2020; Zhang et al., 2020).

Developments in AI are suggested to create new streamlined accounting functions (i.e., tasks and roles), providing improved cost structures to organizations (Mohammad et al., 2020; Stancheva-Todorova, 2018).

Furthermore, cloud computing, big data, cybersecurity, virtual reality, and augmented reality are also identified as potent tools that can enhance the report preparation functions of accountants (Imene & Imhanzenobe, 2020).

These trends may have resulted in organizational and personal issues that might inhibit and/or facilitate the integration of technology in accounting practice (e.g., Agyekum & Singh, 2018; Awang et al., 2021; Bauchadze, 2022; Prinstin et al., 2022).

On an organizational level, necessary modifications in existing structures might be necessary for accountants to fully integrate the emerging technologies in their functional responsibilities, with this integration possibly translating into operational efficiencies (Agyekum & Singh, 2018; Bauchadze, 2018).

On a personal level, several skills have been identified to better prime accountants for technological adoption (Awang et al., 2021; Prinstin et al., 2022).

Specifically, adaptiveness and flexibility seem to be recurring approaches necessary for accountants to respond to technological opportunities and challenges (Awang et al., 2021; Nazarova et al., 2021; Sumar, 2021).

Consequently, academic institutions need to integrate these life skills as they prepare aspiring professional accountants for a technologically driven world of work (Prinstin et al., 2021).

With these trends and issues, the current research aims to explore the enablers and inhibitors of technological adoption in Filipino accountants.

Specifically, the researchers aim to answer the following:

1. What are the perceptions and views on the changes in the accountancy profession arising from new technology?
2. What should the accountancy profession do to navigate this technology adoption?
3. What are the new technologies needed for the future practice of the accountancy profession?
4. What is the Professional Accountancy Organization's (PAO) technology skill roadmap, if any, for the profession?
5. Do accountancy schools have a plan or strategy to incorporate these new technologies into their current accountancy curriculum? How do they intend to implement such a plan?
6. What are the current challenges in incorporating these new technologies into the current accountancy curriculum?
7. How should the stakeholders work together to address this technological challenge?

The Philippine accountancy profession

The practice of accountancy in the Philippines was recognized as a profession on March 17, 1923, when the Legislature enacted the Republic Act 3105 also known as Accountancy Act of 1923 (Professional Regulation Commission [PRC], n.d.).

The Professional Regulation Commission through the Board of Accountancy is the regulatory body tasked by the government to regulate the accountancy profession covering the four sectors, Public Practice, Government, Commerce & Industry and Education (PRC, n.d.).

As of 2023, the centenary year of the Philippine accountancy profession, there are about 200,000 registered CPAs spread in the four different sectors locally and thousands working abroad (PRC, n.d.).

Moreover, the Philippine Institute of Certified Public Accountants (CPAs) or PICPA is a non-stock, non-profit organization duly recognized and accredited by the Professional Regulation Commission (PRC) as the Accredited Integrated Professional Organization (AIPO) for Accountancy in the Philippines (PRC, n.d.).

Under PICPA, there are four sectoral organizations which address the specific needs of their respective members, namely, the Association of CPAs in Public Practice for CPAs (ACPAPP), the Association of CPAs in Commerce and Industry (ACPACI), the Government Association of CPAs (GACPA) and the National Association of CPAs in Education (NACPAE) (PRC, n.d.).

Theory of Planned Behaviour

The current study is theoretically anchored on the Theory of Planned Behaviour (TPB [Ajzen, 1991]).

Emanating from the Theory of Reasoned Action (TRA [Fishbein & Ajzen, 1975]). Central to the theory is the intention to adopt a new behaviour.

In the TPB, attitude, subjective norm, and perceived behavioural control (PBC) are seen to relate to an agent's intention to adopt a new behaviour.

Attitudes pertain to the beliefs the agent has about the behaviour in consideration (Ajzen, 1991). In turn, such beliefs are indexed on the agent's negative or positive outcomes of the behaviour in question (Ajzen, 1991).

Consequently, the subjective norm pertains to the combination of normative belief and motivational compliance to such belief (Ajzen, 1991).

The normative belief pertains to the agent's perception of how important stakeholders would view the behaviour while motivational compliance pertains to external pressures felt by the agent coming from the important stakeholders (Ajzen, 1991).

PBC differentiates TPB from TRA (Ajzen, 1991). PBC refers to how the agent internally recognizes the resources and opportunities available to them as they intend to adopt the behaviour (Ajzen, 1991). Ajzen (1991) points out that perceived, rather than actual, control is more important in determining behaviour achievement, partially owing to its association with self-efficacy.

The TPB is contextualized in this research since its main question pertains to the accounting stakeholders' (i.e., public practitioners, accountancy schools, and PAOs) adoption

of emerging technologies such as visual Internet of Things, robotic process automation, machine learning/intelligence, extended reality, big data, cybersecurity, cloud computing, blockchain, augmented reality, artificial intelligence, and artificial human assistants.

The related attitudes, normative beliefs, and control perception of the stakeholders will allow the current research to better understand the mechanisms needed for stakeholders in the profession to be better equipped in adopting the said emerging technologies.

Finally, in understanding these mechanisms, the researchers formulated a roadmap towards technology adoption, nuanced to the context of the accountancy profession in the Philippines.

Methods

The current research followed the sequential explanatory mixed methods design. The said design was best suited for the identified research questions since such necessitate both quantitative and qualitative methods in identifying the technological perceptions of professional accountants and explaining the reason for such perceptions. Three studies were conducted in answering the questions.

Data collection

Study 1 was a quantitative study that explored professional accountants in public practice (PAIPP) with respect to awareness, utilization, technological preparedness, human resource preparedness, technological investment, attitude, subject norm, perceived behavioural control, intention to adopt, perceived benefits, and perceived challenges pertinent to the emerging technologies. The PAIPPs were recruited through the help of the ACPAPP.

Study 2, on the other hand, was also a quantitative study exploring the awareness, competency, technology cruciality, curricular incorporation, and usage of accounting teachers, pertinent to the emerging technologies. Demographic profiles of the respondents for both studies were also collected. Both instruments for Studies 1 and 2 were distributed electronically.

Study 3 is a qualitative study aimed at further explaining the results of Studies 1 and 2. Three focus group discussions (FGDs) were conducted with the directors and officers of PICPA, ACPAPP, and nACPAE, respectively representing the integrated accountancy profession, PAIPPs, and accounting teachers in the Philippines. The FGDs followed a semi-structured format, based on a predetermined interview guide. As part of research ethics protocols, the informed consent process was explained to all participants. Consequently, the participants' informed consent was obtained.

Data analysis

Descriptive statistics were used to initially analyze the levels of the perception of PAIPPs and accounting teachers in Studies 1 and 2, respectively.

For Study 1, the correlation coefficient of the potential drivers and inhibitors was determined vis-a-vis the intention to adopt.

Consequently, bootstrapped mediation analysis was conducted in an effort to explain

the possible mechanism why certain variables drive the respondents' intention to adopt.

Finally, a structural equation model was determined in analyzing the role played by the attitudes, subjective norm, and perceived behavioural control in driving the respondents' technological adoption intention, following TPB.

Study 3 was analyzed using the standard thematic analysis (see Braun & Clarke, 2006) in meaning thematization using a priori codes aligned with the intention determinants in TPB.

Results and discussions

Study 1: Survey of professional accountants in public practice

Descriptive statistics

Table 1: Firm type

Legal status	Number of respondents	Percentage
Large partnership	3	2.7%
SMP partnership	37	32.7%
Sole practitioner	73	64.6%
Total	113	100.0%

It may be noted that almost 65% of the respondents are sole practitioners. Such qualification might provide an important nuance to the specific results.

Table 2: Number of firm partners

Number of partners	Number of respondents	Percentage
1	73	64.6%
2	9	8.0%
3	8	7.1%
4	9	8.0%
5	7	6.2%
6	4	3.5%
21	1	0.9%
25	1	0.9%
300 and over	1	0.9%
Total	113	100.0%

Table 3: Respondent's designation

Designation	Number of respondents	Percentage
Staff	9	8.0%
Supervisor / Manager	20	17.7%
Partner / Proprietor / Consultant	84	74.3%
Total	113	100.0%

74.3% of the respondents are partners, proprietors, or consultants.

With this majority, the results are generally from the point of view of high-level decision makers in public practice.

Table 4: Number of years in operations

Number of years	Number of respondents	Percentage
1 to 3	25	22.1%
4 to 6	15	13.3%
7 to 9	15	13.3%
Above 9	58	51.3%
Total	113	100.0%

Table 5: Number of the firm's staff

Number of staff	Number of respondents	Percentage
10 and below	99	87.6%
11 to 20	7	6.2%
21 to 50	4	3.5%
Above 50	3	2.7%
Total	113	97.3%

Table 6: Main variables

	N	Mean	Median	Standard deviation	Minimum	Maximum	Shapiro-Wilk W	Shapiro-Wilk p
Awareness	113	3.05	3	1.21	1	5	0.945	<.001
Utilization	113	2.23	2.09	1.01	1	4.64	0.925	<.001
Technological preparedness	113	3.46	3.4	0.976	1	5	0.958	0.001
Human resource preparedness	113	3.32	3	1.04	1	5	0.945	<.001
Technological investment	113	3.18	3	0.973	1	5	0.961	0.002
Attitude	113	3.79	4	0.993	1	5	0.873	<.001
Subjective norm	113	3.76	4	1	1	5	0.874	<.001
Perceived behavioural control	113	3.36	3	0.958	1	5	0.933	<.001
Intention to adopt	113	3.55	3.5	1.02	1	5	0.903	<.001
Perceived benefits	113	3.84	4	1.03	1	5	0.875	<.001
Perceived challenges	113	3.55	3.5	0.921	1	5	0.93	<.001

PAIPPs have exhibited relatively positive attitudes towards benefits, value creation potential, and rewards of emerging technologies in their professional practice.

Further, the PAIPPs perceive that they are expected by their stakeholders to adopt these technologies through a relatively high subjective normativity.

However, PAIPPs have indicated that adopting these technologies is neither easy nor difficult through a neutral perception of behavioural control. Finally, PAIPPs have exhibited relatively high intentions to adopt these technologies.

PAIPPs are somewhat aware (mean score=3.05) of the technologies but they seldom utilize (mean score=2.23) them. Please refer to Tables 7 and 8 for the specific awareness and utilization levels for each technology, respectively.

Furthermore, PAIPPs are moderately prepared to adopt these technologies, with their human resources being somewhat prepared for the adoption. On the other hand, the PAIPPs' firms have moderate investments in emerging technologies.

Finally, PAIPPs perceive that the challenges and benefits of technological adoption are relatively high.

Table 7: Level of awareness

(1 – Not at all and 5 – Fully aware)

	N	Missing	Mean	Median	Standard deviation	Minimum	Maximum
Visual Internet of Things	113	0	3.15	3	1.36	1	5
Robotic process automation	113	0	2.87	3	1.33	1	5
Machine learning / Intelligence	113	0	2.97	3	1.32	1	5
Extended reality	113	0	2.84	3	1.33	1	5
Big data	113	0	3.24	3	1.28	1	5
Cybersecurity	113	0	3.27	3	1.34	1	5
Cloud computing	113	0	3.23	3	1.34	1	5
Blockchain	113	0	2.82	3	1.36	1	5
Augmented reality	113	0	2.88	3	1.37	1	5
Artificial intelligence	113	0	3.15	3	1.29	1	5
Artificial human assistants	113	0	3.10	3	1.33	1	5

Top technologies that PAIPPs are aware of are cybersecurity (3.27), big data (3.24), and cloud computing (3.23).

On the other hand, they are least aware of blockchain (mean score=2.82), extended reality (mean score=2.84), and robotic process automation (mean score=2.87).

Table 8: Level of utilization

(1 - Not at all utilized and 5 - Utilized all the time)

	N	Missing	Mean	Median	Standard deviation	Minimum	Maximum
Visual Internet of Things	113	0	2.11	2	1.16	1	5
Robotic process automation	113	0	2.06	2	1.18	1	5
Machine learning / Intelligence	113	0	1.91	2	1.09	1	5
Extended reality	113	0	2.49	2	1.27	1	5
Big data	113	0	2.50	2	1.24	1	5
Cybersecurity	113	0	2.50	2	1.25	1	5
Cloud computing	113	0	2.12	2	1.21	1	5
Blockchain	113	0	2.35	2	1.27	1	5
Augmented reality	113	0	1.89	2	1.06	1	5
Artificial intelligence	113	0	2.54	2	1.31	1	5
Artificial human assistants	113	0	2.12	2	1.15	1	5

PAIPPs' top utilized technologies are artificial intelligence (mean score=2.54), big data (mean score=2.50), and cybersecurity (mean score=2.50).

On the other hand, their least utilized technologies are augmented reality (mean score=1.89), machine learning intelligence (mean score=1.91), and robotic process automation (mean score=2.06).

Inferential statistics

Table 9: Difference in awareness and utilization

	Statistic	df	p	Mean difference	SE difference		Effect size
Student's t	-8.080	112	<0.001	-0.813	0.101	Cohen's d	-0.760
Wilcoxon W	250		<0.001	-0.955	0.101	Rank biserial correlation	-0.878

It may be noted from Table 7 and 8 that the PAIPPs' level of awareness is generally higher than their utilization of the technologies.

This difference is further confirmed by the tests in Table 9 which shows that the differences are statistically significant at the 1% level for both the Student-t and Wilcoxon W tests.

Table 10: Correlates of intention to adopt

	Pearson's r	p-value	Spearman's rho	p-value
Awareness	0.491***	<0.001	0.527***	<0.001
Utilization	0.386***	<0.001	0.421***	<0.001
Technological preparedness	0.763***	<0.001	0.747***	<0.001
Human resource preparedness	0.642***	<0.001	0.653***	<0.001
Technological investment	0.695***	<0.001	0.678***	<0.001
Attitude	0.668***	<0.001	0.651***	<0.001
Subjective norm	0.792***	<0.001	0.783***	<0.001
Perceived behavioural control	0.746***	<0.001	0.740***	<0.001
Perceived benefits	0.791***	<0.001	0.746***	<0.001
Perceived challenges	0.450***	<0.001	0.470***	<0.001

Note. * p < 0.05, ** p < 0.01, *** p < 0.001

Table 10 confirms that all variables are significantly related to the PAIPPs' intention to adopt the emerging technologies.

Referring to Spearman's Rho, subjective norm, technological preparedness, perceived benefits, and perceived behavioural control are all strongly positively associated with the PAIPPs' technological adoption intention.

Further, technological investment, human resource preparedness, attitude, awareness, perceived challenges, and actual utilization are also strongly positively associated with the PAIPPs' intention to adopt the technologies.

Quantitative models

Before proceeding to the main model, we have identified two significant explanations as to how PAIPPs can adopt emerging technologies in accounting. These preliminary models were investigated to identify some nuances in the initial relationships among the variables.

Mediation model 1: Technological preparedness mediating awareness with intention to adopt

It can be recalled that there is a strong positive association between the PAIPPs' awareness of the emerging technologies and their intention to adopt ($r_s = 0.527, p < 0.001$).

We investigated the possible mechanism that can explain why the PAIPPs' awareness might translate to a higher degree of intention to adopt.

Intuitively, we investigated the firm's technological preparedness as a possible explanation for the initial association between awareness and intention to adopt.

Table 11: Model 1 mediation estimates

Effect	Label	Estimate	SE	95% confidence interval		Z	p	% Mediation
				Lower	Upper			
Indirect	a × b	0.375	0.064	0.254	0.506	5.841	<0.001	90.510
Direct	C	0.039	0.077	-0.109	0.196	0.508	0.611	9.490
Total	c + a × b	0.414	0.068	0.279	0.544	6.132	<0.001	100.000

The results in Table 11 support our hypothesis that the firm's technological preparedness explains why PAIPPs' awareness might translate to intention to adopt.

Specifically, the indirect effect is significant due to the absence of zero values within the confidence interval.

Further, the indirect effect can account for 90.51% of the total effect.

The direct effect, on the other hand, was non-significant due to the presence of zero values within the relevant range.

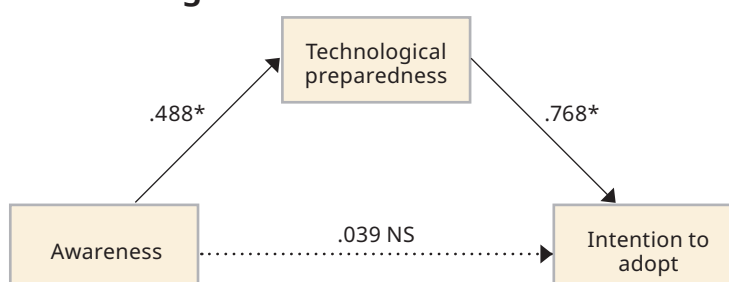
It may be noted that the direct effect estimate from the mediation model ($b = 0.039$) was a significant reduction of the existing correlation coefficients ($r = 0.429, p < 0.001; r_s = 0.527, p < 0.001$).

This, therefore, indicates a complete mediation.

Table 12: Model 1 path estimates

		Label	Estimate	SE	95% confidence interval		Z	p
					Lower	Upper		
Awareness	→ Technological preparedness	a	0.4881	0.0594	0.368	0.601	8.222	<0.001
Technological preparedness	→ Intention to adopt	b	0.7683	0.0858	0.591	0.926	8.956	<0.001
Awareness	→ Intention to adopt	c	0.0393	0.0774	-0.109	0.196	0.508	0.611

Figure 1 further illustrates that PAIPPs' technological awareness is associated with their intention to adopt because their firms are prepared to capitalize on the benefits of the technologies through the utilization of tools, software, and platforms as a way of improving the firm's productivity.

Figure 1: Mediation model 1

Mediation model 2: Attitude explaining perceived challenges' relationship with intention to adopt

One surprising initial result is how perceived challenges are associated with the intention to adopt. Intuitively, one might expect that the higher the perceived challenges are, the lower the PAIPPs' intention to adopt.

However, the reverse is true in the current study. With this surprising result, we have investigated the possible mechanism why challenges are positively and significantly associated with the PAIPPs' intention to adopt.

We first hypothesized that Filipinos' general positive attitude may play a role in explaining the mechanism of interest.

Table 13 indicates that the indirect effect of the PAIPPs' attitude towards technology adoption is significant.

The direct effect was now reduced to being non-significant ($b = 0.189$, $LL = -0.008$, $UL = 0.439$) compared with the initial correlation coefficients ($r = 0.450$, $p < 0.001$; $r_s = 0.470$, $p < 0.001$).

Table 13: Model 2 mediation estimates

Effect	Label	Estimate	SE	95% confidence interval		Z	p	% Mediation
				Lower	Upper			
Indirect	a × b	0.309	0.0793	0.150	0.463	3.9	<0.001	62
Direct	C	0.189	0.1136	-0.008	0.439	1.67	0.096	38
Total	c + a × b	0.499	0.1265	0.247	0.741	3.94	<0.001	100

As with Model 1, a full mediation model can be observed in Model 2. This means that attitude can explain why despite the challenges in technological adoption, Filipino PAIPPs are nonetheless positive about their intention to adopt the technological advances pertinent to their practice.

Table 14: Model 2 path estimates

	Label	Estimate	SE	95% confidence interval		Z	p
				Lower	Upper		
Perceived challenges → Attitude	a	0.513	0.124	0.253	0.735	4.13	<0.001
Attitude → Intention to adopt	b	0.603	0.099	0.392	0.779	6.1	<0.001
Perceived challenges → Intention to adopt	c	0.189	0.114	-0.008	0.439	1.67	0.096

Figure 2: Final mediation model 2

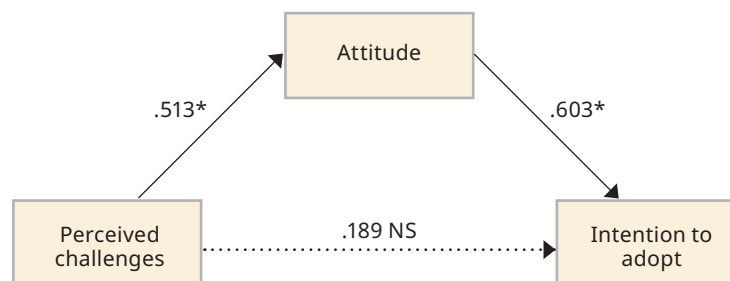


Figure 2 demonstrates how the PAIPP's perceived technological challenges positively translate to their intention to adopt, primarily because of their ability to frame the technologies positively (i.e., through their positive attitude). Further, the PAIPP's relatively positive assessment of the technologies' benefits, rewards, and value creation explains why relatively high technological challenges still translate to relatively high intention to adopt.

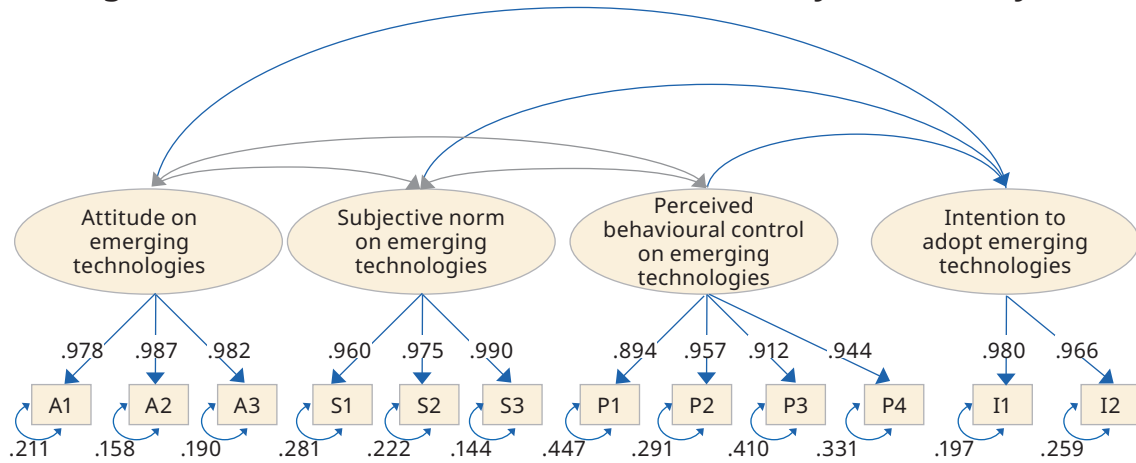
Model 3: Application of the theory of planned behaviour

We then proceeded to perform a structural equation modelling (SEM) following the theory of planned behaviour, where attitudes, subjective norm, and perceived behavioural control are theorized to drive the PAIPPs' intention to adopt the emerging technologies.

Initially, a confirmatory factor analysis was performed as shown in Figure 3.

It can be seen that the factor loading of all items is above the standard 0.80 benchmark, indicating that the items load well to the related latent variables.

Figure 3: Baseline model from the confirmatory factor analysis



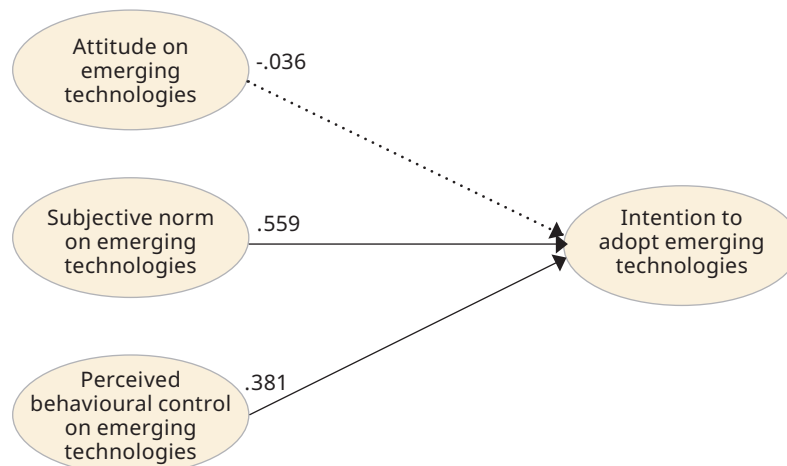
Prior to performing the SEM, we identified that the data are not multivariate normal (i.e., Mardia’s coefficient normalized estimate = 47.208, higher than the standard 6 benchmark).

With this, we will rely on the robust fit indices.

As indicated in Figure 4, a statistical fit was achieved by the model since the Satorra-Bentler χ^2 is not significant. This indicates that the data statistically fit with the proposed model.

Furthermore, all relative fit indices indicated a good fitting model since all of them are above the standard benchmarks. Ultimately, these results might indicate that the model is a good fitting one due to its statistical and relative fit.

Figure 4: Structural equation model



Satorra-Bentler Scaled χ^2 : $\chi^2 = 60.083$, $p = .1134$; Non-Normed Fit Index: .987; Comparative Fit Index: .991; Root Mean Square Error of Approximation: .047 (lower limit: 0.00, upper limit: 0.081)

Taking into consideration the good fit of the model, it can be noted that subject norm and perceived behavioural control were observed to significantly and positively drive the PAIPPs’s intention to adopt the emerging technologies. Attitude, while initially a significant predictor in the other models, was no longer a significant factor as regards technological adoption. This means that the social approval of technological adoption mainly drives the intention of the PAIPPs. This might mean that social approval of professional stakeholders

(e.g., regulators, clients, senior leadership, professional organizations) can translate into the PAIPPs' willingness to adopt technology.

This might be reflective of the high in-group collectivism observed in the Philippine culture, which might also explain why personal attitudes became non-significant when social factors were considered in the model (see Borromeo et al., 2022).

Further, we also noted that the perceived ease of using the emerging technologies is a positive factor in the PAIPPs' adoption. This ease of use can be related to the actual interface of the technology and to the accessibility of training and resources to the PAIPPs.

Study 2: Survey of professional accountants in the academe

Descriptive Statistics

Table 15: Type of Higher Education Institution

Type	Number of respondents	Percentage
College	12	25.5 %
University	35	74.5 %

Table 16: University status

Status	Number of respondents	Percentage
Private	29	61.7 %
Public	18	38.3 %

Table 17: Respondents' designation

Position	Number of respondents	% of total
Dean	7	14.9 %
Faculty teaching accounting in business courses	1	2.1 %
Faculty teaching the Accountancy Programme	25	53.2 %
Head of Program	11	23.4 %
Administrator	3	6.3 %

Table 18: Number of years as an institution

Levels	Number of respondents	% of total
Less than 1 year	1	2.1%
1 to less than 5 years	7	14.9%
5 to less than 10 years	4	8.5%
10 to less than 50 years	16	34.0%
50 to less than 100 years	16	34.0%
More than 100 years	3	6.4%

Table 19: Number of years of establishment of the accountancy programme

Levels	Number of respondents	% of total
Less than 1 year	7	14.9%
1 to less than 3 years	5	10.6%
3 to less than 10 years	2	4.3%
10 to less than 50 years	21	44.7%
50 to less than 100 years	12	25.5%

The results were nuanced by the specific characteristics of the respondents. On an organizational level, the majority of the respondents belonged to private universities (Tables 15 and 16), with 10 to 100 years of existence of both the university and the accounting programme (Tables 18 and 19). On the other hand, the majority of the respondents are accounting teachers and programme heads, accounting for more than 76% of the total responses (Table 17).

Table 20: Main variables

	N	Mean	Median	Standard deviation	Minimum	Maximum	Shapiro-Wilk W	Shapiro-Wilk p
Awareness	47	3.820	4.000	0.665	2.360	5.000	0.964	0.155
Competency	47	2.100	2.000	0.775	1.000	4.000	0.910	0.002
Cruciality	47	2.530	2.360	1.080	1.000	5.000	0.945	0.027
Incorporation	47	1.790	1.450	0.828	1.000	4.000	0.832	<0.001
Usage	47	2.960	3.000	0.539	1.670	4.000	0.978	0.531

Overall, respondents are moderately aware of the emerging technologies (score ranged from 1.790 to 3.820). The ability of the respondents to facilitate learning using emerging technologies and the actual integration of such technologies in the curricula were both at the foundational levels. Finally, the respondents expressed a general high level of cruciality integrating the emerging technologies into the existing learning experiences.

Table 21: Level of awareness

(1 – Not at all and 5 – Fully aware)

	N	Mean	Median	Standard deviation	Minimum	Maximum	Shapiro-Wilk W	Shapiro-Wilk p
Artificial human assistants	47	3.53	4	1.080	1	5	0.882	<.001
Artificial intelligence	47	4.19	4	0.741	2	5	0.809	<.001
Augmented reality	47	3.60	4	1.060	1	5	0.870	<.001
Blockchain	47	3.74	4	1.11	1	5	0.875	<.001
Cloud computing	47	4.06	4	0.818	2	5	0.835	<.001
Cybersecurity	47	4.30	4	0.805	2	5	0.769	<.001
Data analysis /Big data	47	4.11	4	0.840	2	5	0.830	<.001
Extended reality	47	3.23	4	1.110	1	5	0.844	<.001
Machine learning / Intelligence	47	3.74	4	1.010	1	5	0.884	<.001
Robotic process automation	47	3.72	4	0.902	2	5	0.869	<.001
Visual Internet of Things	47	3.81	4	1.100	1	5	0.864	<.001

Respondents were most aware of cybersecurity (4.30), artificial intelligence (4.19), and data analysis/big data (4.11) (4.06). They were, however, least aware of extended reality (3.23), artificial human assistants (3.53), and augmented reality (3.60).

Table 22: Level of competence

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

	N	Mean	Median	Standard deviation	Minimum	Maximum	Shapiro-Wilk W	Shapiro-Wilk p
Artificial human assistants	47	1.85	2	0.955	1	4	0.800	<.001
Artificial intelligence	47	2.02	2	0.921	1	4	0.849	<.001
Augmented reality	47	1.85	2	0.908	1	4	0.810	<.001
Blockchain	47	2.09	2	0.929	1	4	0.856	<.001
Cloud computing	47	2.28	2	0.800	1	4	0.859	<.001
Cybersecurity	47	2.43	2	0.853	1	4	0.873	<.001
Data analysis /Big data	47	2.51	2	0.856	1	4	0.856	<.001
Extended reality	47	1.89	2	0.961	1	4	0.811	<.001
Machine learning / Intelligence	47	1.98	2	0.921	1	4	0.830	<.001
Robotic process automation	47	1.94	2	0.942	1	4	0.828	<.001
Visual Internet of Things	47	2.32	2	0.958	1	4	0.877	<.001

Respondents self-reported the highest levels of competence in teaching the following emerging technologies: data analysis/ big data (2.51), cybersecurity (2.43), and visual Internet of Things (2.32). They were least fit to incorporate artificial human assistants (1.85), augmented reality (1.85), and extended reality (1.89) in the accountancy curriculum.

Table 23: Degree of cruciality

(1 – Least crucial and 5 – Most crucial)

	N	Mean	Median	Standard deviation	Minimum	Maximum	Shapiro-Wilk W	Shapiro-Wilk p
Artificial human assistants	47	2.74	3	1.26	1	5	0.899	<.001
Artificial intelligence	47	2.66	3	1.36	1	5	0.889	<.001
Augmented reality	47	2.83	3	1.24	1	5	0.904	<.001
Blockchain	47	2.38	2	1.24	1	5	0.872	<.001
Cloud computing	47	2.23	2	1.34	1	5	0.821	<.001
Cybersecurity	47	2.21	2	1.33	1	5	0.815	<.001
Data analysis /Big data	47	2.19	2	1.35	1	5	0.812	<.001
Extended reality	47	2.81	3	1.17	1	5	0.907	<.001
Machine learning / Intelligence	47	2.55	3	1.23	1	5	0.882	<.001
Robotic process automation	47	2.60	3	1.26	1	5	0.883	<.001
Visual Internet of Things	47	2.64	3	1.26	1	5	0.893	<.001

Respondents state that data analysis/ big data (2.19), cybersecurity (2.21), and visual Internet of Things (2.64) were most crucial to be integrated in the accountancy curricula (i.e., 1 – most crucial, 5 – least crucial). However, they viewed artificial human assistants (2.74), augmented reality (2.83), and extended reality (2.81) as the least crucial emerging technologies for curricula integration.

Table 24: Degree of incorporation

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

	N	Mean	Median	Standard deviation	Minimum	Maximum	Shapiro-Wilk W	Shapiro-Wilk p
Artificial human assistants	47	1.53	1	0.905	1	4	0.631	<.001
Artificial intelligence	47	1.68	1	0.958	1	4	0.719	<.001
Augmented reality	47	1.64	1	0.942	1	4	0.701	<.001
Blockchain	47	1.74	1	0.920	1	4	0.765	<.001
Cloud computing	47	2.04	2	0.884	1	4	0.853	<.001
Cybersecurity	47	2.09	2	0.929	1	4	0.856	<.001
Data analysis /Big data	47	2.04	2	0.955	1	4	0.843	<.001
Extended reality	47	1.70	1	0.954	1	4	0.734	<.001
Machine learning / Intelligence	47	1.68	1	0.935	1	4	0.722	<.001
Robotic process automation	47	1.57	1	0.903	1	4	0.670	<.001
Visual Internet of Things	47	1.98	2	1.050	1	4	0.809	<.001

As regards the level of incorporation into the curriculum, cybersecurity (2.09), cloud computing (2.04), and data analysis/big data (2.04) are the most incorporated emerging technologies.

Finally, artificial human assistants (1.53), robotic process automation (1.57), and augmented reality (1.64) were the least integrated into the accounting curricula.

Study 3: Focus group discussions

Consistent with TPB, we have identified three general themes concerning the technological adoption of professional accountants. In brief, social, personal, and technical/systemic factors align with subjective norms, attitudes, and perceived behavioural control factors (i.e., Figure 4).

The following is a summary of the recurrence of themes across the FGDs:

Table 25: Summary of recurring themes

Theme	PAIPPs	Accounting Teachers	PICPA
Social factors	Present (e.g., clients, network firms)	Present (e.g., curricula stakeholders, industry advisory board)	Present (e.g., industry-academe collaborations)
Personal factors	Present (e.g., training of professionals, lifelong learning)	Present (e.g., industry immersion of teachers, lifelong learning)	Present (e.g., technical skills development of members, lifelong learning)
Utility / Systemic factors	Present (e.g., technology resulting in improved audit practices)	Present (e.g., cost-benefit considerations in technology integration)	Present (e.g., presence of good technological infrastructure)

Theme 1: Social factors driving or inhibiting technological adoption

Two sub-themes concerning the social factors shaping technological adoption pertain to the need for accountants to align with stakeholders and collaborate with them.

Stakeholder alignment pertains to the expectations of various parties as regards technology.

These expectations can either drive or inhibit the professional accountant's ability to adopt emerging technologies.

Alignment with stakeholder needs

Alignment with the needs of various stakeholders was mentioned as either a driver or inhibitor of technological adoption, with the former being more pronounced. Specifically, public practitioners enumerated the social force created by their clients and international networks as a driver for technological adoption:

The adoption is partly driven by the demand, [for example] if their clients are now into data analytics and big data, then most likely, auditing firms have also to upscale... With that regard, this is driven also by, especially for those big firms, international networks to use resources within the network.

The same social force exerted by clients was also mentioned by a representative from PICPA:

New technology, the software, and the new systems that are out in the market, actually, [they] affected...[the] practice.

On the other hand, accounting teachers indicated the role played by accountancy educators in technological integration in the accountancy curricula. Initially, the standard accountancy curriculum is viewed as more aligned with the local licensure examinations (i.e., washback effect), giving little room for technological integration either across courses or as additional stand-alone courses:

As schools are more focused [on] the board exams, [this] hinders us to really incorporate [the emerging technologies], even though we have [the] electives, [but] electives are sometimes seen as an avenue for us just to make sure that all of the topics in the [local board exam] syllabi are incorporated.

Furthermore, institutionally mandated courses (e.g., religion) can also affect the addition of courses covering emerging technologies in the curriculum:

In our case, the constraint comes from the curriculum itself because we have religion courses, our curriculum is already too packed for us to include an additional subject or another IT-related subject [Translated from Filipino].

It can be seen that the expectations of both internal (i.e., university administration) and external (e.g., regulators, students) stakeholders can inhibit technology integration in the curriculum.

In both cases, it can be seen that various stakeholder expectations can shape the integration of emerging technologies in both professional practice and the academic setting. This confirms the strong role performed by subjective norms in shaping the technology adoption intention of accountants, as seen in the quantitative model (i.e., Figure 4).

Collaboration with other parties

To resolve the various constraints faced by professional accountants in adapting to the technological landscape, several collaborations with other parties, including stakeholders, are mentioned by the respondents.

For PAIPPs, respondents indicate the collaboration they form with their clients, as they integrate the emerging technologies into their practice;

Big firms have their own data collaboration platform as a way of getting information from clients. Some of these collaboration platforms have the capability to [directly] access...the accounting system of the client. Of course, there's permission from the client...I think, business intelligence and data analytics [are] also becoming a way for how they will conduct an audit.

Due to the complexity brought about by technological integration, PAIPPs also rely on the work of other professionals as they perform audits:

[Because of the lack of] paper trail... it's hard to audit in terms of risk assessment...appropriate for that particular IT [component]...It will require us to [undertake] professional skepticism and then engage IT experts in the core auditing to support [the] competency requirement of those technologies.

On the other hand, accounting teachers also leveraged internal (e.g., another college) and external parties (e.g., service providers) in accessing the necessary technology to be integrated with the curricula:

We partnered with [college housing information technology], [because] they are also using [enterprise resource planning product], so what they normally do is evaluate the different modules offered by our provider. Then, they will be the ones to assess whether it will also be applicable to us [accountancy department].

Another aspect of collaboration that can drive technology integration is industry-academe partnerships. This collaboration is mentioned by the PICPA representatives, specifically in addressing resource constraints (e.g., industry-academe research collaborations regarding technology issues).

Further, accounting teachers also mentioned collaborations with industry as a way to keep the accounting curriculum technologically updated:

We have [our] Industry Advisory Board. Specifically, we get inputs from them [alumni]. What are the new technologies used by our profession? Then we try to evaluate whether they're available or [whether we] can afford [them].

Other collaborations mentioned by accounting teachers are with the school's top management for budgetary alignments, other schools for the possibility of shared licences, and auditing firms for sharing audit tools.

Finally, PICPAs also mention the possibility of the organization liaising with technology providers and professional accountants as a form of collaboration.

Theme 2: Personal factors driving or inhibiting technological adoption

Personal factors were also mentioned by the representatives from professional groups. Similar to social factors, these factors can either inhibit or facilitate technological adoption.

Technical competency of professionals

In proactively managing the perceived technological competency gap, PAIPPs indicate their human capital investments, particularly in technology-related training of new hires. This is necessary for the staff to be technologically prepared to conduct the audit:

The firms have to invest [in] training...[of] the staff when they join the firms. So that's one of the investments that we have for their training in order for them to use our technology, efficiently and effectively in [the] audit.

Auditing firm representatives also indicate the use of tiered training to cater to the specific needs of the professionals, pertinent to their career stage. However, bridging the technological competency poses a challenge for small and-medium-sized firms, as observed by PICPA representatives:

Those [professionals who] are employed by the big firms technically will already have some training before they are put into the field but those that are employed by the medium [or small sized] businesses may not have the same exposure or training.

This issue is then addressed by PICPAs by offering a variety of technological training to help their members assimilate the necessary technological skills, specifically through the inclusion of digital skills seminars in the scorecards of the chapters:

Since last year, part of the score card of PICPA is [takes into account] digitization, meaning, all chapters are required to conduct seminars on digitization. I think that's part of the initiative of PICPA to address the concerns over new technologies.

In the academe, the teacher's acquisition of the necessary technological skills is also viewed as a main driver of more technological integration in the accounting curricula:

Immersion of faculty [members can be a form of] training. At least, when they [faculty members] teach the technologies, they have the actual experience of using it.

Lifelong learning

Aside from the technical aspect of learning, several respondents express the lifelong learning propensity of professional accountants as a key personal driver for technology adaptation. PAIPP representatives highlight continuous learning as one of the important features of a professional accountant:

I think in our profession, continuous learning is very important. I think whatever level you are at in your profession, you really have to learn and really adapt to all these changes because they're very fast. Technology is very fast.

Also, representatives from NACPAE highlight the need for faculty members teaching accounting and technology-related courses to be constantly updated:

So long as the teacher...is willing to undergo training, because if they do not train, they cannot teach [the emerging technology] even if they are CPAs, but with the appropriate training, they can teach the software [Translated from Filipino].

PICPA, for its part, is committed to being a place of learning for all professionals, including in the technological domain:

PICPA has always been a venue for members to learn. Now, it's up to the members to avail [themselves] of the learning.

Theme 3: Utility/systemic factors driving and or inhibiting technological adaption

Another category of drivers of technological adaption pertains to technical/systemic factors that can facilitate the perception of behavioural control of the professionals. Specifically, the perceived net utility (benefit) of technology, coupled with available resources can facilitate adaptation especially if the corresponding changes are managed effectively.

PAIPPs echo the overall net utility of technology in the profession, especially in the field of audit:

This technology that we have really provided... advantages and benefits to the auditors, rather than negative [impacts]. Somehow, we hear about how our profession can disappear, but somehow these are really tools to improve and make us more efficient.

PAIPPs identified the following as the major benefits of integrating technology in audit engagements: (1) more standardized and compliant audit outputs, (2) increased accessibility, (3) more risk-focused audit approach, (4) real-time supervision of audit work, and (5) shorter audit hours.

For accounting academics, however, one crucial technical barrier to technology integration is the cost and accessibility of the related technologies:

We try to evaluate whether it's [technology] available or [if we] can afford it. Because even if it is used in the industry, if we cannot afford it or it not accessible, [we cannot integrate it]. For example, some auditing tools.

As indicated above, accountancy schools resort to partnering with internal (e.g., other colleges offering IT programmes) and external (e.g., third-party providers) parties in managing both costs and accessibility constraints.

Finally, both PAIPPs and PICPA indicated the need for systemic approaches in managing technology integration. Overall, PICPA identified infrastructure change as a crucial success factor in an internal technological initiative in PICPA:

It's the entire infrastructure of our organization [that] has to be strengthened and challenged.

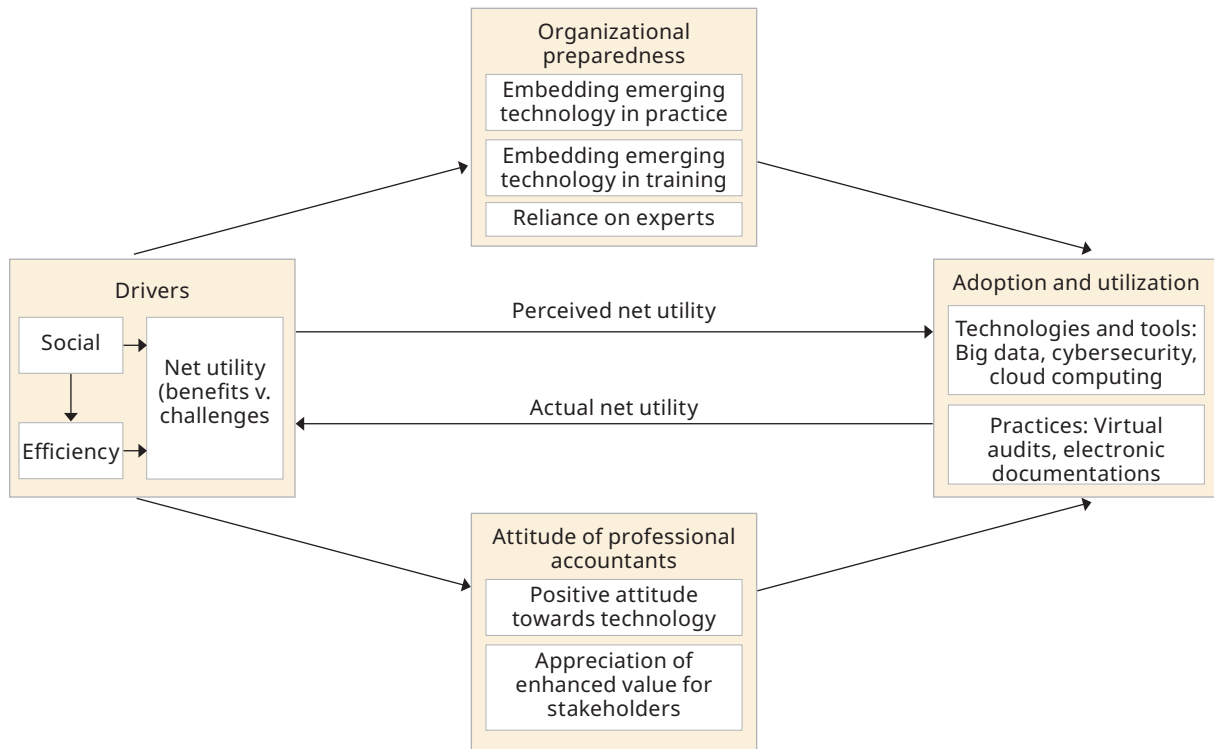
PAIPPs, on the other hand, identified change management as another systemic approach to positively controlling technological adoption:

Bulk of the success of technology journeys is also changed management [since] that's a very heavy component that's sometimes taken for granted...It depends on that change management strategy on how successful the technology adoption would be.

Conclusion

In synthesizing all the studies, we were able to derive a figurative depiction of the technology adoption model in the Philippines:

Figure 5: Figurative depiction of technology adoption in the Philippines



As indicated in both the quantitative and qualitative studies, social drivers are very crucial factors in technology adoption in the Philippine accounting context (e.g., expectations of clients, partner firms), coupled with efficiency expectations.

These drivers were seen to translate into a positive general perception of technological utility (i.e., benefits).

Because of these positive forces, technological adoption specifically manifests in the tools used by practitioners, as well as the emerging practices.

In the context of the Philippines, two categories of factors might drive the positive relationship between the drivers and the actual technological adoption.

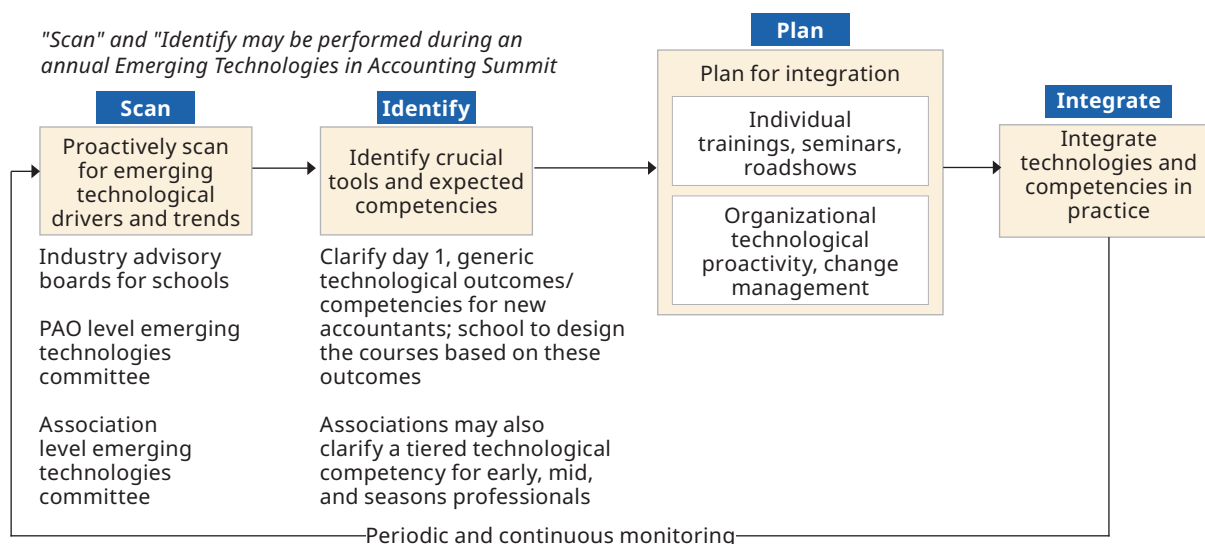
Primarily, the professional's attitude was seen to facilitate the relationship between the adoption drivers.

Specifically, the following attitudes were observed across the studies: (1) a relatively positive attitude towards technological adoption and (2) the role of life-long learning in the adoption process.

Aside from personal factors, organizational factors were also seen to facilitate the technological adoption of professionals.

These organizational factors include (1) training accountancy professionals in terms of technology, (2) acquisition of emerging technologies and embedding them in actual practice, and (3) eliciting the help of experts in complex technological matters.

With these results, we propose a possible roadmap to better prepare for technological adoption by accountancy professionals in the Philippines:

Figure 6: Proposed roadmap for technological adoption

The roadmap begins with the technological scanning phase. In this phase, organizations (e.g., PAO, schools) must institutionalize the proactive search for emerging technologies that might shape the profession further in the future.

Specifically, schools might be encouraged to convene their own industry advisory boards to ensure that the curriculum is technologically responsive.

Further, the PAOs can host emerging technology summits by bringing together different stakeholders.

After the scanning phase, an identification stage might be warranted.

In this stage, Day One technological competencies might be identified for accounts across sectors.

Along with these competencies are the tools and the level of proficiency required for new accountants.

Next, organizations and individuals may now plan to integrate the competencies and tools. On a personal level, technological competencies might be explicitly indicated in the personal professional development plans of accountancy professionals.

At the level of the organization, management should be prepared to make the necessary functional (e.g., more human resource investment for technology training) and strategic, if any, to help both the professionals and the organization adapt to the technological challenges.

Finally, both individuals and organizations will now act to integrate the plans into their practice and operations, respectively.

During the integration phase, periodic and continuous monitoring activities may be performed to ensure that necessary adjustments are made to the plan.

Thereafter, after a fixed period of time (e.g., three years), new scanning activities may be performed to re-assess and revise the Day One competencies and tools for new accountants.●

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Appendix 10: Singapore

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Background

Singapore since independence in 1965 has always had a young accountancy workforce and our first generation of accountancy professionals¹ from the dawn of independence are now at the stage of retirement. In the intervening years, the country has built a quality accountancy workforce.

The accountancy profession is championed by the Institute of Singapore Chartered Accountants² (ISCA) which serves as the only national accountancy body in Singapore.

It was established in 1963 and it is the designated entity authorised by the Accounting and Corporate Regulatory Authority³ (ACRA) to confer the Chartered Accountant of Singapore – CA (Singapore) designation⁴.

ISCA currently has more than 33,000 members and it is also a member of the Chartered Accountants Worldwide⁵. The membership comprises of about 13% of members working in the public accounting sector while the rest are professional accountants in business.

Accountancy as a degree was first introduced at the University of Singapore back in the 1960s and with progress and expansion in accounting education, the accountancy degree is now offered by five autonomous universities in Singapore⁶, namely, the National University of Singapore⁷, the Nanyang Technological University⁸, the Singapore Management University⁹, the Singapore Institute of Technology¹⁰ and the Singapore University of Social Sciences¹¹.

1 In this report, we draw a distinction between accounting and accountancy profession with the earlier term “accounting” confining to the role of providing accounting specific services like public accounting practices while “accountancy” refers to accountants who provide accounting or accounting related services in both public and non-public settings.

2 <https://isca.org.sg/> accessed on 5 April 2023.

3 <https://www.acra.gov.sg/> accessed on 5 April 2023.

4 <https://isca.org.sg/about-us/about-the-institute-of-singapore-chartered-accountants> accessed on 5 April 2023.

5 <https://charteredaccountantsworldwide.com/> accessed on 5 April 2023.

6 This is in accordance to when the university was recognised as an autonomous university and the availability of the accountancy degree.

7 <https://bba.nus.edu.sg/academic-programmes/bba-accountancy-programme/introduction/> accessed on 5 April 2023.

8 <https://www.ntu.edu.sg/education/undergraduate-programme/bachelor-of-accountancy> accessed on 5 April 2023.

9 <https://accountancy.smu.edu.sg/bachelor-accountancy> accessed on 5 April 2023.

10 <https://www.singaporetech.edu.sg/undergraduate-programmes/accountancy> accessed on 5 April 2023.

11 <https://www.suss.edu.sg/programmes/detail/ft-bachelor-of-accountancy> access on 5 April 2023.

In Singapore, the accountancy degrees from these five autonomous universities (AUs) are accredited with ISCA.

The graduates from these five AUs are exempted from the foundation programmes and can proceed directly to the professional programme of the Singapore Chartered Accountant Qualification (SCAQ) in their quest to become chartered accountants of Singapore. Two modules from the professional programme (Taxation and Advance Financial Reporting) may also be further granted exemption to these graduates.

There are private education institutions (PEIs) which conduct accountancy programmes for overseas universities, for example, SIM Global Education offers accountancy and finance degrees for University of London (UOL) and Royal Melbourne Institute of Technology (RMIT), among others. These accountancy programmes use the home campus accountancy curricula. These overseas degrees are exempted from part of the foundation programme of the SCAQ. As the accountancy curriculum follows the host campus, these generally align with the home campus accountancy sector.

There are four polytechnics in Singapore that offer diplomas in accountancy and they are Nanyang Polytechnic¹², Ngee Ann Polytechnic¹³, Singapore Polytechnic¹⁴, and Temasek Polytechnic¹⁵. The diploma in accountancy is a precursor to a degree in accountancy or joining the accountancy sector.

This report concentrates on the findings from a joint survey conducted by ISCA, the autonomous universities, the polytechnics and accountancy firms.

Currently the five AUs produce about 1,300 graduates a year who go on to become accountancy professionals.

However, there is a discernible declining trend in the number of accountancy graduates.

This is a global phenomenon and some of the possible reasons may include the lower starting salary, pessimistic perception of the work and the accountancy profession, among others.

One possible concern that is constantly addressed at university open houses is that accountants could be replaced by robots or AI.

However, technology is both an enabler and a threat to the accountancy profession. As an enabler, it allows an accounting professional to be more effective and efficient in his work as the use of technology provides access to timely and quality information for decision making.

However, AI, robotic process automation and other technologies can be a threat as they can make redundant some of the functions which are traditionally done by accountancy professionals.

Nonetheless, instead of being technophobic, accountancy professionals should learn to embrace technology to re-invent themselves.

12 <https://www.nyp.edu.sg/schools/sbm/full-time-courses/accountancy-and-finance.html> accessed on 5 April 2023

13 <https://www.np.edu.sg/schools-courses/academic-schools/school-of-business-accountancy/diploma-in-accountancy> accessed on 5 April 2023.

14 <https://www.sp.edu.sg/sb/courses/full-time-diplomas/DAC> accessed on 5 April 2023.

15 <https://www.tp.edu.sg/schools/bus/accountancy-and-finance> access on 5 April 2023.

This study documents the adoption of technology by the accountancy sector in Singapore.

The findings are arranged in three parts: Professional Accounting Organization (ISCA), accountancy schools of Institutes of Higher Learning (IHLs) and accountancy firms.

Thereafter, a roadmap to move technology adoption forward in the accountancy sector in Singapore will be proposed.

Part 1: Professional Accounting Organization (PAO) – ISCA

A survey instrument was sent to ISCA for their views on technology adoption in the accountancy profession.

The survey is augmented by discussions with senior members of ISCA to provide a more in-depth understanding of the responses to the survey instrument. The demographics and views of the only national PAO in Singapore are documented below.

The survey was completed by members of the senior management. ISCA has a full-time staff of less than 100 and it has a digital technology roadmap to elevate the accountancy profession.

The digital technology roadmap is built in consultation and collaboration with different government agencies like the Singapore Accountancy Commission, and guided by the Media Industry Digital Plan (IDP) developed by the Infocomm Media Development Authority (IMDA), among others.

With the digital technology roadmap, ISCA seeks to help members level up the digital¹⁶ capabilities and create a healthy accountancy ecosystem which embraces technology. It is important to contextualize Singapore's digital journey. Singapore's ambition is to be a global financial hub but she is a small country with a small labour force.

In this context, the perennial talent crunch faced by Singapore's accountancy sector presents strong motivations for pushing the use of technology. Through the use of technology, Singapore benefits from productivity gains from its labour force.

Moreover, digital tools also serve as a bridge to tap into technology talent pools from outside of Singapore's boundaries. The development of a strong core of accountancy professionals who are skilful in technology is imperative to make Singapore an attractive and competitive global financial hub.

Today, Singapore is most well placed among ASEAN countries when it comes to the adoption of technology.

However, this has not always been the case. Previously, the rate of technology adoption was universally low in all ASEAN countries, including Singapore.

The acceleration in technology adoption is not by accident or simply through market evolution.

In April 2017, recognising that the evolving technology landscape is redefining businesses and the accountancy sector, the Singapore government launched various programmes, such as SMEs Go Digital to support SMEs in the use of technology to boost productivity.

In support of the use of technology, ISCA launched programmes for small and medium

¹⁶ The words “technology” and “digital” are used inter-changeably.

accountancy practitioners (SMPs) to help them defray the costs of adopting baseline technology solutions such as audit software, automation of payroll, among others.

ISCA's strategy aims to create momentum through the introduction of baseline technology solutions to enable accountancy firms to experience the benefits of technology and kickstart their technology adoption journey.

ISCA's step-by-step digital technology adoption roadmap comprises a digital readiness self-assessment, a curated list of sector-specific digital solutions to fill the gaps identified, regular technology seminars on the newest digital tools, and technology advisory services to provide personalised recommendations on suitable digital tools and support schemes for accountancy firms.

This includes working with government agencies to curate, pilot test and launch support schemes that will encourage and incentivise accountancy firms to develop various sector-wide technology. Such technology awareness and support provided to accountancy firms is backed by funding and advisory assistance.

The support is essential to speed up the pace of technology adoption. Both big and small accountancy firms have been helped to move at a faster pace in technology adoption through the systematic and purposeful digital technology roadmap of ISCA.

a. Technological preparedness

ISCA was asked about her preparedness concerning technology adoption from four different dimensions: i) Attitude towards technology adoption, ii) subjective belief about technology adoption in the accountancy sector, iii) perceived behavioural control on technology adoption, and iv) the accountancy sector's intention to engage the technology.

i. Attitude towards technology adoption

In terms of attitude towards technology adoption, ISCA is of the view that its members will benefit from technology adoption.

They also strongly believe that members can create more value as they adopt technology in their businesses and work.

Finally, ISCA also strongly agrees that members will find it rewarding to adopt technology in accountancy practices.

To function as a global financial hub, Singapore has relied on the foreign supply of accountancy professionals to augment its local accountancy manpower needs.

In recent years, there has been an intensification of the talent crunch in the accountancy sector due to two factors – first, the Singapore government has tightened manpower policies by lowering the quota of foreign workers in Singapore.

Second, there has been lower interest in the study of accountancy by students.

These two factors have exacerbated the talent crunch in the accountancy sector. Technology adoption can help the accountancy sector address these talent crunch challenges.

For instance, recent developments in generative AI show potential for reducing manpower needs in the accountancy industry and also the possibility of delivering higher productivity.

In the ensuing interview, ISCA reiterated the benefits of technology adoption in the

accountancy sector and how members will benefit from it. ISCA opined that this is crucial for the continuing development of the sector.

ISCA views digitalization or technology adoption as a megatrend with pervasive and permanent impacts on all aspects of business and accountancy.

When COVID-19 hit, digitalization went on overdrive as organizations quickly embarked on digital transformation to ensure business continuity.

However, this is only the first phase of digitalization. Moving forward, Singapore will enter into a digital-first economy and, after that, perhaps a digital-centric one. For that to happen, technology adoption needs to happen quickly and across all industries; those industries which are left behind would not be as competitive as those which adopt technology early and integrate them into their business strategy.

Therefore, it is crucial for the accountancy sector to adopt technology quickly and effectively.

Standing on the cusp of such a tectonic shift in the business landscape, accountancy professionals are increasingly tasked to be champions of business transformation.

This strengthens the capabilities of the accountancy profession and provides better, even unparalleled, opportunities.

ii. Subjective belief about technology adoption

The respondent was also asked about her subjective belief on what ISCA's senior leaders, key leaders in the accountancy profession, regulators and members think and believe about technological advances.

The respondent affirms that the various stakeholders of the accountancy profession should adapt to the technological advances in accountancy.

ISCA views technology adoption as a key transformative force that will once-and-for-all erase the inaccurate and untrue stereotypical image that those in the accountancy profession are primarily 'bean counters'.

Through technology adoption, accountancy professionals will better actualize their roles as strategic advisers and champions to steer businesses and organizations toward new heights in emerging trends, such as sustainability, artificial intelligence, and digitalization.

Overall, it is ISCA's belief that accountancy professionals will benefit from a more fulfilling career, as well as more diverse career paths through technology adoption.

iii. Perceived behaviour control on adoption of technology

ISCA affirms that it is easy for members to adapt to technological advances in accountancy given the available financial resources. Of significant interest, ISCA strongly agrees that accountancy professionals are provided with access to continuing professional development programmes related to the technological advances in accountancy.

However, ISCA is neutral when it comes to whether accountancy professionals have the available organizational resources¹⁷ to adapt to the technological advances in accountancy.

¹⁷ Organizational resources would include: resources to implement new digital solutions, train and educate staff, redesign roles, and integrate technology into a firm's processes and systems.

The findings suggest that much work needs to be done to help accountancy professionals to alter their behavioural approach towards technology adoption by boosting the available organizational resources.

ISCA's experience is that when it comes to digitalization, organizations can be categorized into three behaviour groups. These three groups are – 1) the proactive adopters; 2) the reactive adopters; and 3) the passive adopters.

In Singapore, it is common to see organizations spread across all three groups. Organizations in each group require different degrees of support and resources in line with their differing appetites for digitalization.

To encourage all three groups to digitalize, ISCA's strategy is to focus its efforts on the proactive adopters and help uplift them into successful case studies.

Doing so would motivate the organizations in the reactive adoption segment to adopt technology as well. This creates a healthy 'rat race' effect that knocks passive adopters into a reactive or even a proactive mode due to the fear-of-missing-out (FOMO) mindset.

iv. Intention to engage technology

Finally, the respondent was asked to provide her views on whether accountancy professionals are committed and planning to adapt to technological advances in accountancy.

The response received is that ISCA is very positive about both these aspects in accountancy professionals.

ISCA has achieved success in shaping the accountancy sector's baseline digital adoption¹⁸.

Moving forward, ISCA will continue to curate more digital solutions, especially advanced solutions for the accountancy sector. Together with various government agencies, ISCA will help conceptualise funding solutions to defray the cost of digital adoption.

Recently, ISCA announced plans to invest S\$2,000,000 in artificial intelligence to spearhead an "Artificial intelligence (AI) for the Accountancy Industry" initiative¹⁹, also known as the "AI for AI" initiative, to strengthen the capabilities of the accountancy profession and provide more opportunities for ISCA members and the business community to consider the adoption of AI.

ISCA would fund the development of AI solutions to serve the accountancy sector by developing actionable models to showcase real-world applications and results.

The AI for AI initiative is a multi-pronged approach that taps into various partnerships to co-create AI solutions.

ISCA will engage academic experts through the ISCA Research Network, comprising academic partners, as well as seek technical expertise from the technology sector, and solicit participation from the accountancy community at large.

ISCA will also proactively examine the impact of AI on the accountancy profession. ISCA has committed to working closely with policymakers and regulators to review and finetune government policies in this space.

18 <https://www.acra.gov.sg/docs/default-source/default-document-library/accountancy/sac-reports/aecensus2021.pdf>

19 <https://futurecfo.net/ai-for-accounting-isca-earmarks-s2m-for-research-and-implementation/> accessed on 20 August 2023.

The end goal is to ensure that auditing and accounting standards are developed alongside technological advancements in the accountancy sector.

This is part of an ongoing effort to promote the use of technology tools in the accountancy sector.

In addition to the survey questionnaire and responses to open questions, a more in-depth discussion was conducted with ISCA with the following additional questions:

What technological changes have affected the practice of accountancy in Singapore?

ISCA is of the view that the adoption and accessibility of cloud-enabled accounting and auditing automated software, use of data analytics, visualization tools and robotic process automation (RPA) to replace routine processes have improved the quality of auditing and financial reporting.

This has also boosted productivity among accountancy professionals.

ISCA emphasizes the importance of accountancy professionals continuing to acquire the requisite digital skillsets to harness technology and complement their technical and professional skills.

How did the recent technological changes affect the practice of accountancy in Singapore?

ISCA opines that both accountancy firms and those with significant accountancy functions have automated many routine and repetitive tasks.

This has enabled accountancy professionals to focus on higher-value work to provide greater insights and value to clients.

With digitalization and remote working, accountancy firms and professionals can now function “without borders”.

Given Singapore’s manpower constraints, ISCA observes that there is an upward trend in offshoring to meet demand and existing challenges.

The offshoring is made possible by the advent of technology for remote working.

What are the challenges faced by both ISCA and her members from these recent technological changes?

Beyond procuring technology, firms need to look at equipping staff with the requisite digital skills and redesigning processes to fully harness the advantages of automation and technology.

There are numerous challenges in this and some of them include: allocating sufficient resources to implement new digital solutions, training and educating staff, redesigning roles, and integrating technology into firms’ processes and systems.

For all these endeavours, investment in effort, time and financial resources is needed and must be viewed from a long-term perspective.

What has ISCA done to address these challenges?

ISCA adopts a tailored approach and has different initiatives to drive digital

transformation across the accountancy sector.

ISCA curates tried-and-tested solutions which are introduced to members through technology talks and show-and-tell sessions.

Training courses and webinars are conducted regularly to equip members with the relevant digital skills and keep them abreast of the latest technology trends.

ISCA is constantly looking for opportunities to roll out new initiatives and tools to drive digital transformation.

For example, the Job Redesign Toolkit has been introduced to transform accounting roles and the possibility of weaving AI and even ChatGPT into the digital transformation of the workplace.

ISCA works closely with solution providers to customise solutions catered to the needs of the industry and enabling ease of adoption through plug-and-play solutions or technology tools.

In addition, ISCA collaborates with government agencies to curate funding schemes that help defray the cost of digital transformation.

What are the benefits so far observed from these technological changes?

Today, young graduates place a premium on high-value-adding work and having a meaningful career.

Leveraging digital tools and RPA, firms are now able to automate routine and repetitive tasks. The deployment of digital tools enhances productivity and efficiency.

As mentioned above, the use of digital tools and RPA allows staff to be freed from routine tasks and thus able to focus on higher-value work.

Some of the higher value-added works include innovating service delivery by providing valuable insights to clients through the use of data analytics and advisory tools.

What are ISCA's significant milestones/success stories regarding the technological adoption of her members?

Findings from the Accounting Entities (AE) Census 2021²⁰ showed a general improvement and rise in the adoption of digital solutions across the sector.

91% of firms have adopted at least 1 or more technology solutions, while 66% adopted at least 2 or more technology solutions.

There is an observed and documented trend of greater adoption of technology in the accountancy sector.

What are the factors that lead to these milestones/success stories?

ISCA works closely with key stakeholders (government agencies, technology solutions providers) to launch support schemes that help to incentivise and promote the adoption of digital technology.

²⁰ <https://www.acra.gov.sg/docs/default-source/default-document-library/accountancy/sac-reports/aecensus2021.pdf>

This is in addition to developing various sector-wide initiatives and programmes to increase awareness and back firms with funding and advisory support.

This is particularly crucial for smaller accountancy firms and SMEs' finance teams with limited resources.

Initiatives were also tailored specifically to the differing needs of member segments such as technology active firms vis-a-vis technology passive firms which require more push to adopt technology.

This enables a differentiated approach targeting at the different stages of adoption of technology by accountancy firms.

How does ISCA ensure that her members' technological adoption is integrated into her long-term strategy and agenda?

ISCA's core interest is to provide value to members, the accountancy profession, and the business community.

As a membership organization which strives to be a "world-class accountancy body of trusted professionals", her mission is to serve and advance the members' interests and the development of the accountancy sector and ecosystem.

As mentioned earlier, ISCA has made a significant investment in artificial intelligence through the AI for AI initiative. The AI for AI initiative incorporates various processes, such as bringing on-board academic partners through the ISCA Research Network, to promote the use of new technology in the interests of accountancy professionals, as well as the general public.

In turn, the public interest will be well served by an efficient and effective accountancy profession adequately equipped with the latest technology.

In alignment with ISCA's strategic priorities, ISCA is committed to supporting and partnering with members on their digital transformation journey.

Moving forward, what digital skills do you think your members should possess?

Increasingly accountants will be tasked to champion digitalization in various capacities.

As a result, depending on the roles, accountancy professionals need to acquire relevant skills in order to serve as strategic partners for organizations and contribute strategically to the latter's overall success.

This could be as simple as being in the know of the latest technological product available for adoption, or as complex as undergoing reskilling to acquire deep skills in the identified technology.

What is more important is to adopt a mindset of lifelong learning, constantly learning to stay relevant.

How should the stakeholders of the profession work to ensure that accountants remain technologically adept in the future?

ISCA is of the view that building a strong ecosystem to facilitate partnership and collaboration between ISCA, accounting firms, accountancy professionals, government agencies and technology vendors is extremely crucial.

The trusted relationship and collaborations will allow the business sector to come together, learn from one another, and co-create solutions that enable the sector to grow and transform as one vibrant community. The key spillover effect will be the enhancement of Singapore as a reputed global financial hub.

What lessons have ISCA and her members learnt throughout their technology adoption journey?

Technology adoption is an ongoing and long-term journey that requires commitment from all parties to further invest in digital transformation.

With evolving automation and technology, some existing roles of accountancy professionals may need to be redesigned to enable them to take on higher-level and more value-adding roles.

As digital transformation is less about digitalization but more about transformation, there is a need to bring together the various components, such as job redesign, to ensure that the existing workforce has the required skill sets through upskilling and re-skilling.

In addition, those who are entering the accountancy workforce must be equipped to be ready for plug-and-play.

ISCA has always been working closely with educational institutions to train the next generation of accountancy professionals. This is even more important in the current evolving technology space.

In summary, ISCA has been very vigilant in keeping track of the development of digital technology in the accountancy sector.

It plays a key role in promoting, encouraging and catalysing the adoption of digital technology by her members and the accountancy profession.

It also plays a vital role in working with the relevant agencies of the government to provide the necessary funding and incentives for technology adoption.

ISCA has a technology adoption roadmap which helps to guide her strategy and plans to upskill the digital competencies of her members.

Part 2: Accountancy schools of institutions of higher learning (IHLs)

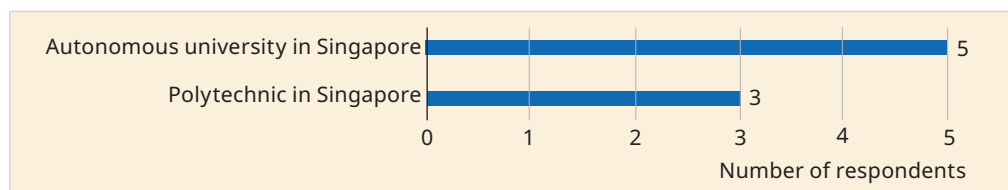
a. Demographics of the respondents

A survey instrument was sent to the nine institutes of higher learning (IHLs), which comprise five autonomous universities and four polytechnics in Singapore.

The autonomous universities and polytechnics offer accountancy degrees and diplomas respectively.

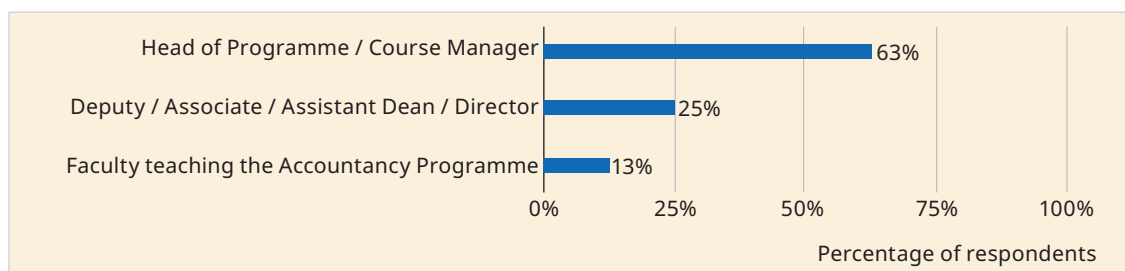
Figure 1 below shows that short of a response from one polytechnic, the response rate was almost 100%.

Figure 1: Respondents by types of institutions of higher education



The survey instrument was completed by senior staff in the respective IHLs and Figure 2 shows the positions of the respondents.

Figure 2: Position of the respondents at the institutions of higher learning



The average number of years in which the accountancy programmes of the IHLs have been established is 18.9 years.

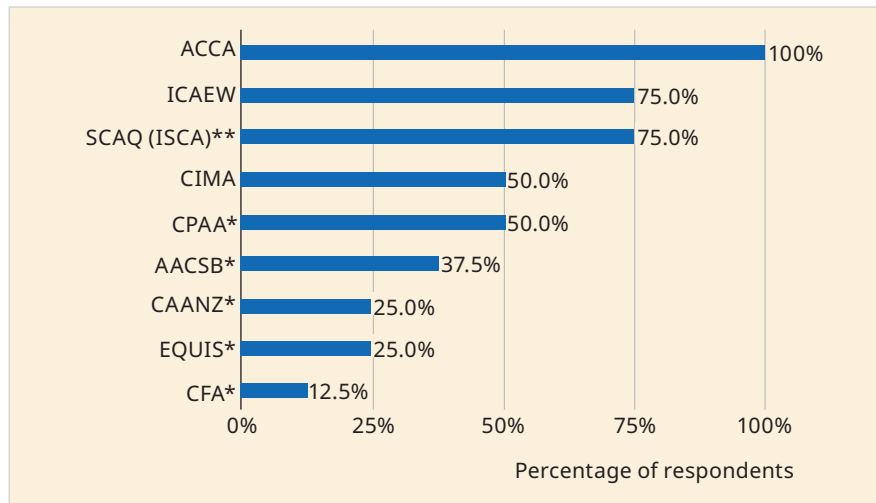
This would suggest that on average, the accountancy programmes have experienced the changes brought about by the Global Financial Crisis (GFC) in 2008.

This is an observation that the accountancy programmes would have undergone major revisions which would have led to constant and continuous improvements in the curriculum over time.

For the 8 respondents, their total enrolment is about 4,500 students. Figure 3 below shows the accreditation of the various institutions.

All the respondents have ACCA accreditation. In addition, the accountancy programmes from the five universities and one polytechnic are accredited²¹ under SCAQ a Singapore national accreditation programme.

²¹ The SCAQ requires the completion of a foundation programme and then the professional programme. To be a Singapore Chartered Accountant after completion of the professional programme, the candidate will have to be a graduate except for the special case where an individual has an advanced diploma in accounting from Ngee Ann Polytechnic.

Figure 3: Accreditation obtained by the institutions of higher learning

ACCA – Association of Chartered Certified Accountants
 ICAEW – Institute of Chartered Accountants in England and Wales
 SCAQ – Singapore Chartered Accountant Qualification
 CIMA – Chartered Institute of Management Accountants
 CPAA – CPA Australia
 AACSB – Association to Advance Collegiate Schools of Business
 CAANZ – Chartered Accountants Australia & New Zealand,
 EQUIS – European Quality Improvement System
 CFA – Chartered Financial Analysts

* The accreditation is only for degrees in universities

** See footnote 17

B. Awareness, competencies, importance and incorporation of selected emerging technologies

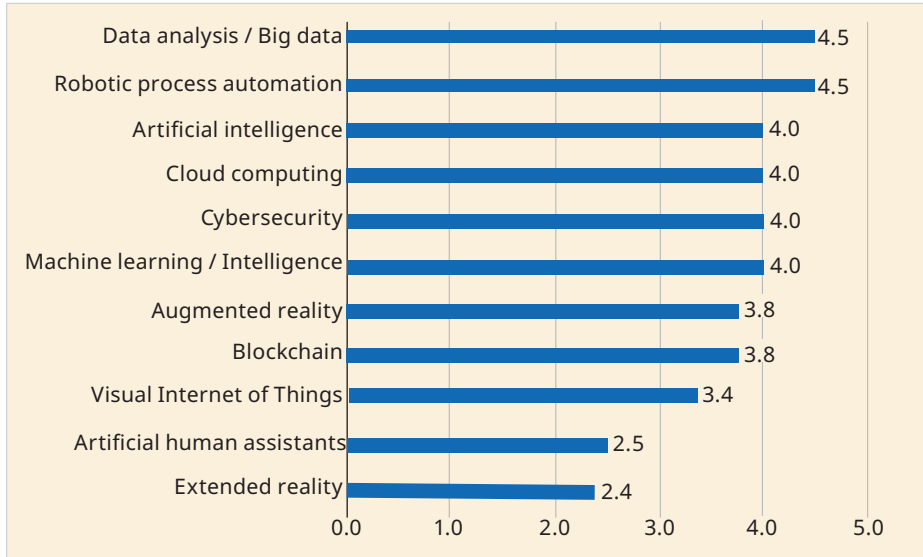
Respondents were asked about their level of awareness of a list of selected technologies. The selected technologies are based on a literature review and industry sensing of what are the more popular technologies employed in the accountancy industry.

Figure 4 shows the level of awareness of the respondents of the selected technologies from the IHLs' perspective in ascending order.

Data analysis/big data (4.5) and robotic process automation (4.5) are the two technologies with the greatest amount of awareness followed by four other technologies: machine learning/intelligence (4.0), cybersecurity (4.0), cloud computing (4.0) and artificial intelligence (4.0).

This is not unexpected as a subsequent examination of the current curriculum offered by the five AUs suggests that there is a systematic pattern across these AUs to address the usage of technology in a scaffolding manner.

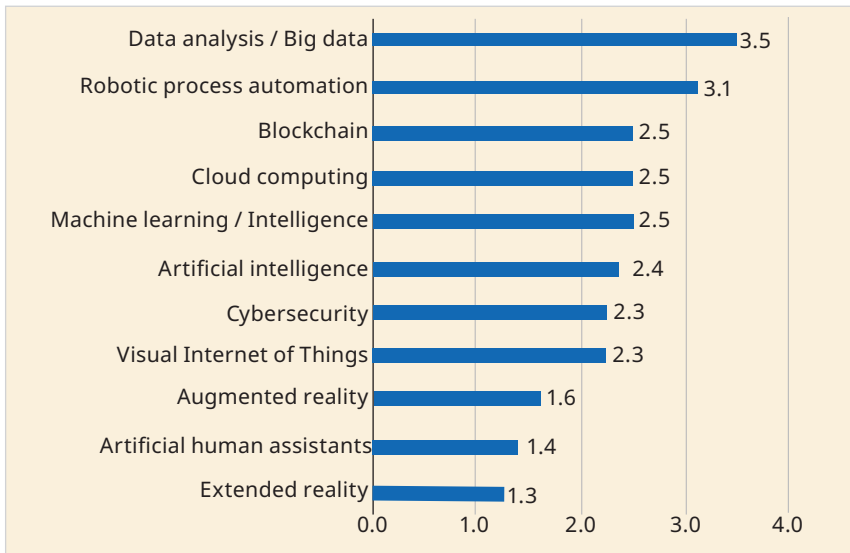
Figure 4: Level of awareness of the selected emerging technologies
(1 – Not at all and 5 – Fully aware)



Respondents were asked about their level of competency in teaching these selected technologies.

Figure 5 summarizes their responses. The two technologies that were most incorporated into the accountancy curriculum are data analysis/big data (3.5) and robotic process automation (3.1). The rest of the technologies score 2.5 or lower.

Figure 5: Level of teaching competency in the selected emerging technologies
(1 – None, 2 – Foundational, 3 – Intermediate, 4 – Advanced)



The respondents were further asked about which emerging technology is crucial to be incorporated into their accountancy curriculum.

Figure 6 shows the summary statistics of their responses. Clearly, data analysis/big data (4.6), robotic process automation (4.6), and cybersecurity (4.3) are the front runners. The three technologies that have very low ratings are: extended reality (2.0), augmented reality (2.1) and artificial human assistants (2.3).

Figure 6: Level of importance of the selected emerging technologies to be incorporated into the accountancy curriculum
(1 – Least Crucial and 5 – Most Crucial)

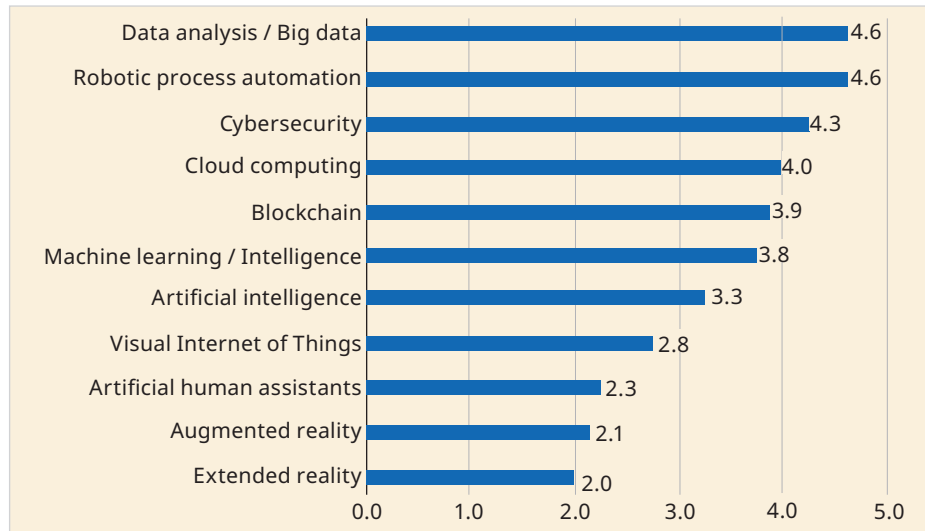


Figure 7 provides the Respondents' summary statistics of the level of incorporation of the selected technologies into their current accountancy curriculum.

Not surprisingly in Figure 7, again, data analysis/big data (3.3) and robotic process automation (2.8) are the two front runners, followed by cybersecurity (2.5) and machine learning/intelligence (2.5).

Figure 7: Level of incorporation of the selected emerging technologies into the accountancy curriculum
(1 – None, 2 – Foundation, 3 – Intermediate, 4 – Advanced)

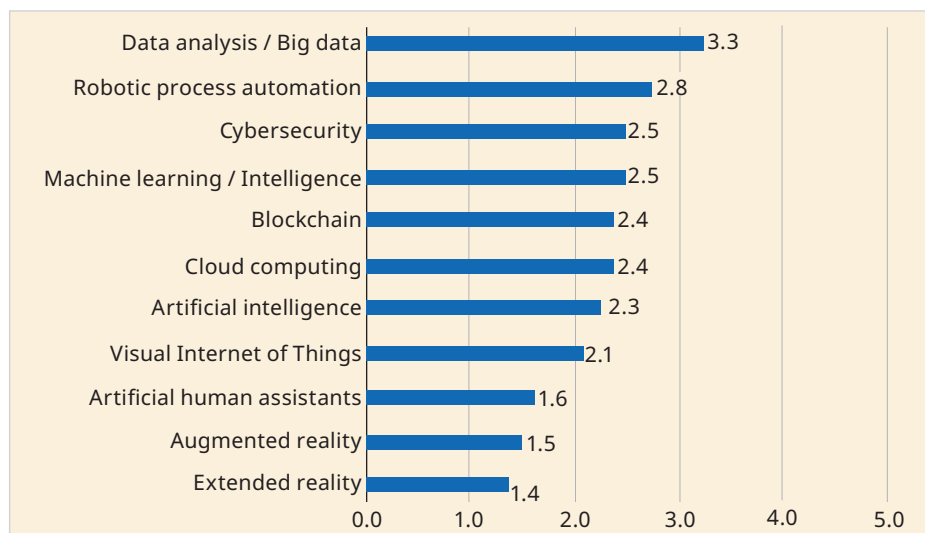


Table 1 below pulls together the findings in Figures 4 to 7, namely, ranging from getting feedback on the level of awareness of the selected technologies to their incorporation into the accountancy curriculum.

Table 1 shows the ranking given by the respondents with regard to each of the technologies in relation to the measures related to technology adoption: awareness, competency, importance and incorporation.

Table 1: Ranking of responses by the 4 measures of technology adoption – awareness, competency, importance and incorporation

	Awareness		Competency		Importance		Incorporation		Average rank
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	
Data analysis / Big data	4.5	1	3.5	1	4.6	1	3.3	1	1.0
Robotic process automation	4.5	1	3.1	2	4.6	1	2.8	2	1.5
Machine learning/ Intelligence	4.0	3	2.5	3	3.8	6	2.5	3	3.8
Cloud computing	4.0	3	2.5	3	4.0	4	2.4	5	3.8
Cybersecurity	4.0	3	2.3	7	4.3	3	2.5	3	4.0
Blockchain	3.8	7	2.5	3	3.9	5	2.4	5	5.0
Artificial intelligence	4.0	3	2.4	6	3.3	6	2.3	7	5.5
Visual Internet of Things	3.4	6	2.3	7	2.8	8	2.1	8	7.3
Augmented reality	3.8	7	1.6	9	2.1	10	1.5	10	9.0
Artificial human assistants	2.5	10	1.4	10	2.3	9	1.6	9	9.5
Extended reality	2.4	11	1.3	11	2.0	11	1.4	11	11.0

There is a significant level of convergence for the top 2 technologies (i.e., data analysis/ big data and robotic process automation) in the four measures related to technology adoption. This is similarly the case for the lowest three technologies (i.e., augmented reality, artificial human assistants and extended reality).

However, there are observable differences and these are highlighted in bold in Table 1.

Firstly, machine learning/intelligence scores highly in awareness (4.0) and importance (3.8) but competency (2.5) and incorporation (2.5) in the accountancy curriculum score much lower.

A possible explanation is that there is a general perception that machine learning will have a significant role to play in the future; however, there is still uncertainty as to how it is to be applied in the accountancy industry.

Therefore, the scores relating to competency in teaching and incorporation into the accountancy curriculum are low.

Secondly, even though cybersecurity has a high level of awareness (4.0) and importance (4.3), incorporation (2.5) into the accountancy curriculum and teaching competency (2.3) is low.

This is not surprising as cybersecurity is a very specialized domain which generally

does not fall within accountancy expertise and thus significant specialized training is required.

Thirdly, the level of awareness for blockchain has a score of 3.8 and its importance, 3.9; however, the levels of competency and incorporation into the accountancy curriculum score significantly lower (2.5 and 2.4 respectively).

The same observations apply to cloud computing. The awareness of blockchain and cloud computing may pertain to how they can be used effectively and widely in the accountancy industry.

Fourthly, interestingly, even though artificial intelligence recorded a high level of awareness (4.0) and level of importance (3.9), the levels of competency and incorporation are the lowest amongst the seven technologies, namely, 2.4 and 2.5 respectively.

This could be similar to the case of Generative Artificial Intelligence (such as ChatGPT, Dall-E) where there is great awareness of what it can do potentially to change the accountancy industry but the competency to teach it effectively, or its relevance to the accountancy industry and the need to incorporate the technology into the accountancy curriculum are still uncertain at this juncture.

Table 2 shows the technology courses offered by the five AUs in their accountancy programmes.

Table 2: Technology courses offered by the 5 AUs

Programming for data analytics courses	Python for Data Analytics
	Programming for Business Analytics
Data management courses	Fundamentals of Data Mining
	Data Management
	Designing and Developing Databases
Data analytics courses	Business Analytics Applications and Issues
	Analytics: Visual and Predictive Techniques
	Data Analytics and Visualization
	Data Modelling and Visualization
	Spreadsheet Modelling and Analytics
	Predictive Modelling
	Business Analytics Applications and Issues
Cybersecurity courses	Foundations of Cyber Security
	Cyber Risk and Forensic Work
Machine learning / Artificial intelligence courses	AI in Accounting & Finance
	Data Analytics and Machine Learning
	Machine Learning and AI for FinTech
Specialised analytics courses	Audit Analytics
	Forecasting and Forensic Analytics
	Analytics for Value Investing
	Analytics in Finance and Real Estate

The polytechnics are also offering technology courses in their accountancy programmes, albeit at an intensity and volume that are not as comprehensive as the AUs. Table 3 provides a listing of some of these accounting-related and technology courses offered by the polytechnics.

Table 3: Technology courses offered by the 4 polytechnics

Business technology and data fluency courses	Programming for Business
	Data Fluency
	Business IT and Spreadsheet Application
	Digital Accounting Technology and Application
Data analytics courses	Accounting System & Analytics
	Business Technology & Analytics
	Information Systems & Financial Analytics
	Data Science Fundamentals and Analytics
	Business Analytics
	Digitalization & Data Analytics
	IT & Data Analysis for Business
	Forensic Accounting & Analytics
Artificial intelligence courses	Predictive Analytics with AI
	AI and Its Impact

Tables 2 and 3 suggest that the broad areas of the top 7 technologies are covered in courses with specific labels and they include: Data analysis / big data, cybersecurity, machine learning/ intelligence and artificial intelligence.

A closer examination of the accountancy curriculum would include robotic process automation, blockchain and cloud computing in the data management or business analytics courses. A glaring observation is that data analytics has the widest and broadest coverage in the AUs and the polytechnics. The challenge is always how much depth of coverage is involved.

The courses in Tables 2 and 3 provide evidence that the IHLS in Singapore are knowledgeable and cognisant of the technologies in the accountancy industry and are systematically incorporating them into their accountancy curriculum despite the challenges.

What are some of the software used in teaching technology courses?

The respondents were also asked to provide the list of software that they use to teach their courses.

Table 4 summarizes the software used and it is consistent with the observation that data analysis/big data has the largest suite of software while there is none for artificial human assistants, augmented reality, cybersecurity and extended reality.

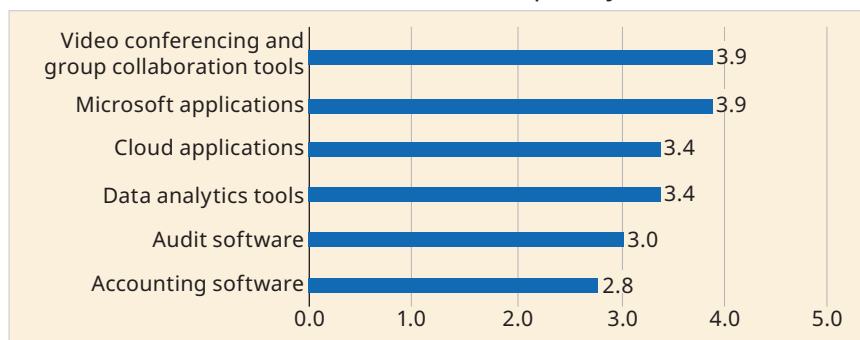
Table 4: Software used for teaching technology

Technology	Software
Artificial intelligence	Python, Alteryx, R
Artificial human assistants	No mention
Augmented reality	No mention
Blockchain	Etherum
Cloud computing	Xero, ABSS, SAP Cloud, Azure, MS. Amazon, AWS, Google
Cybersecurity	No mention
Data analysis / big data	Tableau, Power BI, Hadoop, MongoDB, IDEA, SAP Predictive, R, Python, Kerasa Deep learning model, Google BrainTensorFlow, Hadoop, Apache Spark, AWS, Power Query, SQL
Extended reality	No mention
Machine learning / intelligence	Microsoft Azure Machine Learning, KNIME Analytics Platform, Python, R, Alteryx, Celonis, Kerasa Deep learning model, Google BrainTensorFlow, Hadoop, Apache Spark, AWS
Robotic process automation	UI Path, Python, Power Automate
Visual Internet of Things	Seaborn, Tableau, PowerBI, QlikSense

The respondents were asked how much of a selected suite of technology tools is currently used or has been embedded in the accountancy curriculum in the last 3 years. The responses are summarized in Figure 8. It seems like the most popular are video conferencing tools because of COVID, and Microsoft applications (the existing dominant office software), followed closely by cloud applications, data analysis and audit tools. This is consistent with the findings in the above sections.

Figure 8: Technology tools used in accountancy curriculum

(1 – Never used and 5 – Frequently used)



What are some of the barriers to incorporating technology into the accountancy curriculum?

Respondents were asked to select some of the possible barriers to incorporating technology into their accountancy curriculum. Figure 9 provides a summary of their responses.

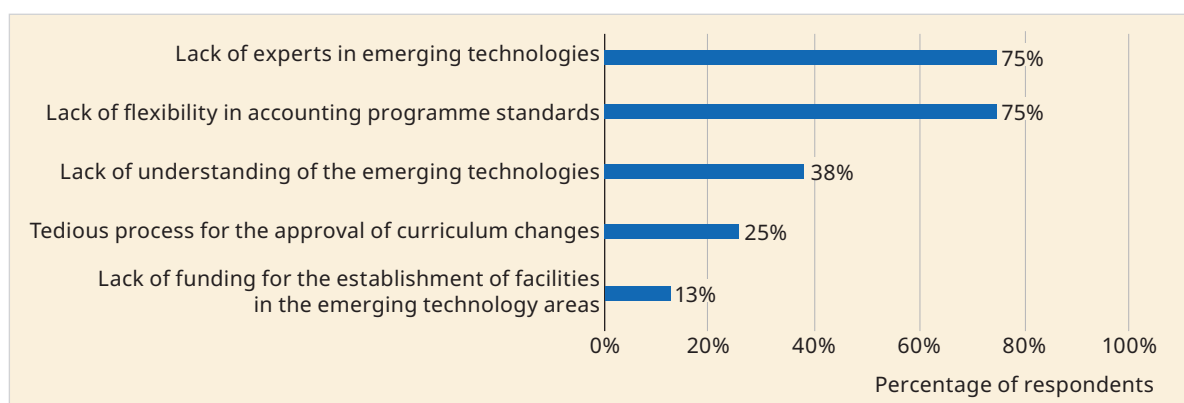
The top 2 barriers are: the lack of flexibility in the accountancy programme because

of the standards and expectations imposed by the accreditation body (75%) and the lack of experts in emerging technologies (75%).

38% of the respondents cite a lack of understanding of emerging technologies as a barrier to adoption.

Interestingly, only 1 respondent mentions that the lack of funding is a barrier. Nonetheless, 25% of the respondents say that it is a tedious process to implement changes in the accountancy curriculum.

Figure 9: Barriers to adoption of technology in accountancy curriculum



There seems to be a concern that accountancy schools are constrained by accreditation agencies which leave them little room to adopt technology in their already crowded accountancy curriculum. One possible explanation is that the accreditation requirements consume a large part of the accountancy curriculum, leaving little room to cover the needed technologies.

The lack of experts to teach emerging technologies is another critical constraint.

What kind of help is needed to incorporate technology into the accountancy curriculum?

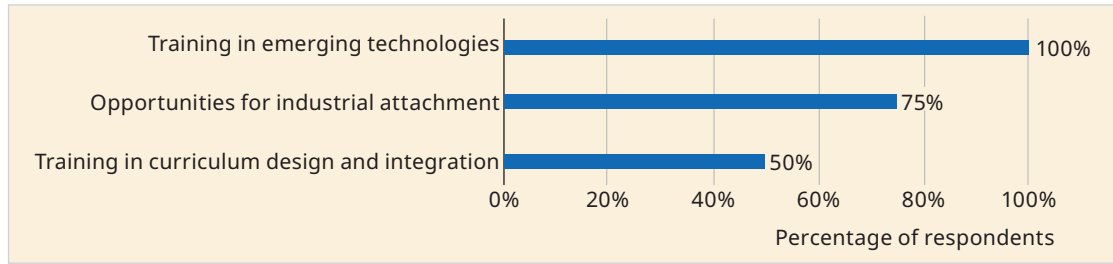
Given the barrier posed by the lack of experts in emerging technologies, respondents were further asked what kind of assistance they would like to have to integrate emerging technologies into existing courses/modules.

Figure 10 provides a summary of their responses.

It is heartening to know that 100% of the respondents believe that training in emerging technologies for the faculty is the way forward to incorporating technology into the accountancy curriculum.

The training can be obtained through industry attachment (75%). Interestingly too, the respondents believe that there is a need to train the faculty in curriculum design and integration (50%) in order to incorporate technology into the accountancy curriculum.

Figure 10: Kind of help needed to incorporate technology into the accountancy curriculum



How should technology courses be taught in accountancy programmes?

The discussion in the accountancy literature is that, ideally, technology for the accountancy profession should be taught by accounting instructors who are experts or very conversant with the technology.

However, there is a severe shortage of such technologically inclined accounting instructors. Alternatively, the technology could be taught by technology experts from outside the accountancy industry. These are also short in supply.

Finally, there is a proposal for a hybrid approach that bundles accounting instructors with IT instructors to co-teach the technology course. The advantage of this approach is that it would overcome the shortage of technologically inclined accounting instructors.

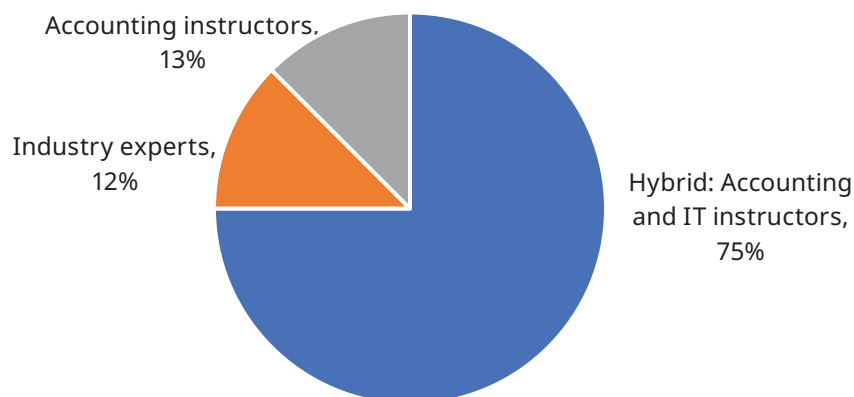
However, the disadvantage is that the technology portion of the course could end up being taught without an accounting context and the course can become disjointed.

Respondents were asked in what ways technology should be taught in accountancy schools, including who should be the main instructors.

Figure 11 shows the responses of the IHLs with regard to who should be teaching the technology component.

Figure 11 suggests that at this juncture, a hybrid approach would be ideal due to the shortage of technologically inclined accounting instructors.

Figure 11: Views on how accountancy schools should teach technology curriculum



Respondents were asked further to name their preferred mode in which the course is to be taught.

Should the technology course be taught as a stand-alone or should it be embedded into the accounting courses?

Both methods have their advantages and disadvantages.

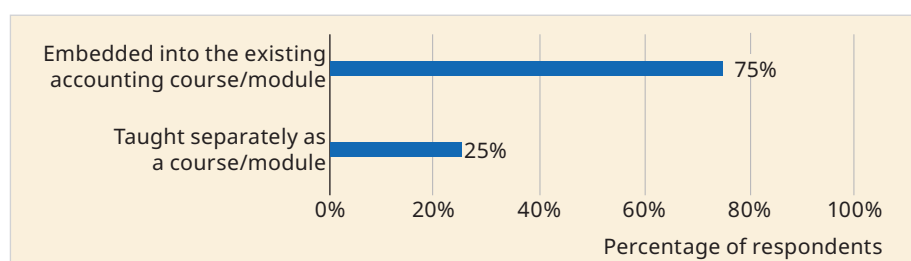
A stand-alone technology course provides the opportunity for instructors to drill deep into the technology. However, the knowledge imparted may be unrelated to accountancy and suffer from a lack of integration with the accountancy domain.

The other approach is to incorporate technology as part and parcel of core accountancy courses. This is ideal but it suffers from two major weaknesses. First, it is much harder to teach an accountancy course with embedded technology. The danger is that the course may end up having insufficient depth and coverage in both accountancy and technology knowledge. Secondly, it is very difficult to get accounting instructors who can weave technology effectively into the accounting core courses.

Figure 12 summarizes the respondents' views on teaching technology in the accountancy curriculum.

A majority of the respondents prefer to have technology taught in accountancy courses in an integrated manner, for example, embedding data analytics into auditing.

Figure 12: Preferences for the way technology is to be taught in the accountancy curriculum



Given the general preference to embed the technology into existing courses, the respondents were further asked how they should incorporate the selected emerging technology into their courses.

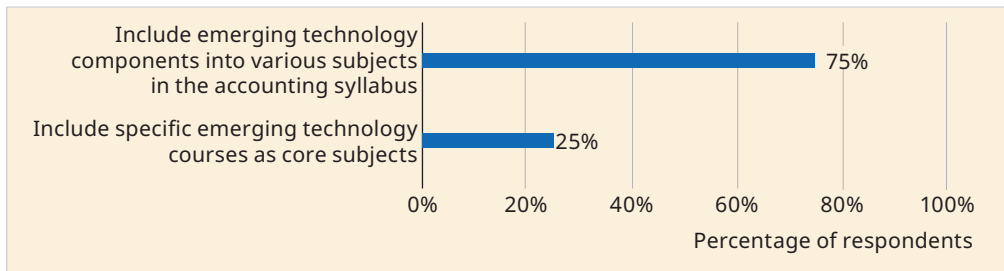
Figure 13 summarizes their responses.

There is a consistent observation that IHLs which prefer to incorporate technology into existing accounting courses would include emerging technology components into various subjects in the accountancy curriculum.

Similarly, those who prefer to teach specific technologies in separate courses would prefer dedicated emerging technology core subjects.

Therefore, there are multiple approaches to incorporating emerging technology into the accountancy curriculum.

Figure 13: Incorporating emerging technology into the accountancy curriculum



What is the current stage of adoption of technology by the IHLs?

Respondents were asked a question on the stage of adoption of technology in their accountancy curriculum.

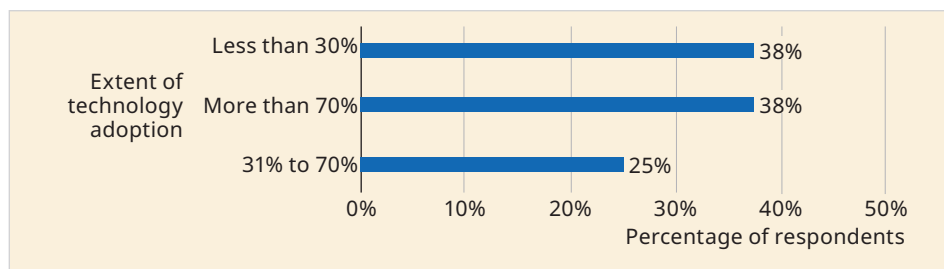
Figure 14 summarizes their responses.

The respondents are all at different stages of adoption and they are equally divided along the spectrum from less than 30% to more than 70%.

This is a continuous journey and it is heartening to document the fact that respondents are aware of their stage of adoption and the technologies they need to work with.

In addition, there is no respondent who indicates that it has not started on technology adoption in their accountancy curriculum.

Figure 14: Stages of technology adoption in accountancy curriculum



In summary, the survey provides evidence that the IHLs in Singapore are taking significant steps to incorporate technology into their accountancy curricula.

The level of awareness is high and the extent of actions taken to incorporate technology into the accountancy curriculum is significant.

The two main constraints are the lack of curriculum space due to the need to meet requirements for accreditation and a shortage of technologically-inclined accounting instructors to teach technology.

Accounting and IT instructors may therefore have to work together to co-teach technology in the accountancy programme.

There is a general preference to weave the technology into the accountancy courses rather than structure mere stand-alone technology courses.

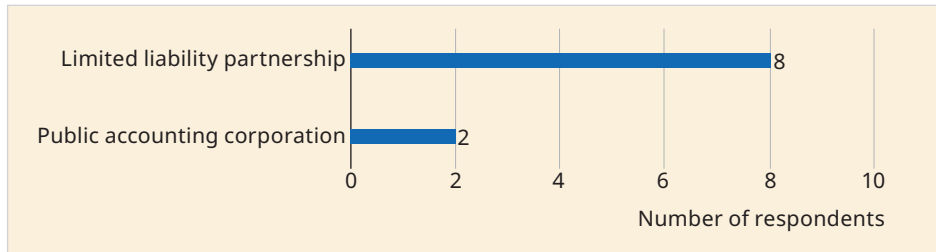
Part 3: Accountancy firms

a. Demographics of the respondents

A survey instrument was sent to accountancy firms for their responses. There were altogether 10 respondents and their corporate profile is shown in Figure 15.

There were two public accounting corporations and 8 limited liability partnerships.

Figure 15: Distribution of respondents' firms by corporate profile



The respective corporate positions of the representatives of the respondent firms are shown in Figure 16.

Eight of the 10 respondents involved their owners, practitioners, partners, directors or shareholders. The other two respondents are represented by managers or supervisors.

Figure 16: Corporate positions of the representatives of respondent firms

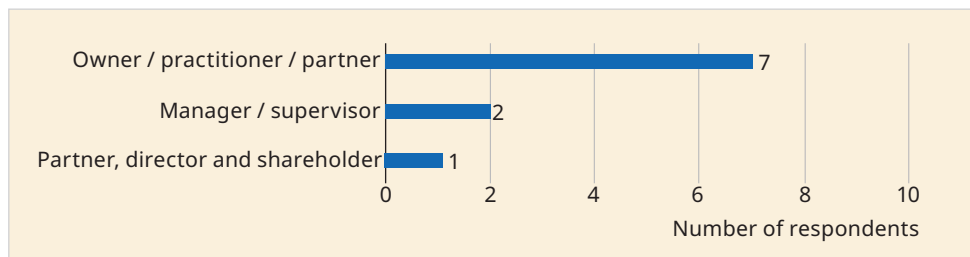
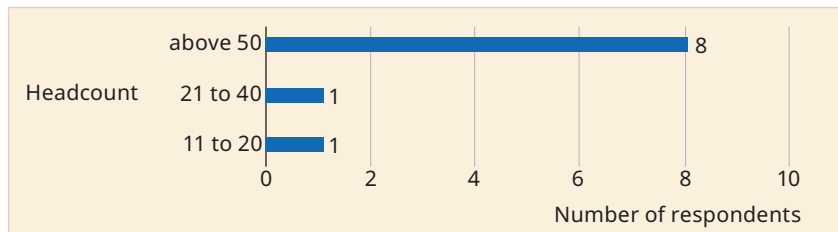


Figure 17 provides an indication of the firm size of the respondents.

80% of the respondents have more than 50 staff while the other two have 11 to 20, and 21 to 40 staff, respectively.

Figure 17: Headcount of respondent firms



The respondents were asked to disclose how long their firm has been in existence.

Nine out of the 10 firms have indicated that their firms have been in existence for more than nine years.

There is one firm which has been in existence for less than nine years.

b. Awareness and utilization of selected emerging technologies

The respondents were asked to provide an indication of their level of awareness of advances in technology pertaining to their industry.

Figure 18 provides a statistical summary of their level of awareness in 11 selected emerging technologies.

The top three emerging technologies of which the respondents have the highest level of awareness are: cybersecurity (4.5), data analysis/big data (4.3) and cloud computing (4.1).

The three emerging technologies that have the lowest level of awareness are visual Internet of Things (2.5), extended reality (2.8) and augmented reality (3.0).

Figure 18: Level of awareness of the selected emerging technologies

(1 – not at all and 5 – fully aware)

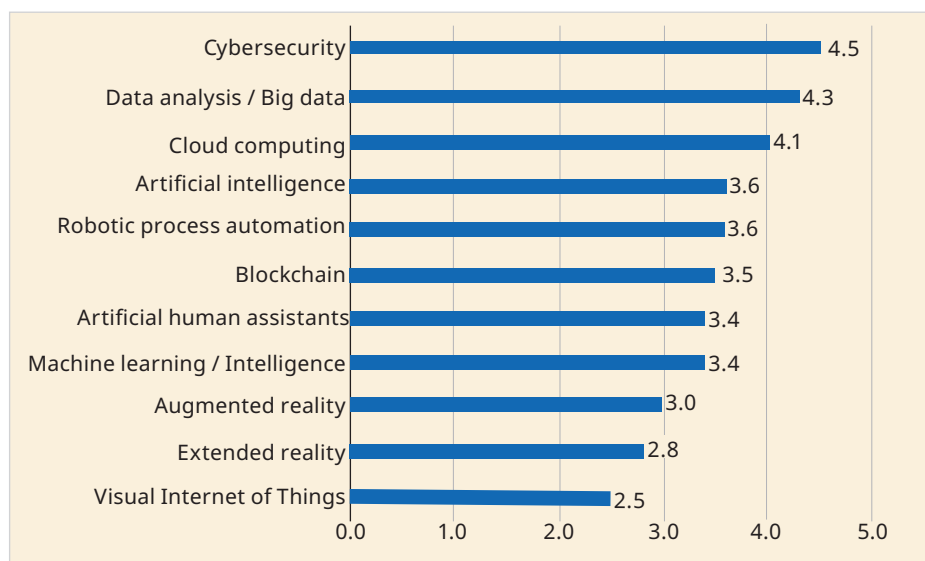


Figure 19 shows the level of utilization of the emerging technologies.

The top three emerging technologies utilized are consistent with the level of awareness (cybersecurity [4.1], data analysis/big data [3.7] and cloud computing [3.3]).

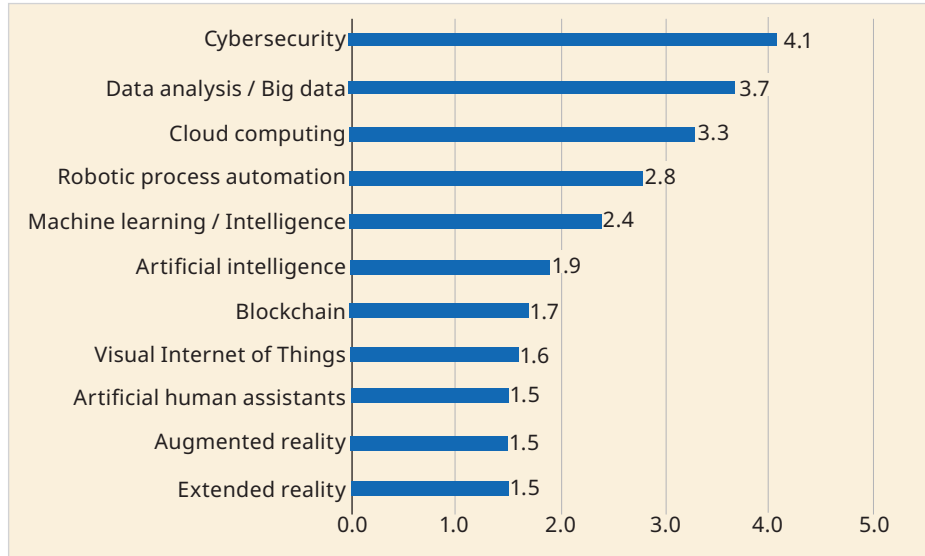
However, the level of utilization on average is lower than the level of awareness.

This is particularly the case for extended reality (1.5), augmented reality (1.5), artificial human assistants (1.5), visual internet of things (1.6), blockchain (1.7) and artificial intelligence (1.9) which are all rated less than 2.0.

This could mean that it is one thing to be aware of a technology but it is another thing to be utilizing the technology.

This is particularly the case for those technologies with an average utilization level of less than 2.

Figure 19: Level of adoption of emerging technologies
(1 - not at all utilized and 5 - utilized all the time)

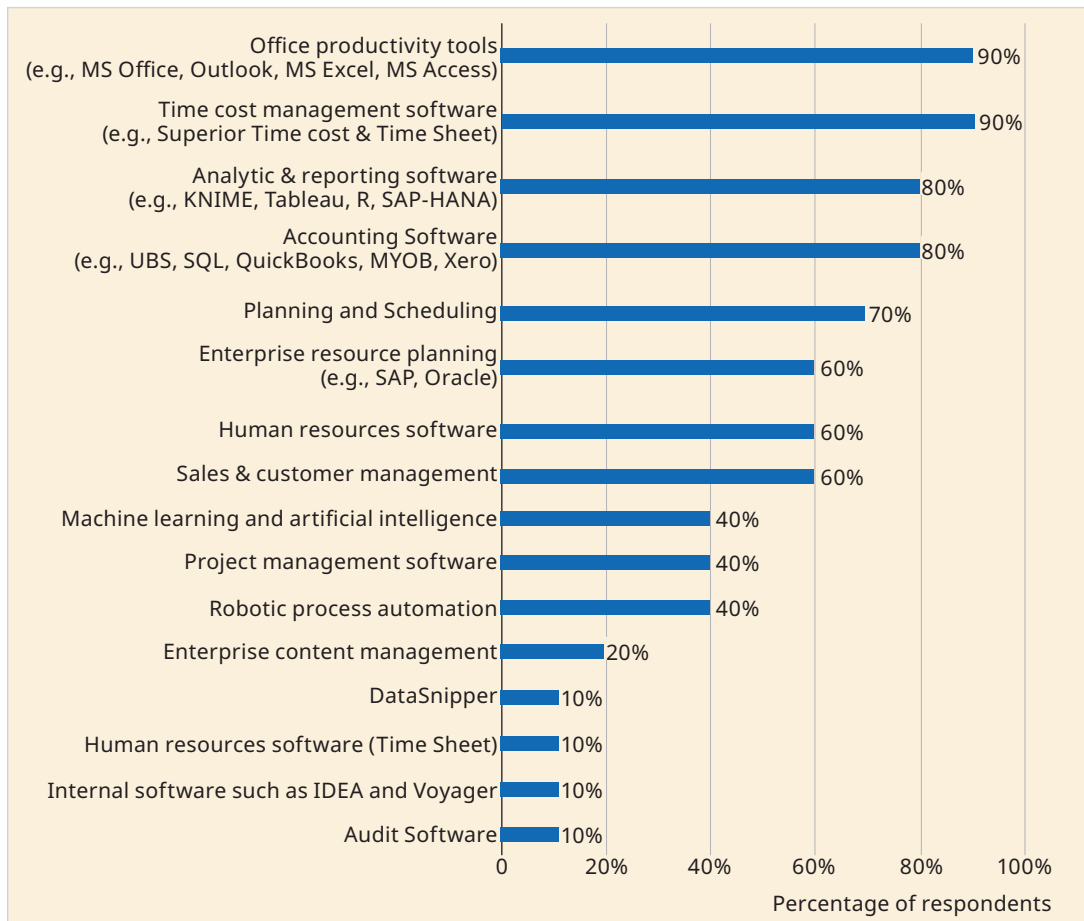


c. Systems and softwares adoption

The respondents were asked to provide their inputs on the types of systems and software which they currently adopt in their work.

Figure 20 shows the list of systems and software adopted by the respondents.

Figure 20: Types of systems and software adopted



The 4 most popular systems or software adopted are: Office productivity tools (90%), time cost management software (90%), analytic and reporting software (80%), and accounting software (80%).

The next 4 most popular software pertain to planning and scheduling software (70%), enterprise resource planning (60%), human resource management software (60%) and sales and customer management software (60%). The findings suggest that for these respondents, the use of systems and software in their business is prevalent.

d. Computer-Assisted Audit Technique (CAAT) adoption

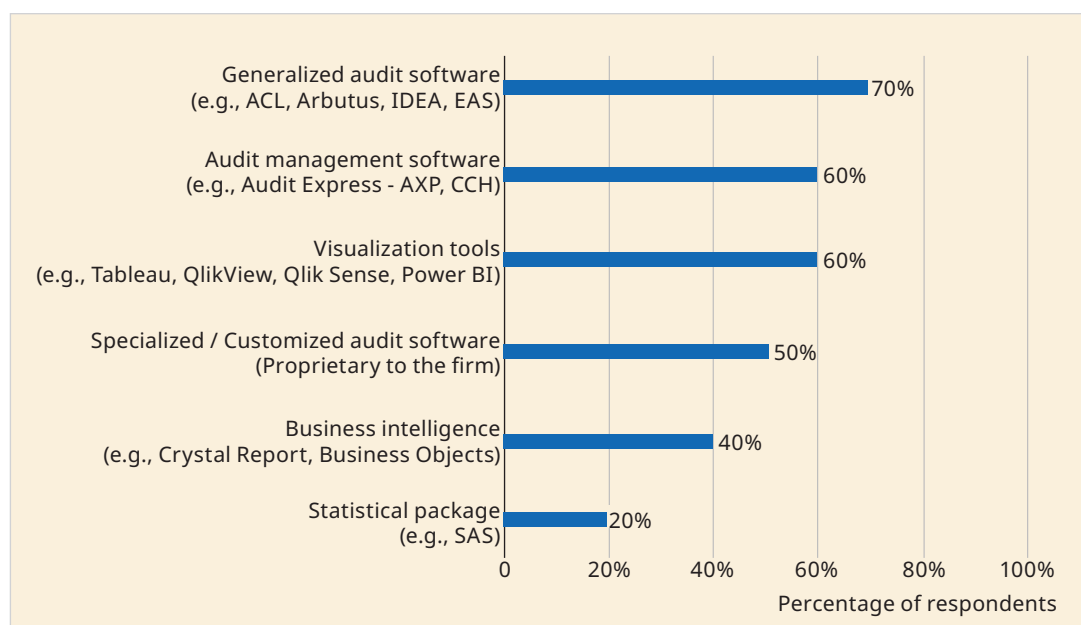
The respondents were specifically requested to provide inputs on the adoption of computer-assisted audit techniques (CAAT).

Figure 21 provides a summary of CAAT adoption. 70% of the respondents use generalized audit software in their operations.

Interestingly 50% or more of the respondents also use specialized or customised audit software which is proprietary to their firm and audit management software for their operations.

This suggests that the use of audit software is imperative in the current auditing landscape. Visualization tools are also used by 60 % of the respondents.

Figure 21: Types of computer-assisted audit techniques (CAAT) adopted



e. Technological preparedness

The respondents were asked about their preparedness for technology adoption from three different dimensions: the approach to technology, manpower skills and knowledge, and investment in technology.

Figure 22 shows the respondents' input on five statements regarding their approach to technology.

The respondents provided positive responses to the five statements (i.e., score of more than 3.0).

It can be concluded that the key motivation for the adoption of IT systems and software is to improve productivity and hence profitability. This is particularly critical in the face of manpower shortages in the accountancy sector in Singapore.

Figure 22: Approach to technology

(1 – Fully disagree and 5 – Fully agree)

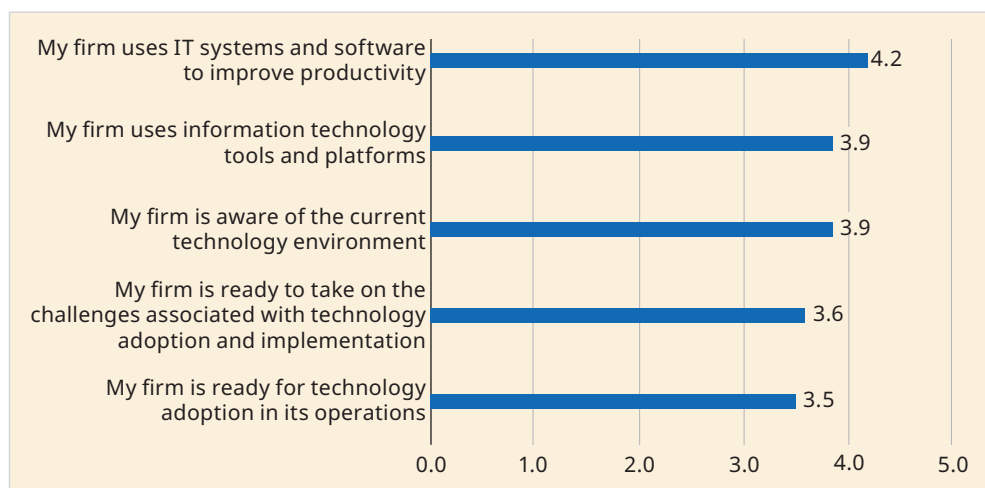


Figure 23 provides a summary of the feedback of respondents on the technological skills and knowledge of their manpower. The responses are generally positive (i.e., a score of more than 3.0).

However, the responses seem to lack the kind of conviction among employees than what is seen in the firms' approach to technology.

There seems to be just slightly more than average agreement on the ability of the staff to manage and handle technology effectively and appropriately (i.e., generally the responses turn in scores that range from low to middle (score of 3.0) except for the employees' ability to easily access relevant technology to solve workplace problems.

This explains why there is a general lack of awareness and adoption of extended reality, augmented reality, artificial human assistants, visual Internet of Things, blockchain, artificial intelligence and machine learning (each of which all receive a score of less than 2.5 in Figure 19).

The findings here may suggest that more can be done to upskill the staff through technology related training.

Figure 23: Manpower skills and knowledge

(1 – Fully disagree and 5 – Fully agree)

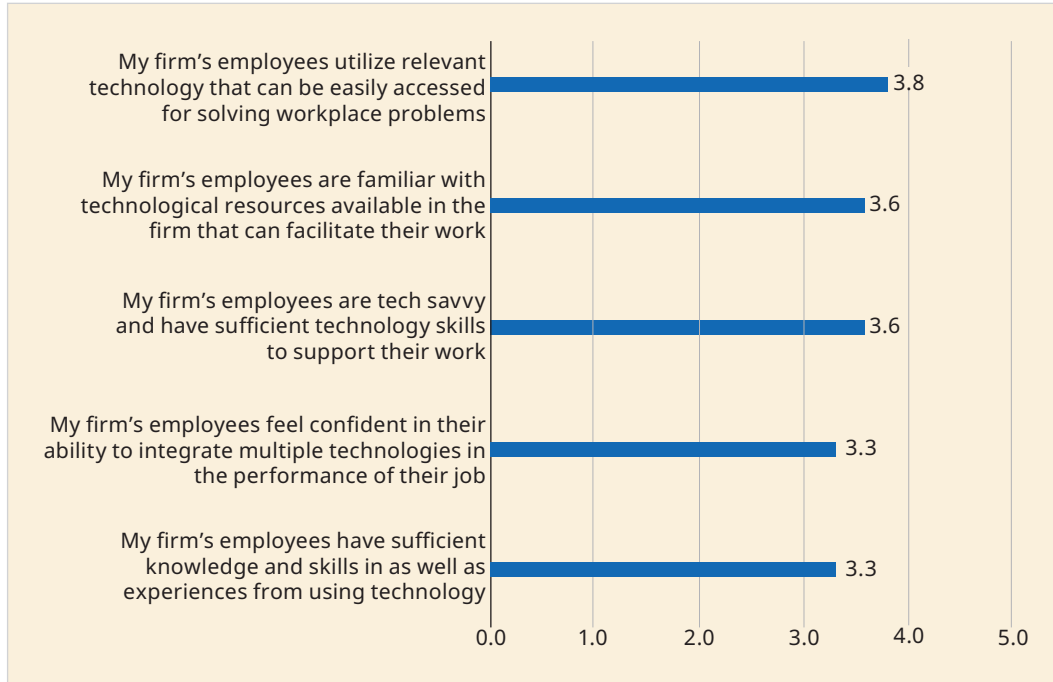
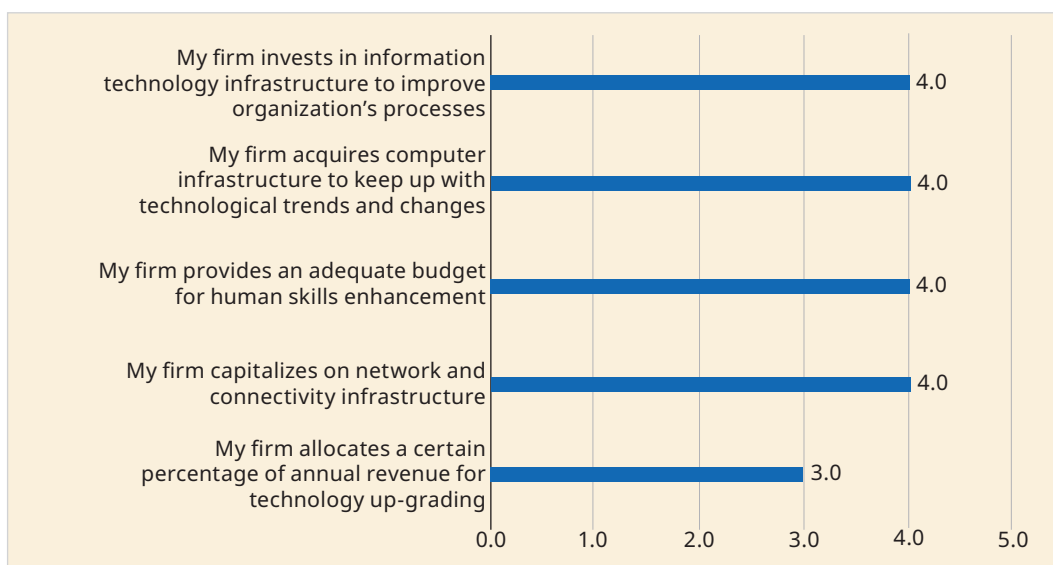


Figure 24 shows the respondents' feedback on their firms' investment in technology. The responses are consistent with the respondents' positive view about adoption of technology and the need for manpower development in the area of technology.

The findings suggest that the respondents are willing to invest in technology infrastructure and may have undertaken actions and formulated a strategy to upgrade the firm's capability in technology.

Figure 24: Investment in technology

(1 – Fully disagree and 5 – Fully agree)



f. Planned behaviour towards technology adoption

The respondents were further requested to provide feedback on statements that help to assess their planned behaviour toward technology adoption.

The planned behaviour covers four key aspects: attitude, subjective belief, perceived behavioural control and intention to engage.

Figure 25 summarizes the respondents' feedback on their attitude towards technology (i.e., a score greater than 4.0).

Figure 25 summarizes the very positive responses from the respondents on their attitude towards technology.

There is a strong belief that their firms will benefit from adapting to the technological advances in accountancy and the adoption is expected to result in greater value creation. The respondents believe that they will be rewarded for adapting to the technological advances.

Figure 25 summarizes the respondents' feedback on their attitude towards technology.

Figure 25: Attitude towards adaption to technological advances

(1 – Fully disagree and 5 – Fully agree)

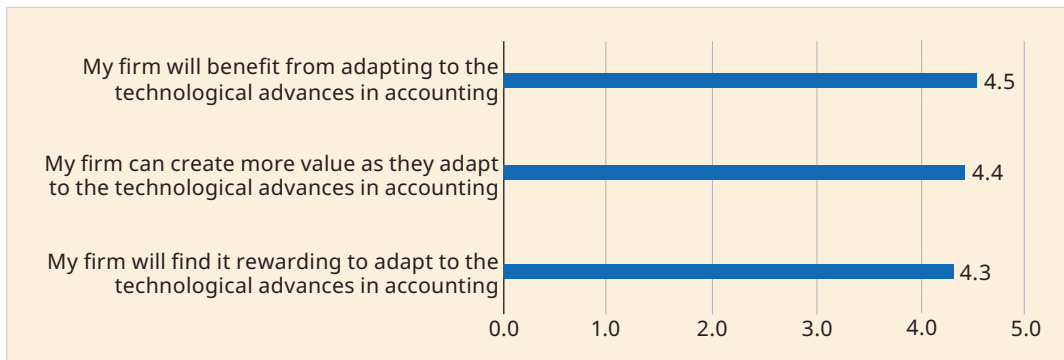


Figure 26 summarizes the respondents' feedback on management's subjective belief concerning the views of the profession, staff and regulators on the adoption of technological advances in accountancy.

There is a very strong subjective belief that the accountancy profession, the firms' employees and regulators believe that adaptation to technology advances in accountancy is imperative to the accountancy profession.

It seems that there is a subjective belief that the technology advancement cannot be stopped and firms must adapt to survive.

Figure 26: Subjective belief about adaption to technological advances

(1 – Fully disagree and 5 – Fully agree)

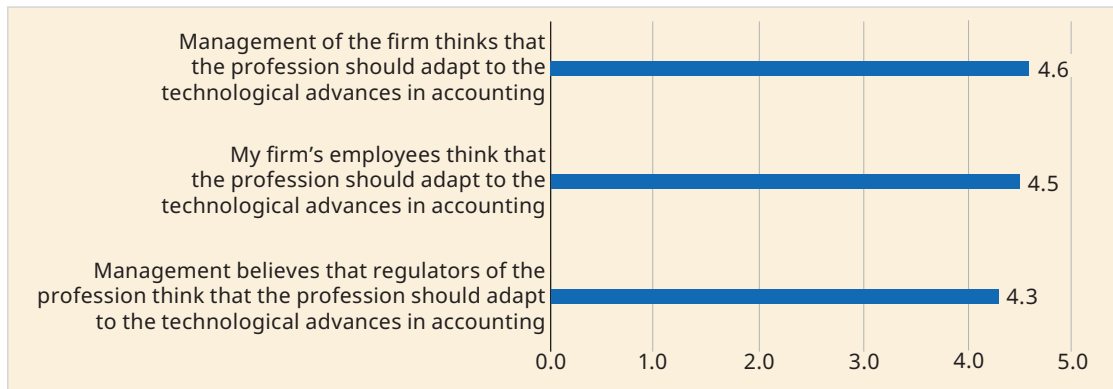


Figure 27 shows the planned behaviour of the respondents in tackling adaptation of technological advances in their firms.

The respondents articulate their planned behaviour in a positive and affirming manner. There is a general positive agreement to the planned actions.

The most important point agreed upon is the necessary provision of support to employees in terms of financial resources, access to technology and professional development to enable employees to upskill to face technological challenges.

However, the scores for planned behaviour are lower than those for attitude and subjective belief towards adaptation to technological advances (i.e., the scores for attitude and subjective belief are all greater than 4.0 as compared to those for planned behaviour which hover between 3.6 to 4.0).

Figure 27: Planned behaviour for adaption to technological advances

(1 – Fully disagree and 5 – Fully agree)

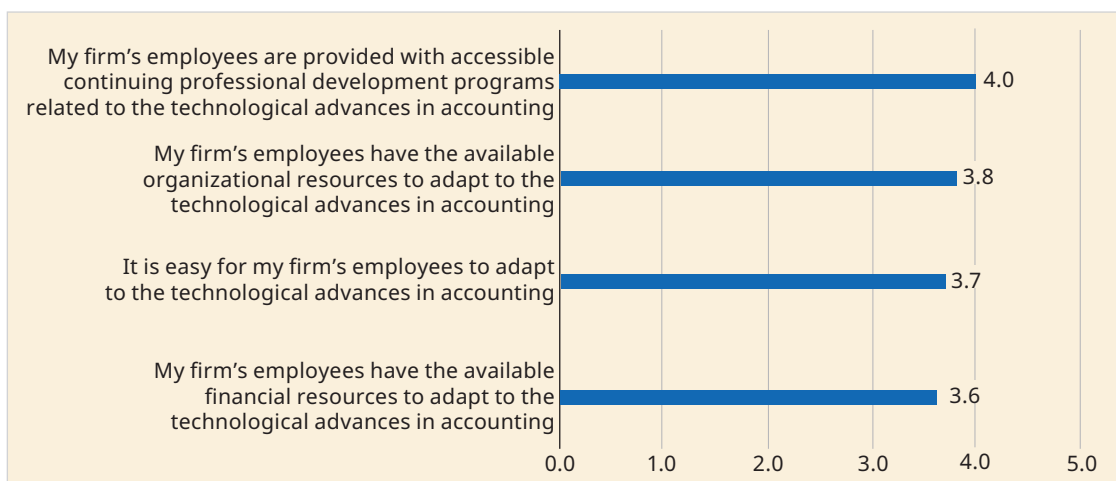


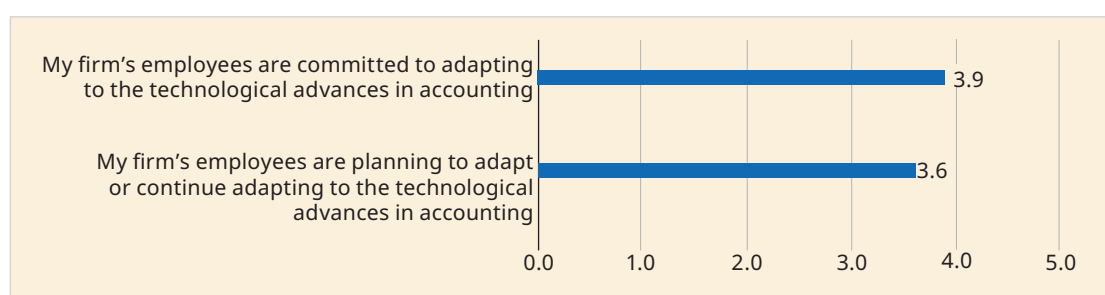
Figure 28 summarizes the respondents' inputs on their intention to engage in adapting to technological advances in their business.

The findings in Figure 28 are interesting as even though there is a positive attitude towards adapting technological advances, a strong subjective belief that technology is crucial to the accountancy sector, and planned behaviour to engage the adaptation, there is a relatively lower positive sentiment about the employees' intention to engaging technology.

This could be a reflection of the shortage of technologically-inclined employees and the difficulties in upskilling employees.

The difficulty could be due to the unwillingness of the employees to learn new skills or the lack of opportunities to acquire new skills.

Figure 28: Intention to engage technology
(1 – Fully disagree and 5 – Fully agree)



g. Expected benefits of technology adoption

The respondents were further asked to articulate the expected benefits of technology adoption.

The list of benefits was curated from the accountancy literature and industry dialogues.

Figure 29 provides a summary of the respondents' feedback on the articulated expected benefits.

There is strong affirmation from the respondents on the well documented benefits of technology adoption.

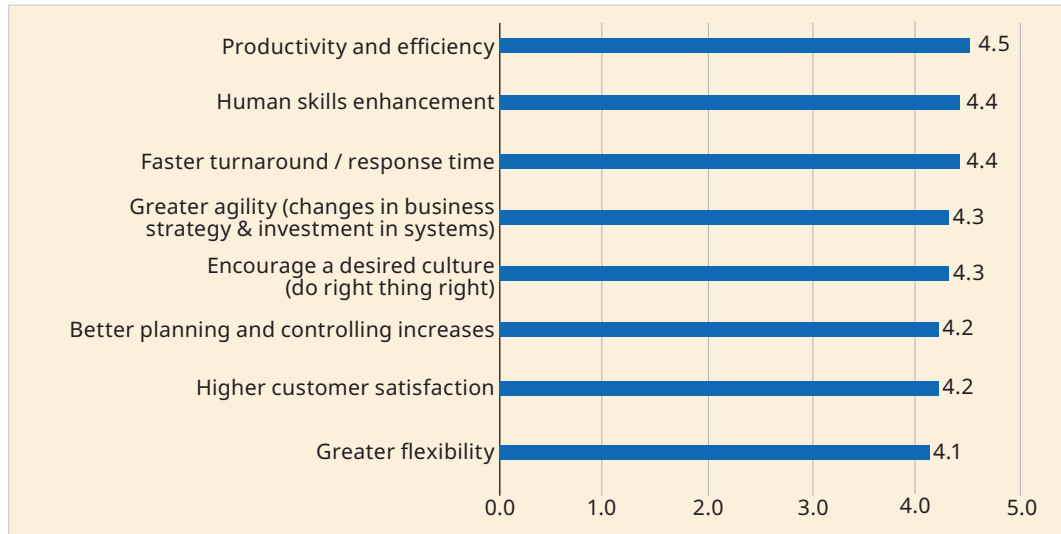
The most compelling reason for this is productivity and efficiency gains (4.5). A few of the respondents provided other reasons for the adoption of technology.

They include better work quality arising from technology adoption and less reliance on manpower in getting the work done.

Interestingly, one respondent suggests that the adoption of technology would allow the firm to focus on other areas that matter to the business.

Figure 29: Expected benefits of technology adoption

(1 – Fully disagree and 5 – Fully agree)



h. Challenges to adoption of technology

The respondents were asked to name challenges to the adoption of technology. Figure 30 provides a summary of the responses.

Figure 30 indicates that the key challenge is the degree of readiness to accept technological changes as the responses seem to suggest that there is a significant resistance to such changes. The second most agreed challenge is high investment costs (4.0).

There also seems to be concerns about the lack of clarity of standards (3.6), regulations or certifications which do not correlate with articulated economic benefits.

Inadequate skills and knowledge of employees (3.4 and 3.5 respectively) are challenges which are well documented.

Interestingly, the lack of governmental support (3.3) as a challenge is not seen to be as huge as other challenges.

From the responses, the challenges can be overcome with proper attention and resourcing, particularly the training of employees.

A few of the respondents cited other challenges which include the lack of a dedicated team to steer technology adoption, high maintenance costs of both hardware and software, stable support from technology service providers and continuity and sustainability of technology adoption.

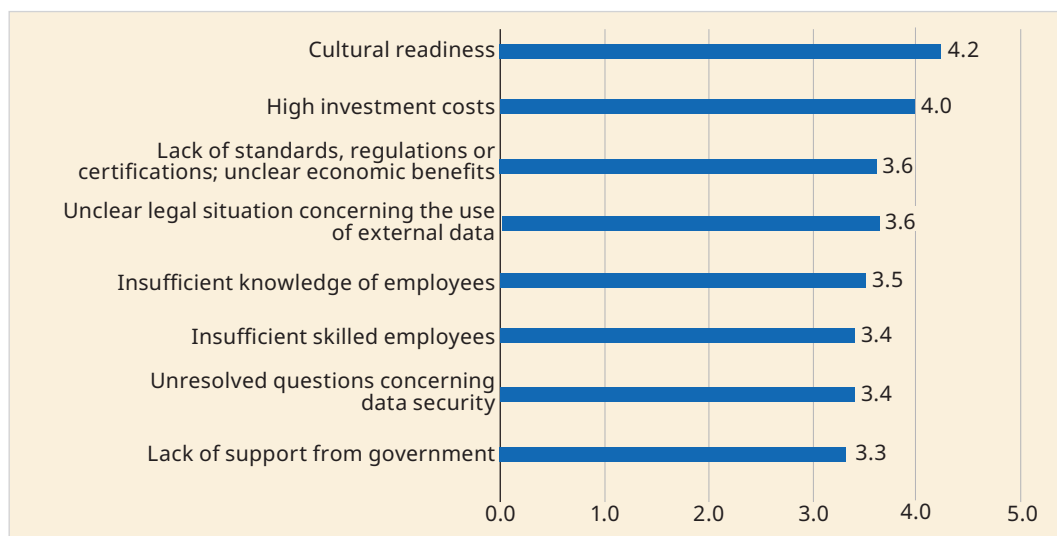
One possible solution to these challenges could be the establishment of a shared services platform for technology implementation.

The platform can be set up by vendors, professional bodies, or institutes of higher learning, to provide variegated adoptions of certain technology capabilities.

This may be particularly useful for small and medium-sized accountancy firms.

Figure 30: Challenges to adoption of technology

(1 – Fully disagree and 5 – Fully agree)



In summary, there is a high level of awareness and utilization of certain technologies which are purported to be most useful to accountancy firms.

These include cybersecurity, data analysis/big data and cloud computing. As expected, the level of adoption is lower than the awareness of such technologies. Accountancy firms have a positive outlook on the importance and approaches to technology.

However, the key challenge is the availability of technologically skilled and knowledgeable talent.

Accountancy firms are willing to embark on technology upskilling as they believe strongly that technology adoption will bring many benefits.

These include: productivity and efficiency, human skills enhancement, and faster turnaround/response time, among others.

Some of the key challenges in technology adoption include the cultural readiness of accountancy firms and the high investment costs.

Synthesis of responses by ISCA, institutes of higher learning and accountancy professionals

This section seeks to provide a synthesis of the responses of ISCA, institutes of higher learning and accountancy firms to the survey. It collates the similarities and differences in responses to the survey from these three groups of stakeholders.

Table 5 provides a comparison of the responses of the three groups with reference to the awareness of selected technologies.

Using a response of 3.0 as a neutral reference point²², on an average basis, extended reality (2.73), visual Internet of Things (2.96) and artificial human assistants (2.97) have lower than neutral awareness.

ISCA has neutral or lower awareness of all these three technologies as well as blockchain

²² All awareness scores of 3.0 or below are in red in Table 5.

(3.00). Institutes of higher learning have neutral or lower awareness of all these three technologies while accountancy firms have neutral or lower awareness of extended reality (2.80), visual Internet of Things (2.50) and augmented reality (3.00).

The accountancy firms expressed a marginally lower awareness of the selected technologies (3.52) on average.

The three groups have an almost similar level of high awareness (i.e., 4.0 and above) of cybersecurity, data analysis/big data and cloud computing for which the scores are 4.17, 4.27 and 4.37 respectively on average.

Table 5: Comparison of awareness of selected technologies

(1 – Not at all and 5 – Fully aware)

	ISCA	Institute of Higher Learning	Accountancy firms	Average
Extended reality	3.00	2.38	2.80	2.73
Visual Internet of Things	3.00	3.38	2.50	2.96
Artificial human assistants	3.00	2.50	3.40	2.97
Blockchain	3.00	3.75	3.50	3.42
Augmented reality	4.00	3.75	3.00	3.58
Machine learning/Intelligence	4.00	4.00	3.40	3.80
Artificial intelligence	4.00	4.00	3.60	3.87
Robotic process automation	4.00	4.50	3.60	4.03
Cybersecurity	4.00	4.00	4.50	4.17
Data analysis / Big data	4.00	4.50	4.30	4.27
Cloud computing	5.00	4.00	4.10	4.37
Overall awareness average	3.73	3.70	3.52	3.65

Table 6 provides the Spearman's correlation coefficient of the level of awareness of the selected technologies amongst the three groups.

Table 6 provides evidence that the level of awareness of the three parties is highly correlated.

This provides some evidence of the congruence of awareness of the three parties and there seems to be a reasonable alignment of the awareness of selected technologies.

It is observed that ISCA and the IHLs have the highest correlation coefficient (0.68).

Table 6: Correlation of awareness of selected emerging technologies

Correlation between ISCA and institutes of higher learning	0.68
Correlation between ISCA and accounting practitioners	0.62
Correlation between accounting practitioners and institutes of higher learning	0.59

Table 7 provides a comparison of the responses of the three parties with reference to the utilization of selected technologies.

On average, the level of utilization of the selected technologies is much lower than the level of awareness.

This is most pronounced for IHLs and accountancy firms.

This is not surprising as awareness always leads utilization. Using 3.0 as the neutral measure²³, the scores for all three groups are 3.0 or less on an overall basis.

In addition, the utilization level of artificial human assistants, augmented reality, extended reality, visual Internet of Things, machine learning/intelligence, blockchain and artificial intelligence all have scores of 3.0 or below on average for each group.

The three parties are relatively divided on the level of utilization of the rest of the technologies even though on average the score is greater than 3.0.

This would seem to suggest that there are differing opinions on which technology is most likely to be utilized.

Table 7: Comparison of utilization of selected emerging technologies
(1 – Not at all and 5 – Fully utilized)

Utilization	ISCA	Institute of Higher Learning	Accountancy Practitioners	Average
Artificial human assistants	2.00	1.38	1.50	1.63
Augmented reality	2.00	1.63	1.50	1.71
Extended reality	3.00	1.25	1.50	1.92
Visual Internet of Things	3.00	2.25	1.60	2.28
Machine learning/Intelligence	2.00	2.50	2.40	2.30
Blockchain	3.00	2.50	1.70	2.40
Artificial intelligence	3.00	2.38	1.90	2.43
Cloud computing	4.00	2.50	3.30	3.27
Robotic process automation	4.00	3.13	2.80	3.31
Data analysis / Big data	3.00	3.50	3.70	3.40
Cybersecurity	4.00	2.25	4.10	3.45
Overall utilization average	3.00	2.30	2.36	2.55

Table 8 shows the correlation of the level of utilization of the selected technologies amongst the three groups.

It provides some evidence to support the divergence of opinion in the utilization of the selected technologies between ISCA and the institutes of higher learning as the correlation is only 0.45.

²³ All utilization scores of 3.0 or below are in red in Table 7.

Table 8: Correlation of utilization of selected technologies

Correlation between accountancy practitioners and institutes of higher learning	0.64
Correlation between ISCA and accountancy practitioners	0.64
Correlation between ISCA and institutes of higher learning	0.45

In analysing the perception of the planned behaviour towards technology adoption for ISCA and the accountancy firms, Table 9 provides a comparison of their expressed views.

On average, there is a stronger inclination towards planned behaviour on technology adoption by ISCA as compared to accountancy firms (ISCA: 4.3 versus Accounting Practitioners: 4.1).

This is especially so where it concerns the intention to engage.

However, for subjective norms on technology adoption, ISCA has scores which are consistently lower than those of accounting practitioners.

Nonetheless, both ISCA and the accountancy firms exhibit coherence in their perspective on several aspects of planned behaviour towards technology adoption: attitude, subjective norms, planned behaviour and intention to engage.

In addition, both ISCA and accountancy firms say that they have a lower than neutral level of agreement towards the statement: “Accounting practitioners have the available organizational resources to adapt to technological advances in accountancy.” (ISCA: 3.0 and accountancy professionals: 3.8).

This could suggest that both groups have some concerns about the adequacy of available organizational resources to adapt to technological advances.

Table 9: Views on planned behaviour towards technology adoption

(1 – Fully disagree and 5 – Fully agree)

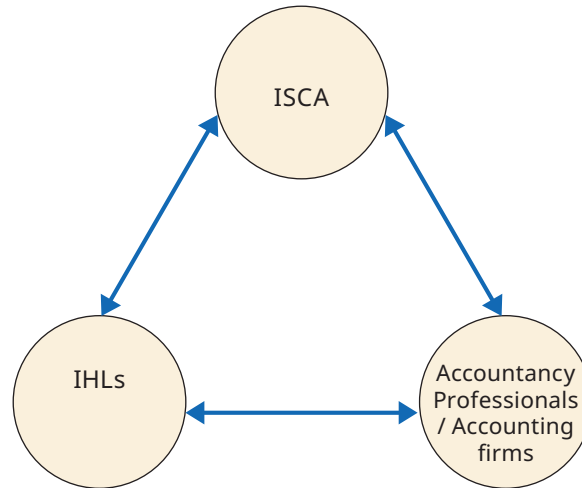
	ISCA	Accountancy practitioners
Attitude		
a. Accounting practitioners will benefit from adapting to the technological advances in accountancy.	5.0	4.3
b. Accounting practitioners can create more value as they adapt to technological advances in accountancy.	5.0	4.4
c. Accounting practitioners will find it rewarding to adapt to technological advances in accountancy.	5.0	4.5
Subjective norms		
a. Accounting leaders think that the profession should adapt to technological advances in accountancy.	4.0	4.5
b. Accounting practitioners think that the profession should adapt to technological advances in accountancy.	4.0	4.6
c. The regulators of the profession think that the profession should adapt to technological advances in accountancy.	4.0	4.3
Perceived behavioural control		
a. It is easy for accounting practitioners to adapt to technological advances in accountancy.	4.0	3.7
b. Accounting practitioners have the available organizational resources to adapt to technological advances in accountancy.	3.0	3.8
c. Accounting practitioners have the available financial resources to adapt to technological advances in accountancy.	4.0	3.6
d. Accounting practitioners are provided with accessible continuing professional development programmes related to technological advances in accountancy.	5.0	4.0
Intention to engage		
a. Accounting practitioners are committed to adapting to technological advances in accountancy.	4.0	3.6
b. Accounting practitioners are planning to adapt or continue to adapt to technological advances in accountancy.	5.0	3.9
Overall average	4.3	4.1

Roadmap to enhance technology adoption in the accountancy sector in Singapore

Given the survey of the three key groups of stakeholders in the accountancy sector in Singapore on their technology adoption, this section weaves their responses together to propose a possible roadmap to enhance technology adoption for the sector in Singapore.

Figure 31 shows the symbiotic relationships and dependencies between the three groups of stakeholders: ISCA, IHLs and accountancy professionals/firms.

Figure 31: Symbiotic relationships and dependency between ISA, IHLs and accountancy professionals



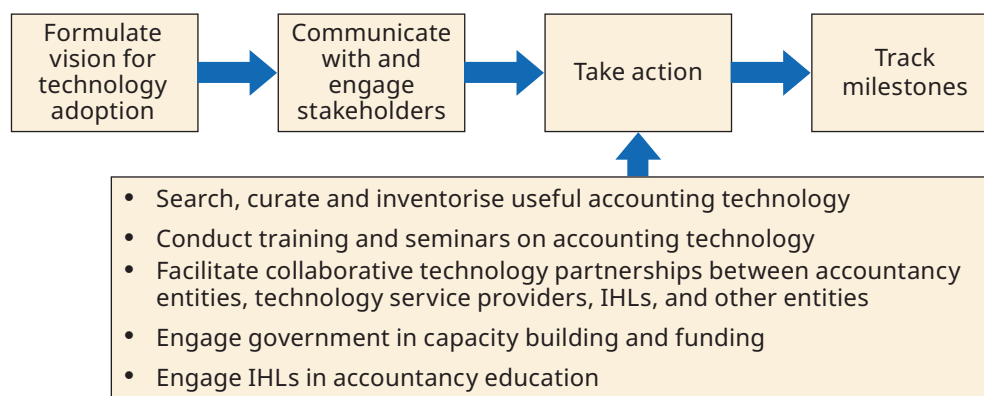
For effective and productive symbiotic relationships, these three parties have to work together in the areas of information sharing, communication of their strategic intentions, collaborative actions and fulfilment of their individual mission and vision.

1. The starting point on the roadmap is that the three parties must affirm the fact that they need each other. They must be in a collaborative multi-period setting in which trust and open communication must characterise their relationships.
2. The end goal is to enable the accountancy sector to be vibrant, nimble and agile in harnessing the use of technology to reap productivity, uphold its reputation, enhance professionalism, sharpen effectiveness and increase profitability gains. This is a common goal and objective of the three parties.
3. With the first step and the end goal in mind, each group will play different roles and contribute to progress in the accountancy profession.

ISCA

4. ISCA as the professional accountancy body in Singapore is an enabler as it envisions how technology will add value to the accountancy profession.

Figure 32 provides a possible roadmap for ISCA.

Figure 32: Possible roadmap for ISCA

5. ISCA will have to:

- a. promulgate a clear vision of technology adoption for the accountancy sector. As the enabler, it sets the tone and the direction for the accountancy sector in technology adoption.
- b. Work closely with IHLs and accountancy professionals/firms through discussions and feedback on technology innovations and needs.
- c. Embark on concurrent and calibrated actions which include:
 - i. Searching the technology space for advances in accounting technology.
 - ii. Curating and inventorising useful accounting technology applications.
 - iii. Conducting training and seminars on accounting technology.
 - iv. Facilitating the setting up of collaborative technology platforms for accountancy entities, especially the smaller entities.
 - v. Engaging accountancy entities, especially the smaller ones, to draw up a strategic technology adoption roadmap for themselves.
 - vi. Engaging the government in building up capacity and securing funding on accounting technology.
 - vii. Engaging IHLs on accountancy education to produce technology-inclined accountancy graduates through the revision of accreditation requirements.
- d. Track the progress of technology adoption and publicize success stories.

Institutes of Higher Learning (IHLs)

6. IHLs are the key education partners which produce accountancy graduates with the necessary technology skills and knowledge for the industry. This can be achieved by:
 - a. Working closely with ISCA and accountancy professionals/firms to understand the technology needs and innovations that are taking place in the industry.
 - b. Collaborating with the experts in the industry to incorporate curated technologies into the curriculum of accountancy training.
 - c. Training and producing technology-inclined accounting instructors who are able to transfer technological and technical know-how to students.
 - d. Establishing close relationships with the industry by having reciprocal exchanges of accounting instructors and accountancy professionals. This can be done by seconding accounting instructors to the accountancy industry on attachment and for accountancy professionals to teach at the IHLs.

- e. Providing feedback to ISCA on accreditation requirements to make them relevant and dynamic to meet the needs of the accountancy sector.
- f. Tracking progress and publicising success stories in educating and training accountancy students in technology adoption.

Accountancy professionals / firms

7. Accountancy professionals and accountancy firms are the key producers of quality accountancy services. They can contribute to technology adoption by:
 - a. Formulating a technology adoption roadmap for themselves or their firms. This will include a technology gap analysis and an articulated strategic technology acquisition plan.
 - b. Working closely with ISCA and IHLs on the collaborative and informative articulation of their technology needs.
 - c. Collaborating with ISCA and the IHLs for the continuous training of staff to keep pace with technological advances.
 - d. Working closely with ISCA and the government to implement technology adoption roadmaps.
 - e. Working closely with IHLs to influence the training of accountants.
 - f. Partnering IHLs to carry out exchanges of accounting instructors and accountancy professionals.
 - g. Tracking the progress of technology adoption and publicizing success stories.

Please refer to Appendix A for a checklist of actions to adopt technology for each of the three groups of stakeholders.

Overall summary

The purpose of this study is to have a pulse on technology adoption in the accountancy profession from the perspective of Professional Accounting Organizations (PAOs), accountancy professionals/firms and accountancy schools.

The findings will inform PAOs, accountancy professionals/firms and accountancy schools on the concrete steps and strategies required to enable the accountancy profession to navigate this digital transformation.

The general findings of the study are that all parties are aware of technological advances and are taking steps to harness them.

In particular, the key finding is that ISCA is taking a leadership position with a technology adoption roadmap to guide its actions in helping the accountancy sector address technology disruption.

The IHLs are also introducing technology courses in their curricula to equip students with the necessary technology and skills.

Similarly, accountancy professionals/firms have articulated a positive attitude and approach towards technology adoption.

Given the findings, a roadmap to enhance technology adoption for the accountancy sector in Singapore is proposed with a checklist of actions.●

Appendix A: Checklist of actions to implement technology adoption

Professional Accounting Organizations

	Yes	No	In-Progress
1. Has a technology adoption roadmap been formulated?			
2. Is there a mechanism and strategy to engage the IHLs and the accountancy professionals/firms through discussions and feedback on technology innovations and needs?			
3. Is there a mechanism for searching the technology space for advances in accounting technology?			
4. Is there a mechanism and strategy to curate and inventorise useful accounting technology applications?			
5. Is there a mechanism and strategy to conduct training and seminars on accounting technology for accountancy professionals?			
6. Is there a mechanism and strategy to facilitate collaborative technology platforms for accountancy entities, especially the smaller accountancy entities?			
7. Is there any scheme to render help and advice to accountancy entities to have a strategic technology adoption roadmap for their firms?			
8. Are there strategic and intentional efforts to engage the government in capacity building and funding accounting technology adoption?			
9. Is there a mechanism or strategy to engage IHLs to contribute their views on accounting education to produce technology-inclined accounting graduates through revisions in accreditation requirements?			
10. Is there a process in place to track the progress of technology adoption and publicize success stories?			

Institutes of Higher Learning (IHLs)

	Yes	No	In-Progress
1. Is there a mechanism and strategy to engage ISCA and accountancy professionals/firms through discussions and feedback on technology innovations and adoption?			
2. Is there a mechanism to collaborate with experts in the industry to incorporate curated technologies into the accountancy training curricula?			
3. Is there a mechanism and strategy to train and produce technology-inclined accounting instructors who can transfer technology to students?			
4. Is there a mechanism and strategy to establish close relationships within the industry by having reciprocal exchanges of accounting instructors and accountancy professionals?			
5. Is there a mechanism and strategy to provide feedback to ISCA on accreditation requirements to make them relevant and dynamic to meet the needs of the accountancy sector?			
6. Is there a process in place to track the progress and publicise success stories in educating and training accountancy students in technology adoption?			

Accountancy Professionals / Firms

	Yes	No	In-Progress
1. Has a technology adoption roadmap been formulated?			
2. Is there a mechanism and strategy to work closely with ISCA and the IHLs to create a collaborative and informative articulation of technology needs?			
3. Is there a mechanism and strategy to collaborate with ISCA and the IHLs for the continuous training of staff to be technologically equipped?			
4. Is there a mechanism and strategy to engage ISCA or the government or IHLs to implement their technology adoption roadmap?			
5. Is there a mechanism and strategy to work closely with the IHLs to influence the training of accountants?			
6. Is there a mechanism and strategy to partner with IHLs in exchanges of accounting instructors and accountancy professionals?			
7. Is there a process in place to track the progress of technology adoption and publicize success stories?			

Appendix 11: Thailand & Lao PDR

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Abstract

This paper examines the levels of awareness, adoption and utilization of emerging technology in accounting practices and education in Thailand and the Lao People's Democratic Republic (Lao PDR).

An online survey and semi-structured interviews were conducted. Respondents are categorized into 3 groups, namely professional accounting organizations, accountancy practitioners and accountancy schools.

It is found that most respondents from the 3 groups recognize the importance of incorporating emerging technology into accounting practices.

However, the levels of awareness, adoption and utilization of emerging technology are limited.

In Thailand, technologies which are commonly known and utilized are data analysis/big data, cybersecurity, cloud computing and robotic process automation. In Lao PDR, the levels of awareness, adoption and utilization are low for all emerging technologies.

Competency of instructors of institutions of higher learning to teach emerging technology is also limited.

While in Thailand, accountancy schools are able to teach emerging technology primarily at the foundation level, in Lao PDR, some accountancy schools do not have the competency to teach technology components at all.

Lack of knowledge of technology and resources, including financial resources, are among the key barriers to the adoption of and adaptation to new technology.

Drawing on findings from this study, it is recommended that professional accounting organizations play active roles in raising awareness of emerging technologies and their implications for accounting practices. They can be a platform for knowledge generation, knowledge dissemination and resource sharing for practitioners and educators.

To enable accountancy academics to keep up to date with emerging technology and enhance their ability to integrate technology into accountancy curricula, it is suggested that closer collaboration between accountancy academics and IT experts – this latter comprising academics and those from industry – is essential.

The accountancy curriculum should also place more emphasis on developing the mindset and skills of students to enable them to recognize challenges, be willing to embrace changes and be able to learn new things.

Introduction

Digitization and technological disruption have created significant changes, challenges and possibilities for accountancy organizations and the accountancy profession. Via the ‘Internet of Things’, everything becomes connected to everyone (Chui et al, 2010).

With mobile technology, social media and cloud computing, organizations are able to store, access and share resources conveniently without excessive costs (Bhimani and Willcocks, 2014).

In 2013, the Association of Chartered Certified Accountants (ACCA) identified 10 technology trends and their impact on the accountancy profession (The ACCA, 2013). The 10 trends include mobility, cloud, social collaboration, digital service delivery, big data, payment systems, cybersecurity, robotics, augmented and virtual reality, and artificial intelligence.

The ACCA argues, “*Unless accountants embrace technology, they will follow the dinosaur into extinction – individually and as a profession.*” (ibid, p.14). The ACCA also suggests that Chief Financial Officers (CFOs) must know about technology as much as they do about financial management, and accountants will need to re-skill in order to remain relevant (ibid.).

While it is important that accountants utilize and leverage technology, professional accounting organizations (PAOs) and accounting education providers can play an important role in facilitating the learning process.

On the one hand, PAOs can be centres for developing, disseminating and sharing resources and knowledge necessary for accountancy practitioners to develop their knowledge and skills. Continuing professional education can be provided to help practitioners keep up to date with the latest emerging technology.

On the other hand, accounting education providers can integrate emerging technology into their curriculum and develop essential skills and competencies for accounting students to ensure that their students are well-prepared to work in a world where technology rules.

With the rapid advancement of sophisticated technology and its implications for the accounting profession, this study examines the levels of awareness, adoption and utilization of emerging technology among accountancy practitioners.

It also explores the views of PAOs on digital disruption to the accounting profession and how they may facilitate their members to deal with the challenges.

Moreover, the study investigates how institutions of higher learning have integrated emerging technology into their accountancy curriculum.

The study attempts to answer the following research questions:

1. To what extent are accountancy practitioners aware of and utilizing emerging technology in their work?
2. How do professional accounting organizations perceive benefits and challenges of adopting and utilizing emerging technology in accounting work?
3. To what extent have institutions of higher learning integrated emerging technology into their accountancy curriculum?

The study aims to:

1. Obtain an understanding of the current state of awareness, adoption and utilization of

- emerging technology among accountancy practitioners,
2. Identify key challenges faced by accountancy practitioners in adopting and utilizing emerging technology, and
 3. Identify key concerns and challenges faced by institutions of higher learning in integrating emerging technology into accountancy curriculum.

Findings from the study will provide a basis for professional organizations and institutions of higher learning to develop accountancy practitioners who are well-equipped with the necessary knowledge and skills which will enable them to embrace technology to work effectively and efficiently.

This report focuses specifically on the awareness, adoption and utilization of technology among accountancy practitioners in Thailand and Lao PDR and the integration of emerging technology into the accountancy curriculum in the 2 countries.

This study is part of a broader research project which surveys the issues of technology adoption in countries across the Association of Southeast Asian Nations (ASEAN). Although there are high shares of regional trade and capital flows within ASEAN, these neighbouring countries have very high cultural diversities (Tonby et al., 2019).

Development of accounting practices and education are also different due to differences in the nature of the country's political and legal system, the nature and power of financial capital providers, the influence of taxation and the strength of the accounting profession (Bounmanit, 2010).

Thailand and Lao PDR are neighbouring countries and share similar languages and many cultural aspects. However, their political and economic systems differ. These differences have led to significant differences in the development of the accountancy profession and education in the 2 countries.

In Thailand, accounting education was initially influenced by the British model, as the 2 pioneers who played a significant role in developing accounting education and profession obtained their qualifications from the Association of the Institute of Chartered Accountants in England and Wales. However, later developments in accounting practices and the accountancy profession were heavily influenced by the US. This is the result of the operations of US-based corporations and economic assistance agreements (Pholkeo, 2013).

In Thailand, the Accountant Association of Thailand (AAT) was established in 1948. It was renamed the Institute of Certified Accountants and Auditors of Thailand (ICAAT) in 1975. In 2004, it adopted its current name, the Federation of Accounting Professions (FAP). Under the Accounting Professions Act B.E.2547 of 2004, the FAP is the only PAO in Thailand which awards the Certified Public Accountant credential. It is also authorized to establish initial professional development and continuing professional development requirements for professional accountants in Thailand. International educational standards are adopted (<https://www.ifac.org/about-ifac/membership/profile/thailand>) as the reference for the assessment of professional qualifications.

As for Lao PDR, after gaining its full independence from France in 1954, the educational and economic systems, as well as the accounting system, were strongly influenced by the French system (Bounmanit, 2010). During 1975-1985, Lao PDR implemented a centrally planned economic system. During this period, its accounting rules and regulations were

used mainly to establish an information and reporting system for the implementation of the government's economic policies and for maintaining control over state assets (*ibid.*). In 1986, the government adopted a new policy, aiming at transforming the economy into a market-oriented system. With economic reform, fundamental changes in accounting systems were needed. The Ministry of Finance issued the Lao General Accounting Plan, with technical assistance from France. The system was statute-based and dominated by taxation requirements (*ibid.*).

The Laos Chamber of Professional Accountants and Auditors (LCPAA) was established in 1998 with the goal of uniting accountancy professionals in the country. The organization offers Certified Public Accountant licences for its members. The Law on Independent Audit of 2014 authorizes the LCPAA, under the oversight of the Ministry of Finance, to set the requirements for initial professional development and continuing professional development in Lao PDR. International educational standards are partially adopted (<https://www.ifac.org/about-ifac/membership/profile/lao-pdr>).

In Lao PDR, there is a shortage of qualified local accounting firms; consequently, banks, insurance companies and most large corporations use services from large international auditing firms (Bounmanit, 2010). These international firms rely heavily on their foreign professional accountants. Small local firms focus primarily on tax and bookkeeping services for SMEs (*ibid.*).

The remainder of this paper is structured as follows. The next section discusses the research methodology. Then, findings from Thailand and Laos PDR are presented, followed by discussions, and the conclusion, implications and limitations of the study.

Methodology

To examine the level of awareness, adoption and utilization of technology among accountancy practitioners, perception of professional accounting organizations and the integration of emerging technology into the accountancy curriculum in Thailand and Lao PDR, a survey, using self-administered electronic questionnaires and semi-structured interviews, was conducted.

Different sets of questions were sent to 3 groups of respondents, namely accountancy practitioners, PAOs and institutions of higher learning which offer accountancy undergraduate degree programmes.

As previously discussed, this study is part of a broader research project which examines the issues across the ASEAN countries. Therefore, questionnaires which contain the same set of questions are used. The questionnaires, initially worded in English, were translated into Thai. For Thai respondents, the Thai version of the questionnaires was disseminated. As for respondents in Lao PDR, the English version of the questionnaires along with the Thai translation were distributed.

To disseminate the questionnaire to accountancy practitioners in Thailand, 4 large international accounting firms were contacted to identify appropriate respondents. A link to the online questionnaire for practitioners was then sent to the identified respondents.

A similar approach was taken for the questionnaire for institutions of higher learning. A list of institutions of higher learning which offer an undergraduate accounting

degree accredited by the FAP was obtained. Telephone calls were then made to identify appropriate respondents.

Out of the 156 institutions on the list, 2 institutions cannot be reached, and 5 institutions reported that the institutions no longer offer undergraduate accounting programmes.

Therefore, a link to the electronic questionnaire was sent to 149 institutions. 23 responses were received, which makes the response rate 15.44%. As for PAOs, a semi-structured interview method was used.

The interviews were conducted with 2 committee members of the FAP, one representing auditing professionals and the other representing accounting professionals.

In addition to the FAP, 4 associations related to the accountancy profession – 2 accounting and 2 auditing – were contacted.

The management of the 4 associations was interviewed to obtain a fuller view of the respective professional organization's perception regarding digital disruption, its implications for the accountancy profession and challenges faced by members.

To disseminate questionnaires in Lao PDR, the LCPAA was contacted. An overview of the research project, research questions and objectives were explained. Links to the electronic questionnaires for accountancy practitioners, PAO and accountancy schools were then sent to the staff of the LCPAA to help disseminate the questionnaires. 3 responses from accountancy practitioners, 1 response from a PAO and 5 responses from institutions of higher learning were received. As the total number of accountancy practitioners and accountancy schools is not known, the response rate cannot be determined.

To analyse the data, descriptive statistics and frequency counts are used. Statistical generalization cannot be made due to the small sample size. The quantitative analysis is supplemented by qualitative data obtained from the interviews.

Findings

This section presents findings of the study. Findings from Thailand will be presented first, followed by those from Lao PDR.

Findings are shown for the 3 categories of respondents, starting with PAOs, followed by institutions of higher learning and accountancy practitioners.

Thailand

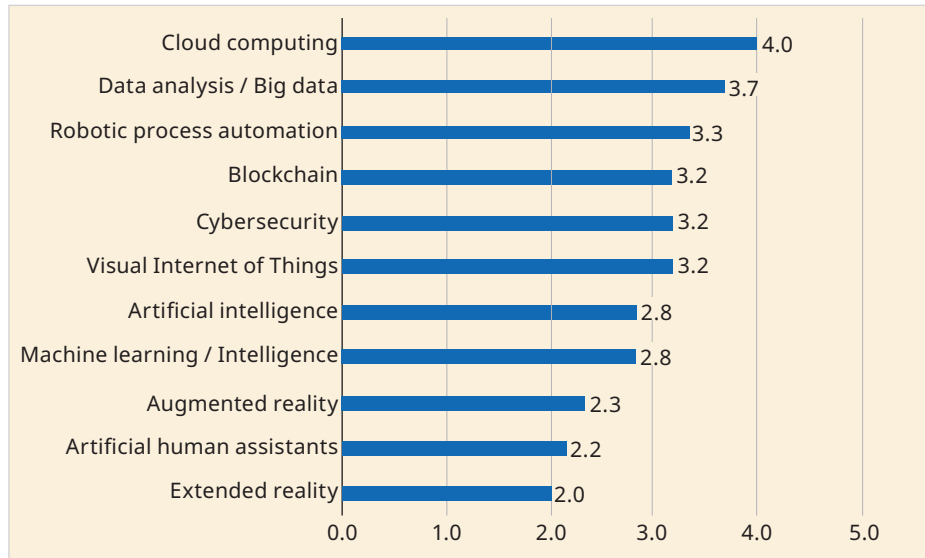
Professional accounting organization (PAO)

PAOs play an important role in facilitating technology adoption in the accountancy profession, as they curate the technology adoption environment. Semi-structured interviews were conducted with management or board members of 6 PAOs. 4 of the 6 PAOs have been operating for more than 10 years. 4 PAOs have a membership size of less than 5,000 members and have less than 50 staff. All the PAOs have a digital technology roadmap to upscale the accounting profession. Responses to the questionnaire are detailed in the figures below.

Figure 1 shows the PAOs' level of technology awareness. It can be seen that cloud computing is the technology of which the respondents are the most aware, followed by data analysis/big data and robotic process automation.

Figure 1: Awareness of the selected emerging technologies

(1 – Not aware at all and 5 – Fully Aware)



From Figure 2, for technology utilization, cloud computing, data analysis/big data and cybersecurity are the top 3 utilized technologies, whereas augmented reality is the least utilized. It should be noted that blockchain has a low level of awareness (1.7), as shown in Figure 2. One of the plausible explanations for this is the lack of expertise in this technology.

Figure 2: Utilization of the selected emerging technologies

(1 – Never utilize and 5 – Always utilize)

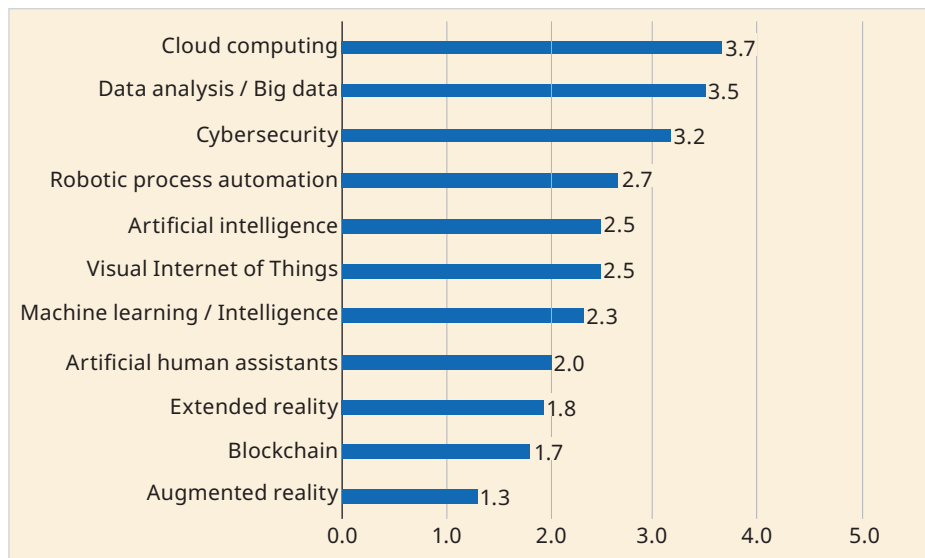
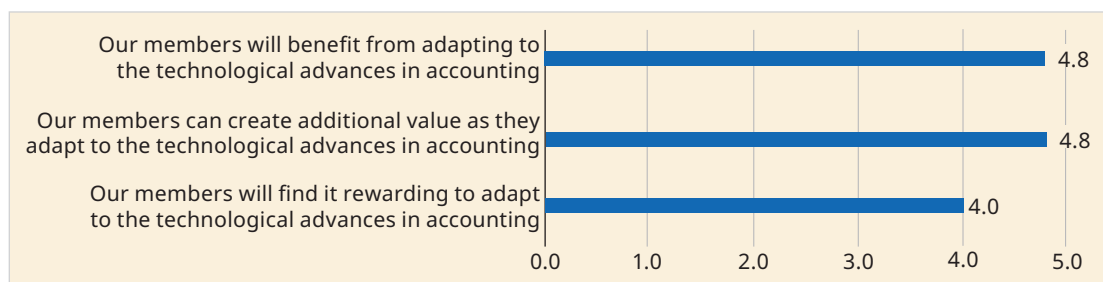


Figure 3 illustrates PAOs members' attitude towards technology. From the PAOs' perspective, the members of the PAOs have a positive attitude towards technology. It is believed that members of the PAOs will find it rewarding, can gain benefits and create higher value when they adapt to the technological advances in accounting.

Figure 3: Attitude towards technology

(1 – Strongly disagree and 5 – Strongly agree)



Respondents highly agree that regulators, members of PAOs, key PAO leaders and senior leaders in the profession believe that the accounting profession should adapt to technological advances in accounting. The average scores are 4.0 and above, as is shown in Figure 4.

Figure 4: Subjective norm

(1 – Strongly disagree and 5 – Strongly agree)

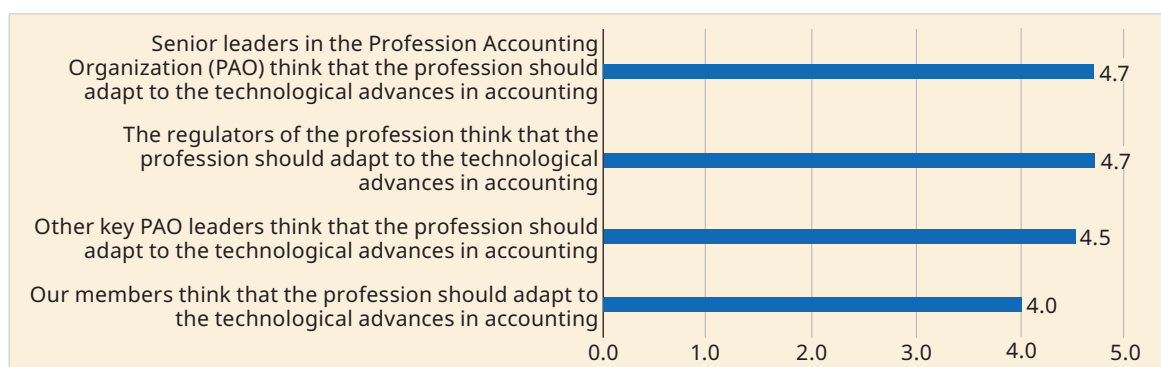
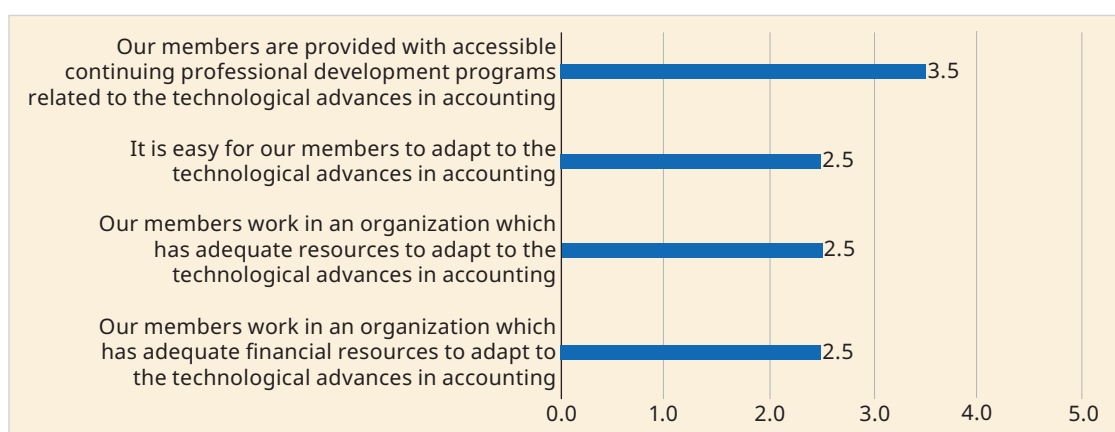


Figure 5 provides the responses about the attitude towards readiness for technology adaptation. From the PAOs' perspective, they agree to a fair extent that their members are provided with accessible continuing professional development programmes related to the technological advances in accounting. However, they express some concerns regarding the adequacy of resources, including financial resources, necessary for technology adaptation.

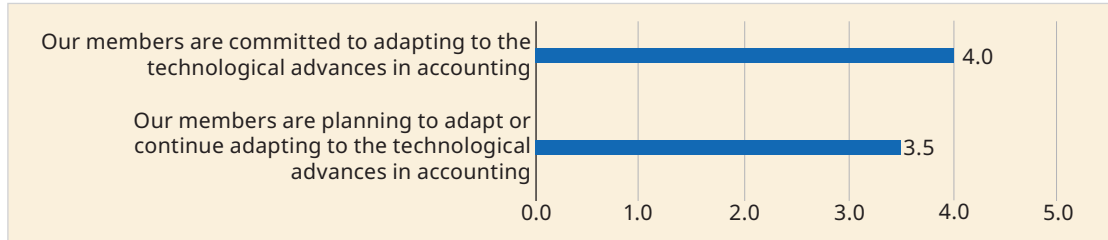
Figure 5: Attitude about readiness for technology adaptation

(1 – Strongly disagree and 5 – Strongly agree)



As for the intention to engage, the PAOs anticipate that their members are planning and are committed to adapting to technological advances in accountancy. The evidence is provided in Figure 6.

Figure 6: Intention to engage
(1 – Strongly disagree and 5 – Strongly agree)

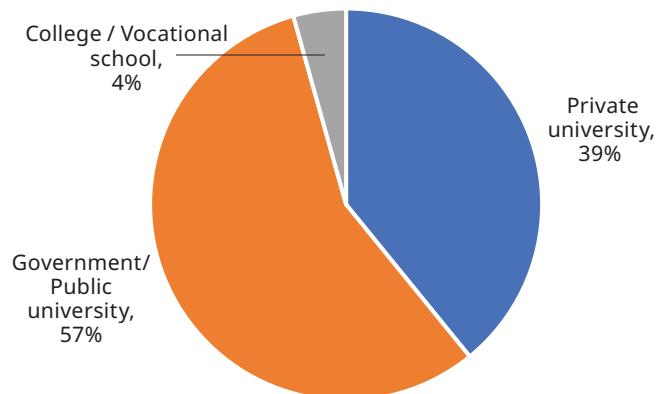


In summary, the PAOs believe that their members are aware of and utilize some of the technologies but there are concerns about readiness for technology adaptation and the adequacy of financial resources.

Institutions of Higher Learning (IHLs)

Figure 7 shows that the majority of the respondents are government/public universities (56.5%), followed by private universities (39.1%) and colleges/vocational schools (4.3%).

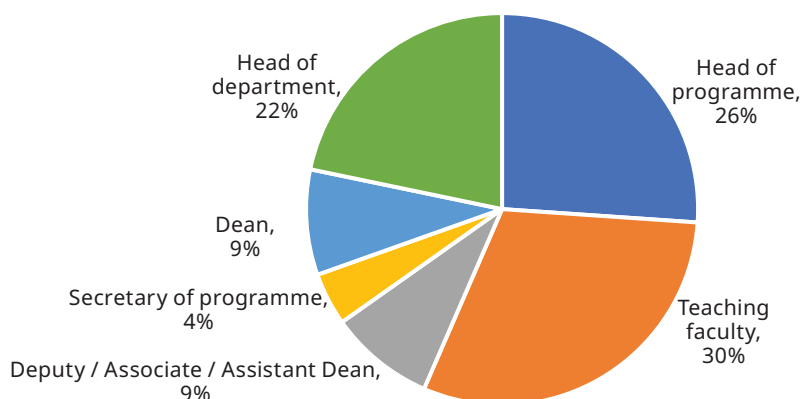
Figure 7: Demographics of the responding Institutions of Higher Learning



The number of years that the IHLs have been offering accountancy programmes ranges from 9 to more than 80. The number of annual enrolled students ranges from 88 to 900.

Most of the accountancy schools have received national accreditation and some of them are accredited by international bodies, for example, the Association to Advance Collegiate Schools of Business (AACSB), European Foundation for Management Development (EFMD) Quality Improvement System (EQUIS) and Association of MBAs (AMBA).

The respondents are primarily faculty members teaching in the accounting programmes, heads of the programmes or heads of accounting departments as shown in Figure 8 below.

Figure 8: Breakdown of the positions of the respondents

The respondents were asked to indicate their level of awareness of the given emerging technologies. Figure 9 shows that the respondents are moderately aware of the emerging technologies, especially data analysis/big data (3.9), cloud computing (3.8) and cybersecurity (3.7) in descending order of the level of awareness.

Figure 9: Level of awareness of selected emerging technologies

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

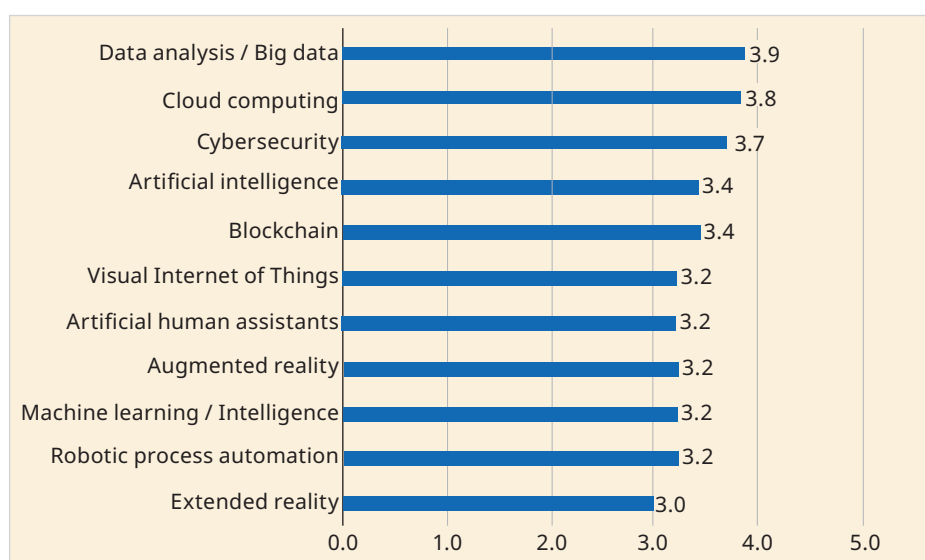


Figure 10 exhibits the level of competency to teach technology in accountancy schools. The highest competency levels are found for data analysis/big data (2.9), cloud computing (2.6) and cybersecurity (2.5), which concur with the level of technology awareness shown in Figure 9.

It can be seen that accountancy schools are aware of these 3 technologies and develop the competency to respond to them. However, there are competency gaps in the teaching of the other technologies.

Figure 10: Level of competency to teach selected emerging technologies

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

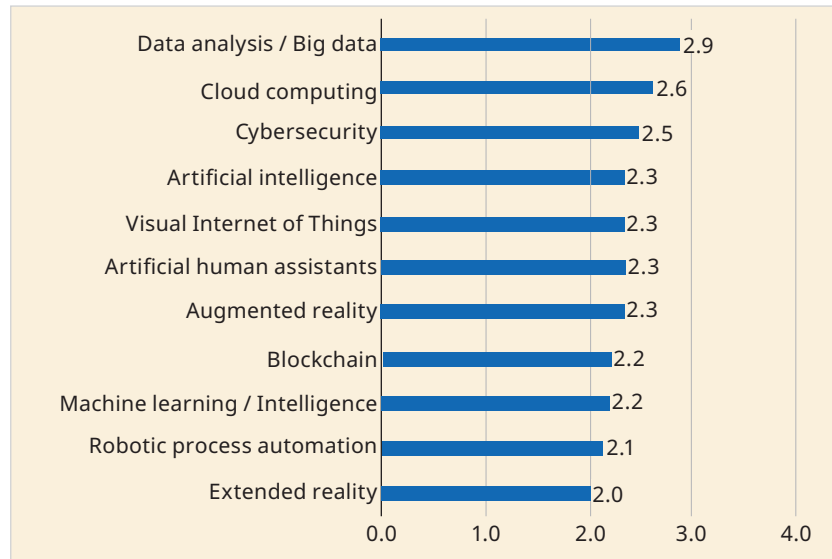


Figure 11 summarizes the opinion on how important a given technology is to be incorporated into accountancy courses. The result shows that data analysis/big data (4.7), cloud computing (4.4), cybersecurity (4.3) and blockchain (4.3) are perceived as very important whereas other technologies are rated as moderately important.

Figure 11: Level of importance of incorporating the selected emerging technologies into the accountancy curriculum

(1 – Not important and 5 – Very important)

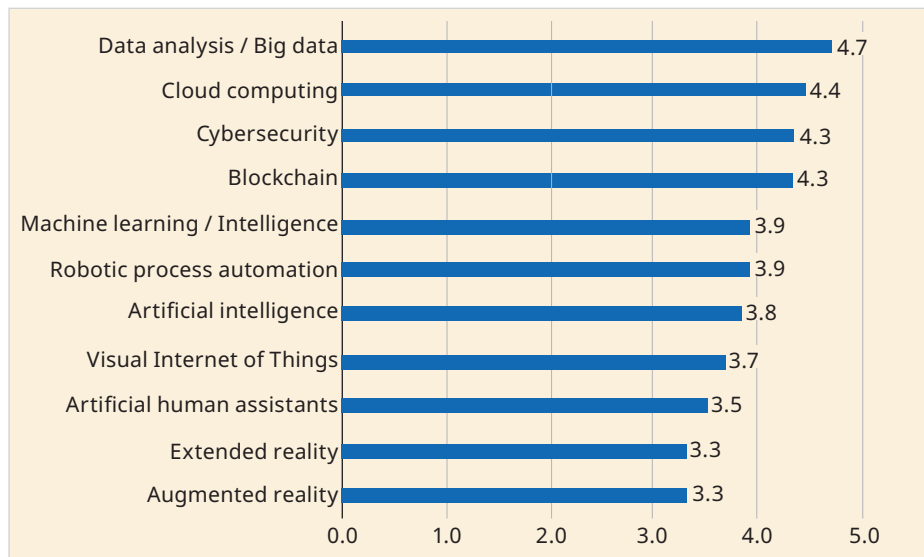


Figure 12 is the response to the question about the level to which technology has been incorporated into the accountancy curriculum. The result shows that most of the institutions have incorporated technology into their curriculum at the foundation level.

The technologies that have the highest scores as regards incorporation into accountancy curricula are data analysis/big data (2.9), cloud computing (2.7), cybersecurity (2.5) and blockchain (2.2). This is consistent with the perceived level of importance of the technologies.

Figure 12: Level of incorporation of selected emerging technologies into accountancy curriculum

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

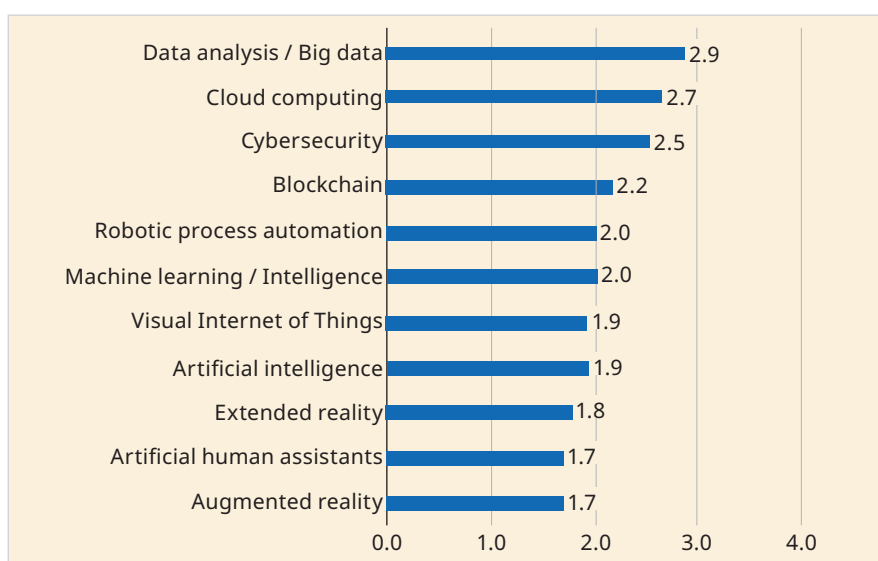


Figure 13 indicates the technological tools, which the institutions currently use or have embedded in their accountancy courses in the last 3 years. The figure shows that accounting software (4.5) is the most used tool, followed by Microsoft applications (4.4) and video conferencing (4.1) and group collaboration tools.

Figure 13: The use of technological tools in the accountancy curriculum

(1 – Never used and 5 – Frequently used)

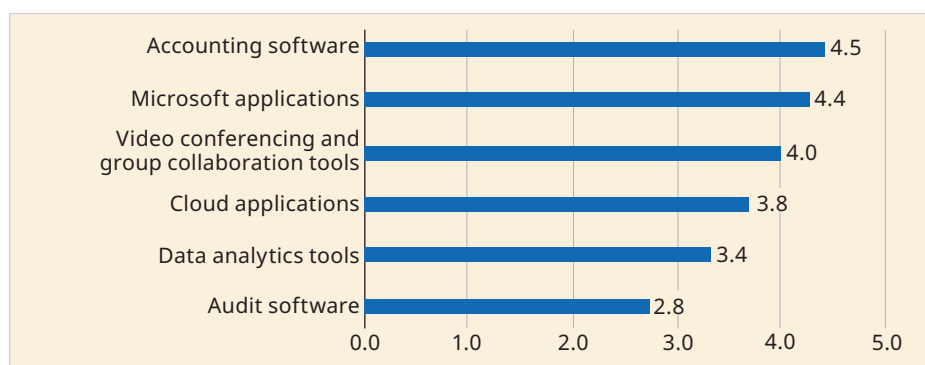
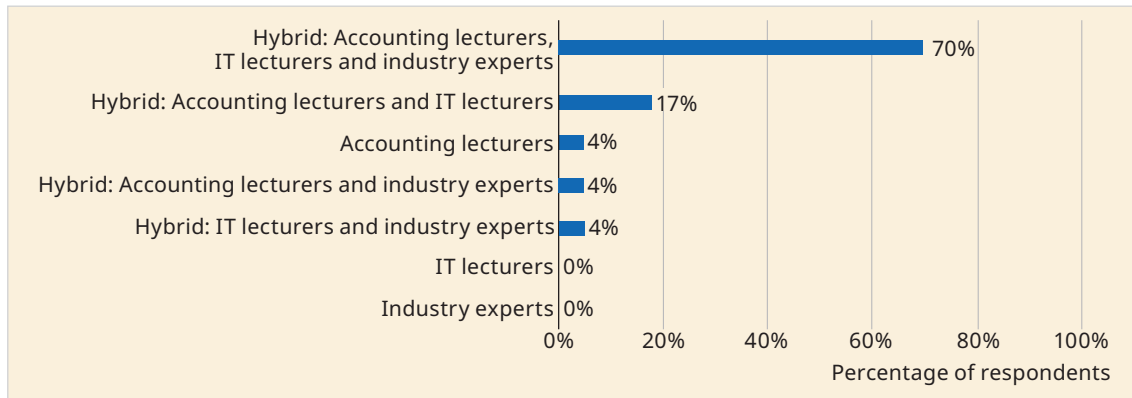
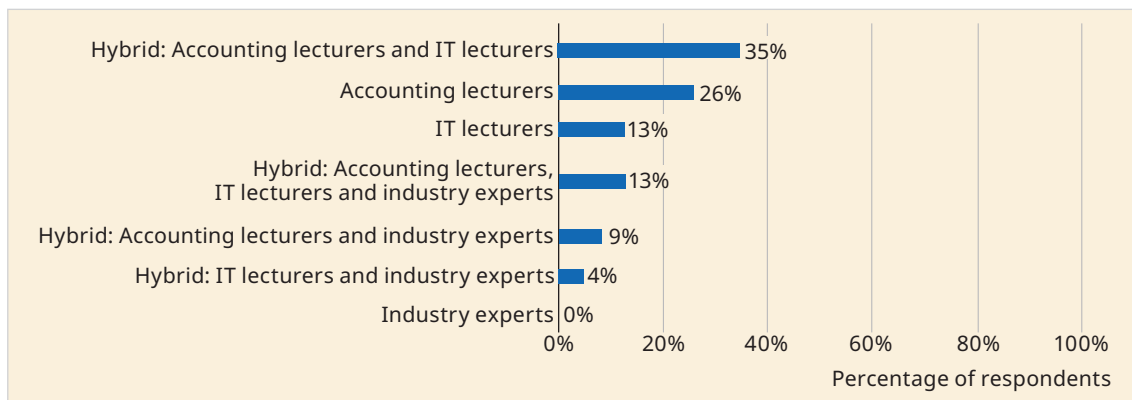


Figure 14 shows the responses to the question about who should teach the technology components in the accountancy programme. The respondents believe that technology should be taught by a combination of accounting lecturers, IT lecturers and industry experts (69.6%) and by accounting lecturers and IT lecturers (17.4%).

None of the respondents suggests that it should be taught solely by IT lecturers or industry experts.

Figure 14: Who should teach technology in the accountancy curriculum

Whereas most respondents perceive that technology should be taught by a combination of accountancy lecturers, IT lecturers and industry experts, the current situation demonstrates that industry experts do not have much of a role in the teaching team as shown in Figure 15. This can lead to further exploration of how to pursue industry experts to be part of the technology teaching team.

Figure 15: Who currently teaches technology in the accountancy curriculum

Regarding the barriers to technology adoption, the respondents could select multiple answers. Figure 16 shows that all the respondents selected the “lack of experts in emerging technology” (100.0%) as one of the barriers. This is followed by the “lack of funding for the establishment of facilities in the emerging technology areas” (78.3%) and the “lack of understanding of the emerging technology” (69.6%).

Figure 16: Barriers to incorporating emerging technologies in the accountancy curriculum

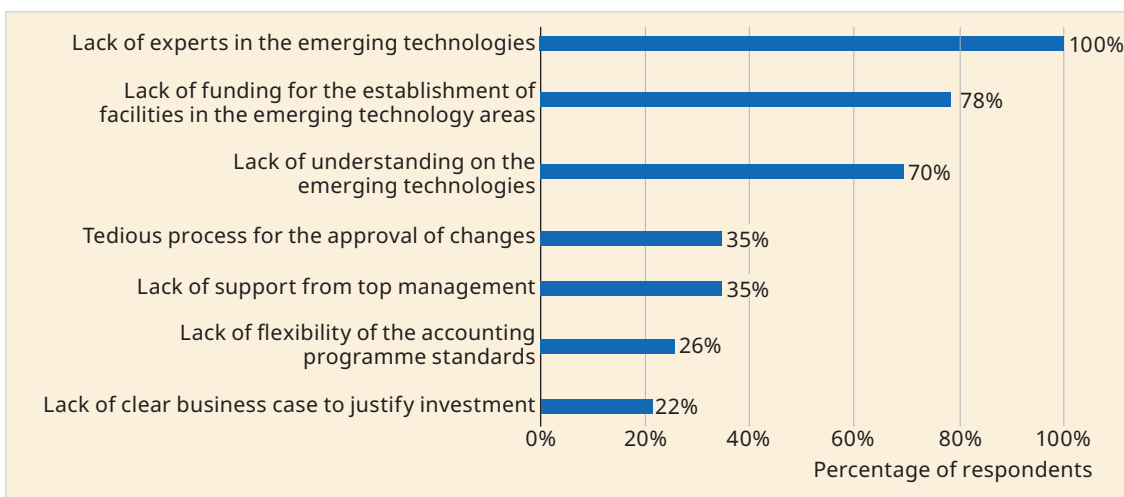


Figure 17 shows the level of assistance required in order to integrate emerging technologies into existing courses/modules. The assistance needed for “training in the emerging technology”, “training in curriculum design and integration” and “opportunities for industrial attachments” are all highly rated.

Figure 17: Level of assistance required

(1 – No need and 5 – Most needed)

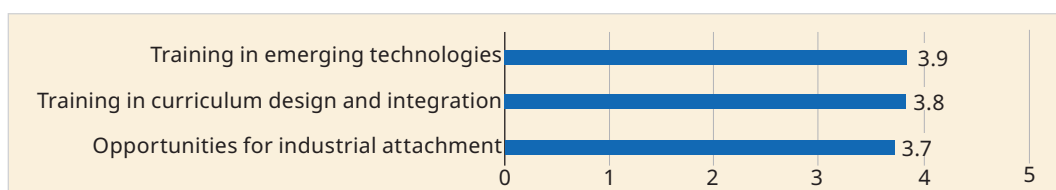
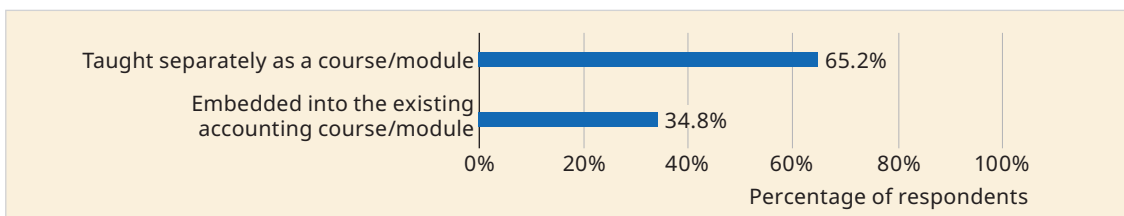


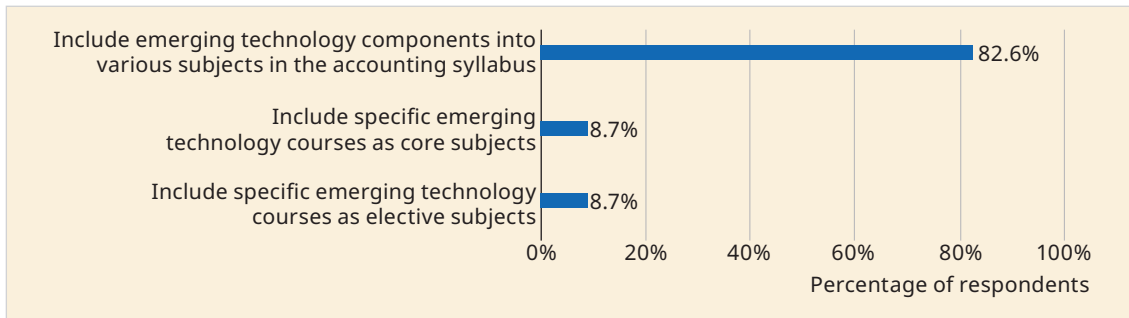
Figure 18 shows the opinions on the ways in which emerging technology can be integrated into the accounting programme. 65.2% of the respondents indicate that the technology should be taught separately as a course/module.

Figure 18: How should technology be integrated into the accountancy curriculum



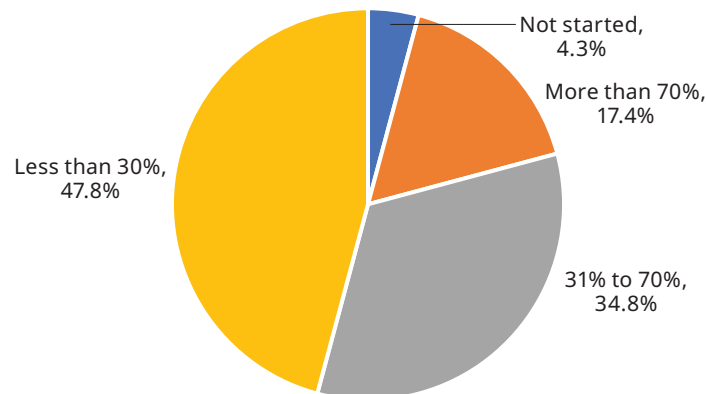
When the respondents were asked what, in their view, is the preferred approach to incorporate emerging technology into the accountancy curriculum, the responses in Figure 19 show that the majority of the respondents (82.6%) select “include emerging technology components into various subjects, including core courses and elective courses” as their response.

Figure 19: The preferred approach to embedding emerging technology into the accountancy curriculum



The respondents were further asked to identify the stage of adoption of technology in their accountancy curriculum. Figure 20 shows that only 17.4% of the accountancy schools have attained more than 70% progress in adopting technology into the accountancy curriculum.

Figure 20: The current stage of technology adoption in accountancy curriculum



In summary, institutions of higher learning in Thailand recognize the importance of emerging technology. However, the level of technology integration into the accountancy curriculum is still at the foundation or intermediate level. Furthermore, the competency to incorporate emerging technology into the accountancy curriculum is rather limited. Additional support in terms of funding and training is needed.

Accountancy practitioners

This section contains the perspective of accountancy practitioners in Thailand.

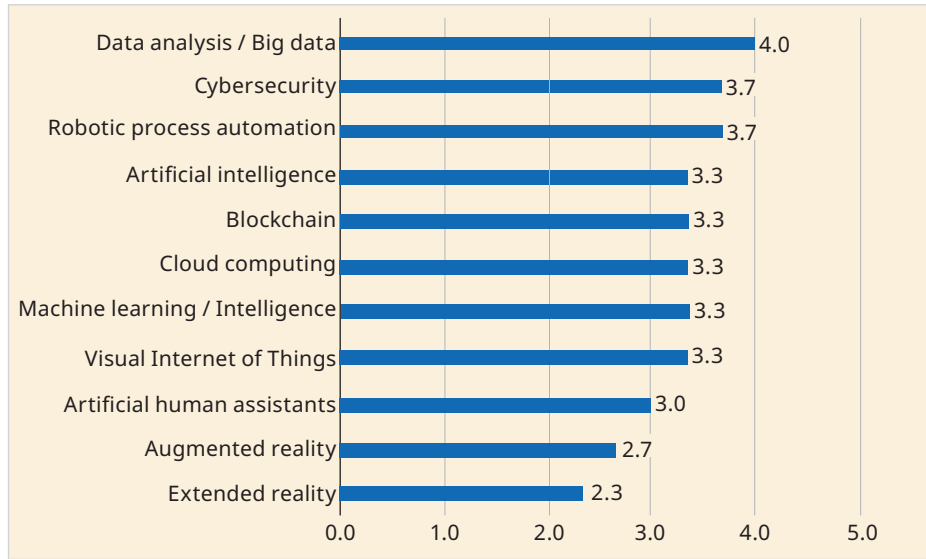
All the respondents are owners/partners/top management of auditing firms. All firms are limited companies. They have been operating for more than 9 years with more than 50 staff.

The number of partners/management staff of the companies ranges from 30-100 people.

Figure 21 demonstrates the awareness of practitioners of the selected technologies. It can be seen that the practitioners are mostly aware of data analysis/big data, whereas extended reality and augmented reality attract the least awareness.

The respondents have a moderate level of awareness of the other emerging technologies.

Figure 21: Level of awareness for the selected emerging technologies
(1 – Not aware at all and 5 – Fully aware)



The practitioners were asked about the level of awareness of the given technologies among their staff. The responses, as presented in Figure 22, are that the staff have a relatively low to moderate level of awareness. Among the specific technologies, data analysis/big data, cybersecurity and cloud computing enjoyed the highest awareness rating.

Figure 22: Level of awareness of the selected emerging technologies among staff
(1 – Not aware at all and 5 – Fully aware)

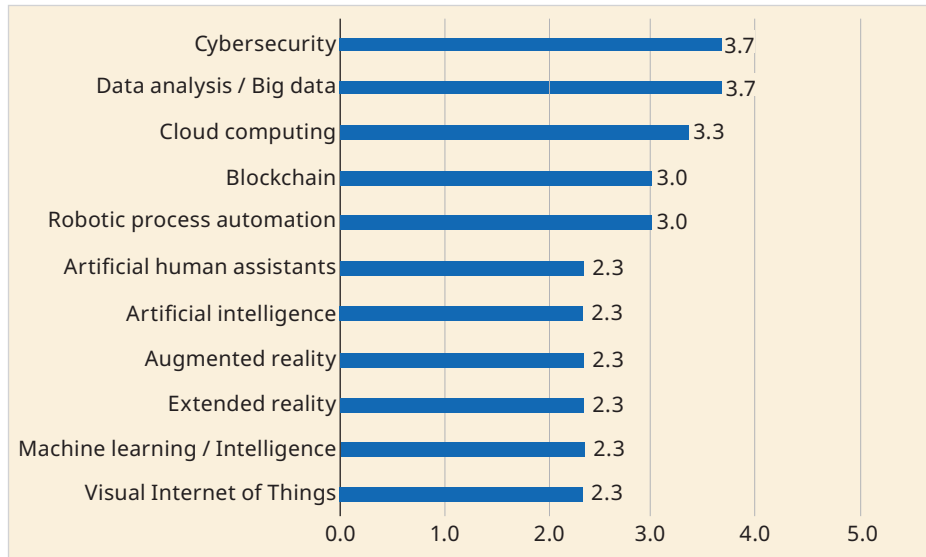


Figure 23 summarizes the level to which practitioners utilize the technology. The most utilized technology is data analysis/big data (4.3), whereas the least utilized is extended reality (1.3) and augmented reality (1.3).

Figure 23: Level of utilization of the selected emerging technologies
(1 – Never utilize and 5 – Always utilize)

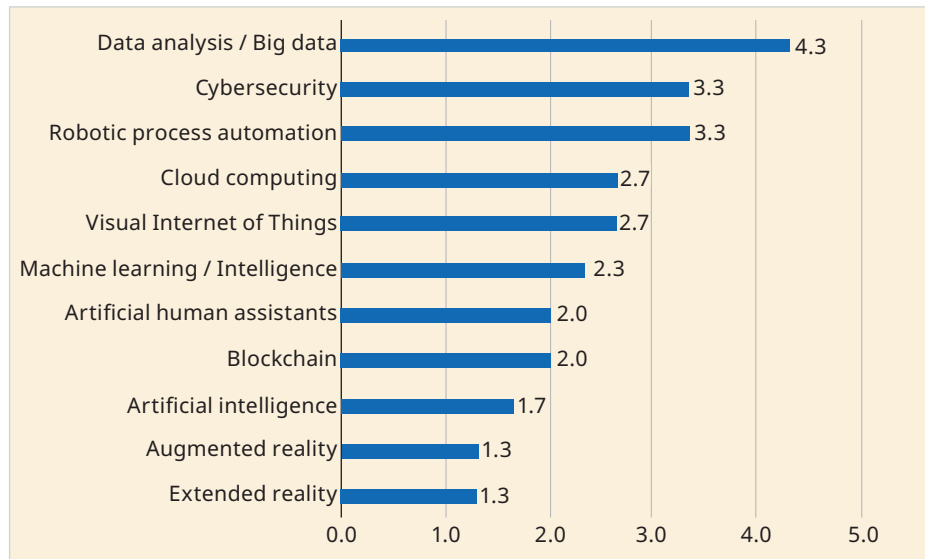
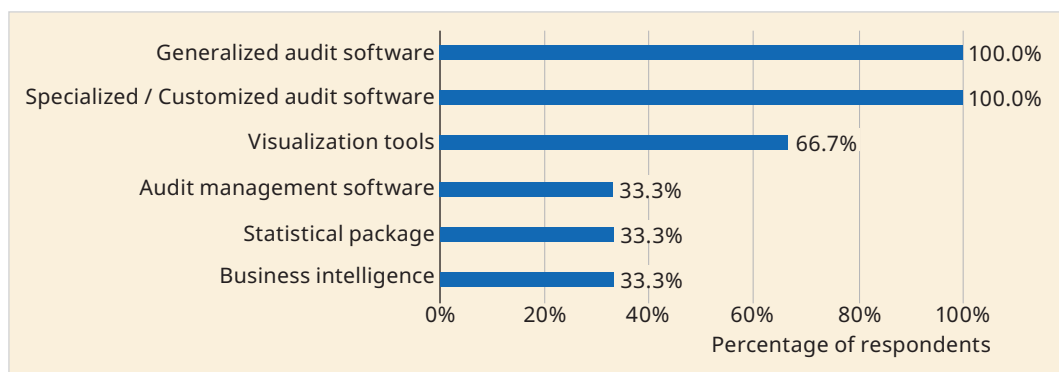


Figure 24 shows that all the respondents adopt time cost management software (100.0%), planning and scheduling (100.0%), office productivity tools (100.0%), human resources software (100.0%) and analytic and reporting software (100.0%). The software which is adopted to a moderate extent includes accounting software and robotic process automation, while the least adopted is sales and customer management (33.3%), and enterprise content management software (33.3%).

Figure 24: The adoption of systems and software



Figure 25 shows the use of computer assisted audit techniques (CAAT) by the respondents. Specialized/customized audit software and generalized audit software are used by all the respondents.

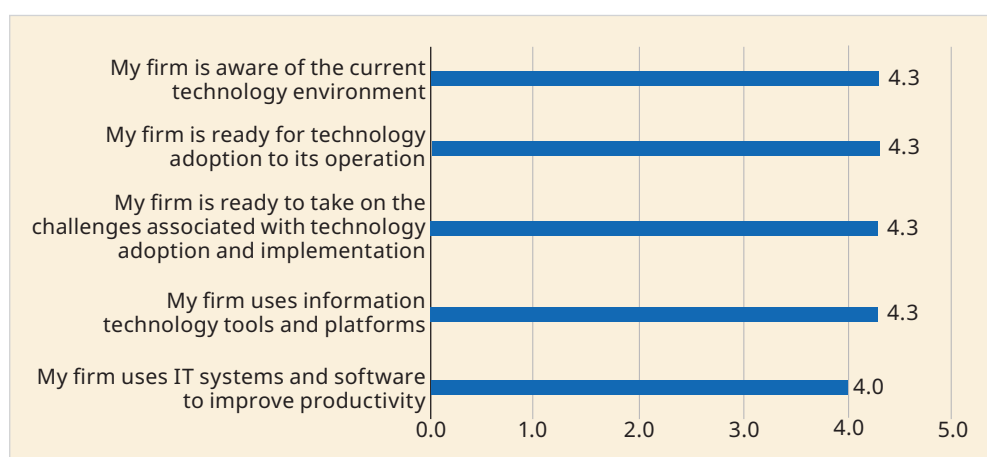
Figure 25: Use of computer assisted audit techniques (CAAT)

Regarding the preparedness for technology adoption, the respondents were asked to rate given statements. The statements are categorized into (1) Approach to technology, (2) manpower skills and knowledge and (3) investment. Figures 26 to 28 sum up the responses.

Figure 26 shows that the practitioners currently use information technology tools and platforms (4.3), and they use IT systems and software to improve productivity (4.0). The practitioners are also aware of the current technological environment (4.3) and are willing to adopt or take on the challenges associated with technology adoption and implementation (both at 4.3).

Figure 26: Technological preparedness: approach to technology

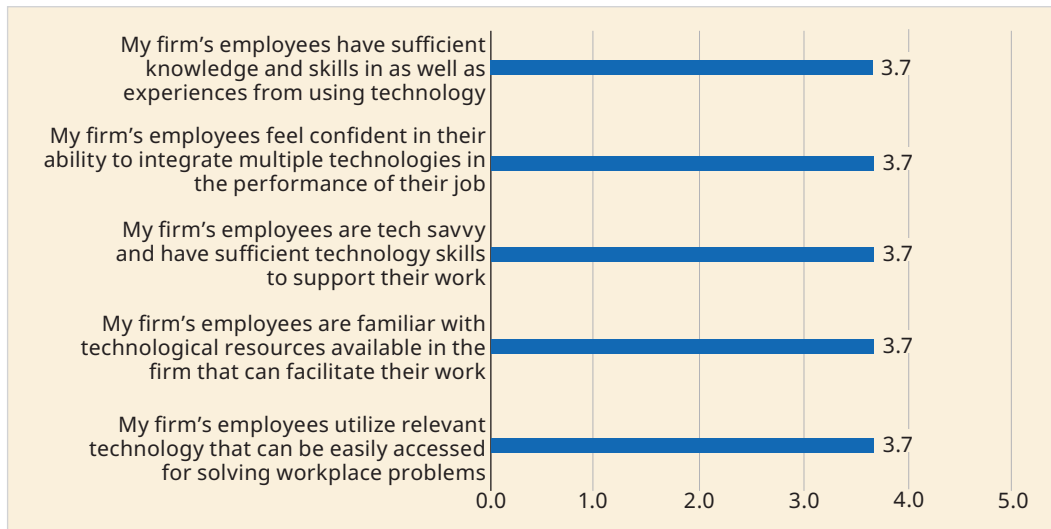
(1 – Strongly disagree and 5 – Strongly agree)



In terms of manpower skills and knowledge, the respondents agree to a moderate extent that the staff in their companies have sufficient knowledge, skills and experience in using technology, and are confident in their ability to integrate multiple technologies in the performance of their jobs. The staff also utilize relevant technology which can be easily accessed or are available in the company to solve workplace problems. The details of the responses are shown in Figure 27.

Figure 27: Technological preparedness: Manpower skills and knowledge

(1 – Strongly disagree and 5 – Strongly agree)



Regarding the company's investments in technology, including equipment, infrastructure and human resources, the respondents highly agree that their companies provide these investments appropriately. Figure 28 shows their responses.

Figure 28: Technological preparedness: Investment

(1 – Strongly disagree and 5 – Strongly agree)

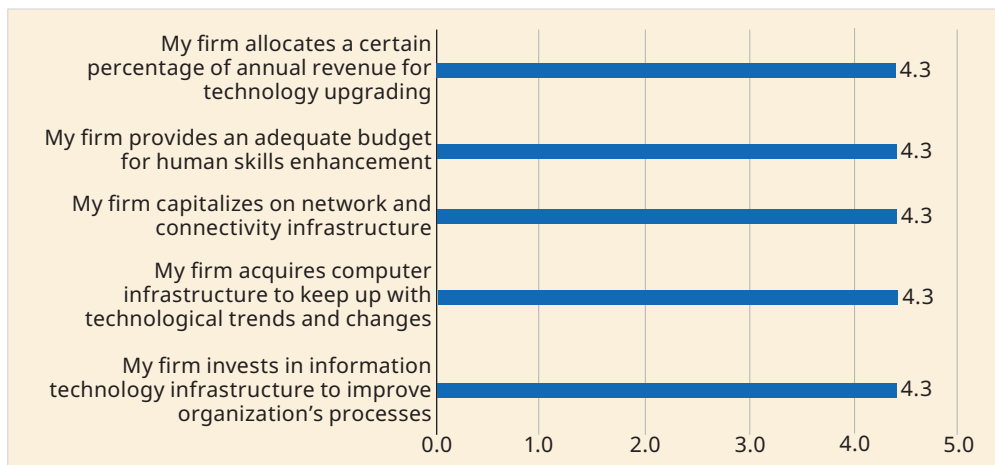


Figure 29 shows the practitioners' attitude towards adaptation to technological advances. It can be seen that the practitioners have a positive attitude towards adaptation to technological advances and they acknowledge the benefits of technological advances to the accountancy profession. The scores ranged from 4.0 to 4.3.

Figure 29: Attitude towards adaptation to technological advances
(1 – Strongly disagree and 5 – Strongly agree)

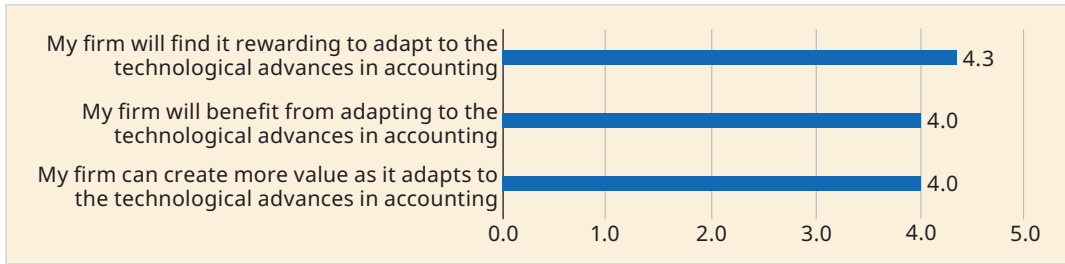


Figure 30 shows the responses to subjective norms. The respondents indicate that the management of their firms highly agrees that the profession should adapt to technological advancements in accountancy, scores ranged from 4.0 to 4.3. However, in the respondents' view, employees may agree with this statement to a moderate extent only (ie., score of 3.3).

Figure 30: Subjective norm
(1 – Strongly disagree and 5 – Strongly agree)

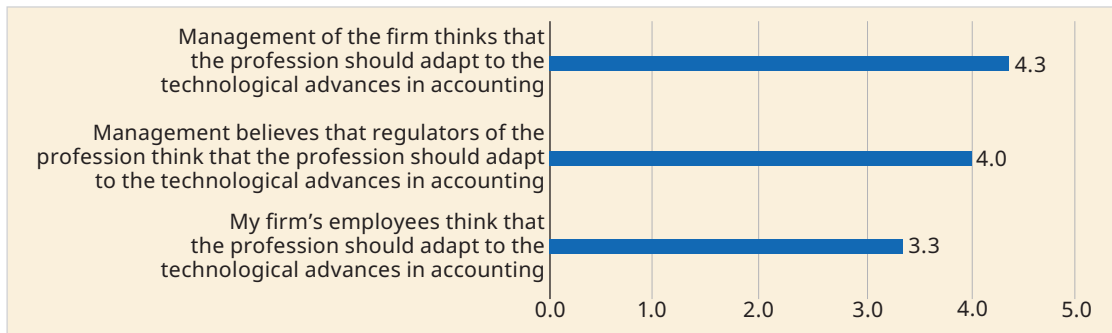


Figure 31 provides the scores for readiness for technology adoption. The respondents moderately agree that their staff are provided with adequate opportunities to participate in professional development programmes. They also indicate that the company resources— both financial and others — are sufficient to adopt technological advances in accountancy.

Figure 31: Attitude towards the readiness of technology adoption
(1 – Strongly disagree and 5 – Strongly agree)

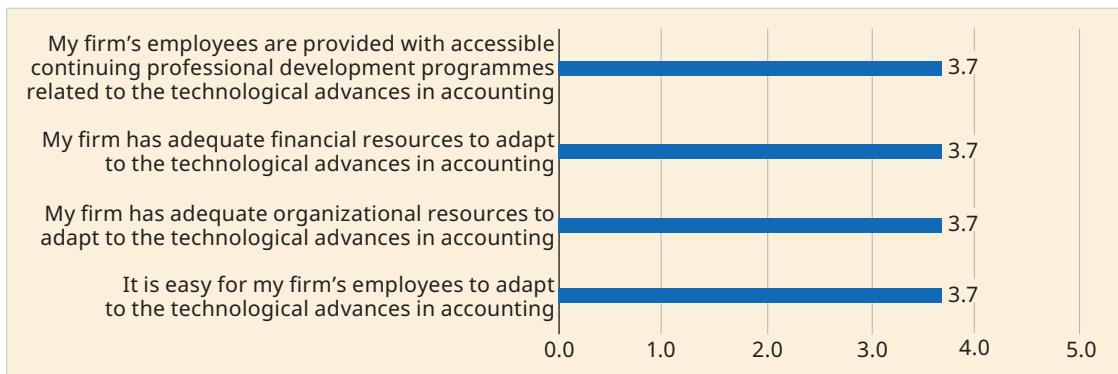


Figure 32 shows the intention of staff in the respondents' companies to plan or commit to adopting technological advances in accountancy. It can be seen that the respondents moderately agree with the statements regarding staff's intentions.

Figure 32: Intention to engage
(1 – Strongly disagree and 5 – Strongly agree)

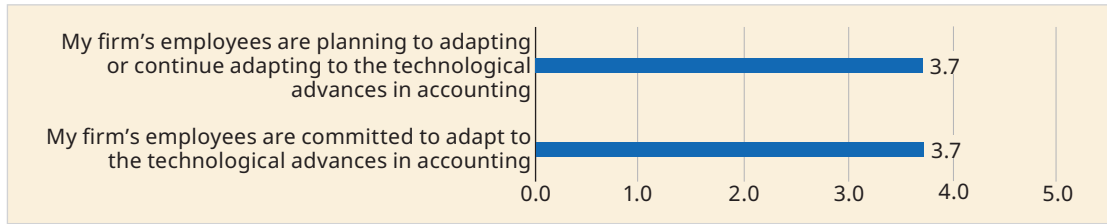


Figure 33 shows the responses about expected benefits that can be generated from technology adoption. The respondents highly agree that the use of technology helps improve planning and control of their operations (4.0) and may result in faster turnaround/response times (3.7). To a fair extent, they agree on other expected benefits.

Figure 33: Expected benefits from the use of technology
(1 – Strongly disagree and 5 – Strongly agree)



Figure 34 shows the challenges to technology adoption faced by the respondents. Thai practitioners do not report high levels of concern with respect to most of the challenges to technology adoption. Nevertheless, the respondents show a moderate degree of concern over organizational culture readiness and high investment costs.

Figure 34: Challenges to technology adoption
(1 – Very unlikely and 5 – Very likely)



In conclusion, the management personnel of accounting firms realize the importance of technology adoption and are willing to provide the necessary resources to tap technology. However, some concerns surround staff enthusiasm for technology adoption.

Lao PDR

Professional accounting organizations

In this section, responses from the PAO in Lao PDR are discussed. The PAO, namely, the Laos Chamber of Professional Accountants and Auditors (LCPAA), has been established for more than 20 years. It has fewer than 5,000 members and not more than 50 staff. The respondent is a board member. The PAO has a digital technology roadmap for the accountancy profession.

Figure 35 shows the level of technology awareness of the respondent. The levels of awareness are moderate for visual Internet of Things, data analysis/big data and cybersecurity. However, for the other selected technologies, awareness is low.

Figure 35: Level of awareness of selected emerging technologies
(1 – Not aware at all and 5 – Fully aware)

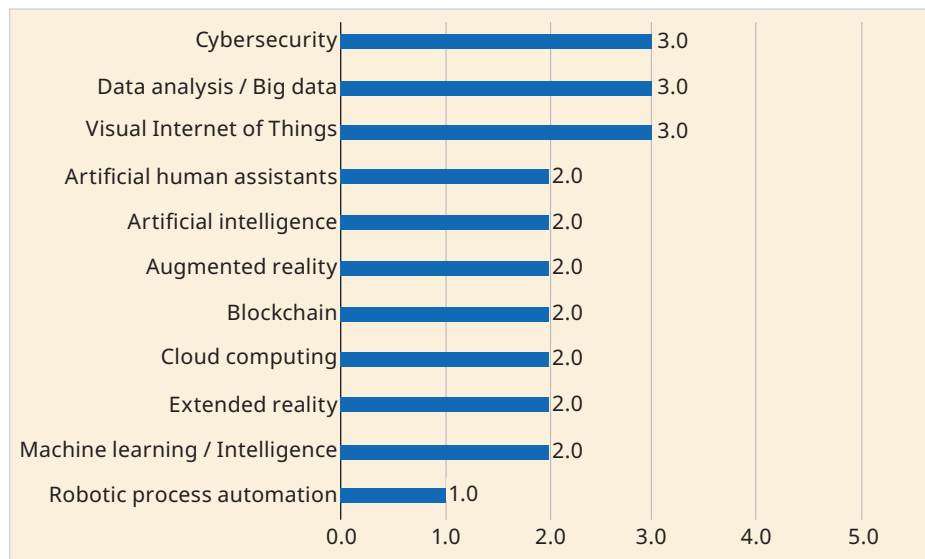


Figure 36 shows the utilization level varies across the listed technologies. Visual Internet of Things, machine learning/intelligence, data analysis/big data, cybersecurity and cloud computing are highly utilized. Blockchain, augmented reality and artificial intelligence are moderately utilized, and robotic process automation, extended reality and artificial human assistants are little used.

Figure 36: Level of utilization of selected emerging technologies
(1 – Never utilize and 5 – Always utilize)

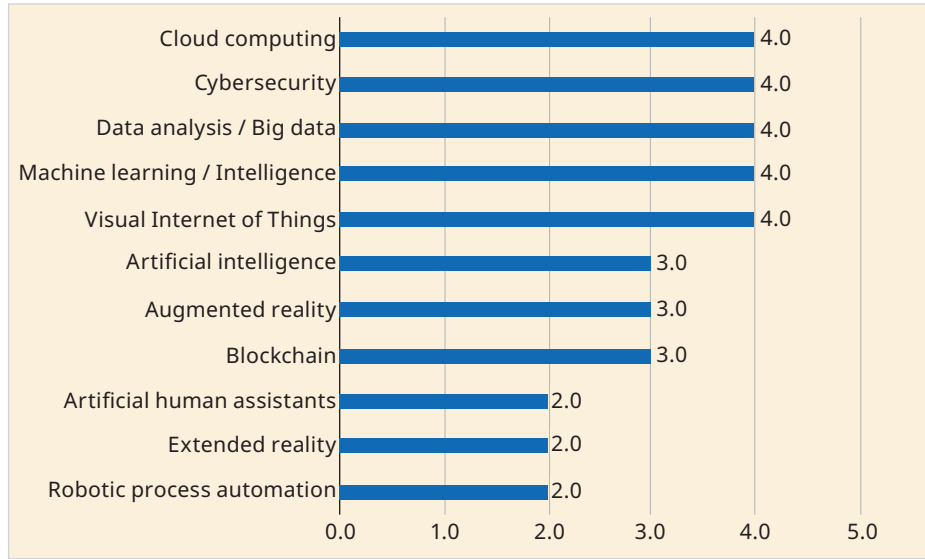


Figure 37 shows the responses for the attitude of the respondent towards technology. The PAO has a very positive attitude that its members will find it rewarding to tap technology and that they will be able to gain benefits and create more value from technological advances in accountancy.

Figure 37: Attitude towards technology
(1 – Strongly disagree and 5 – Strongly agree)

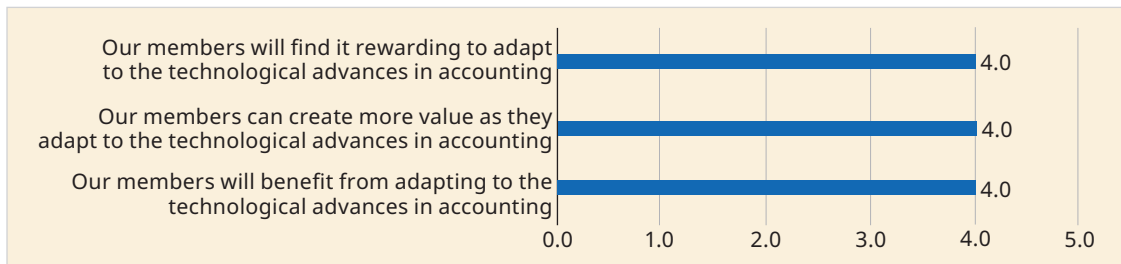


Figure 38 shows the subjective norm of the PAO. The PAO agrees that regulators, its members, other key PAO leaders and senior leaders in the profession believe that the profession should adapt to the technological advances in accountancy.

Figure 38: Subjective norm
(1 – Strongly disagree and 5 – Strongly agree)

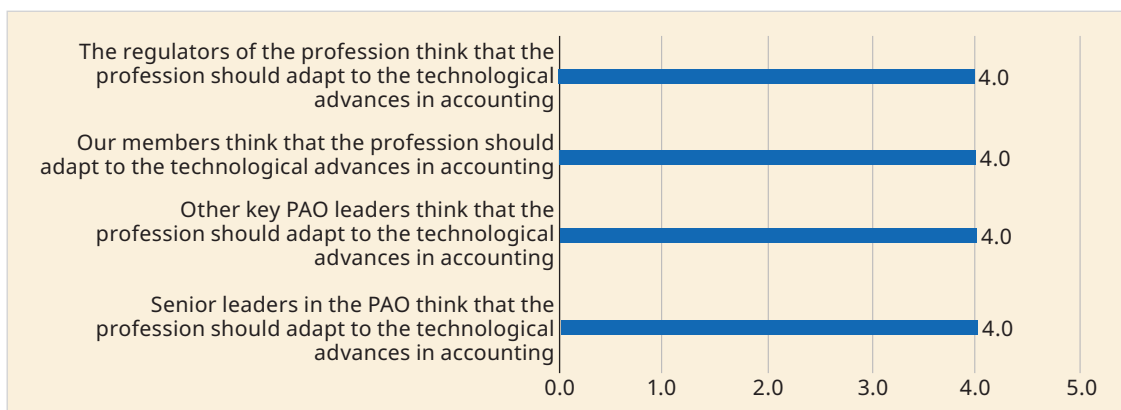


Figure 39 reveals the respondent's attitude towards the readiness for technology adaptation. The PAO believes that its members are not in a strong position to adapt technology, especially when the members lack financial resources.

Figure 39: Attitude towards the readiness of technology adaptation
(1 – Strongly disagree and 5 – Strongly agree)

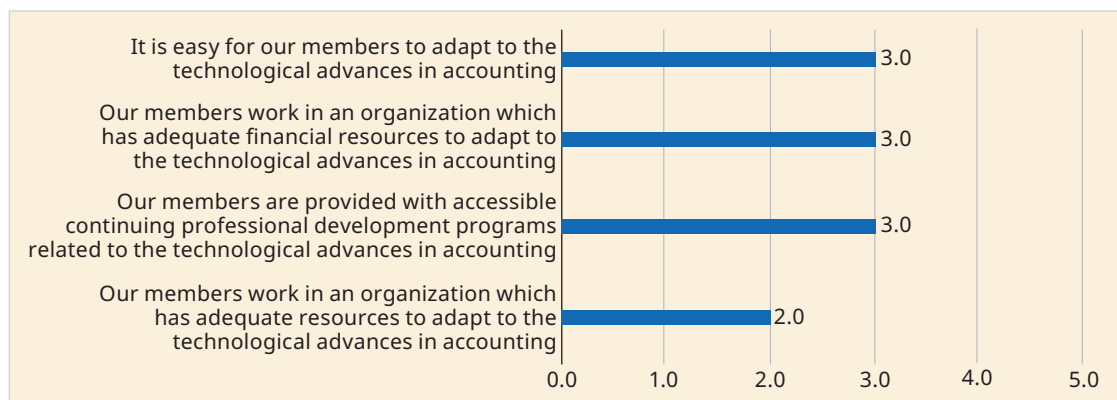
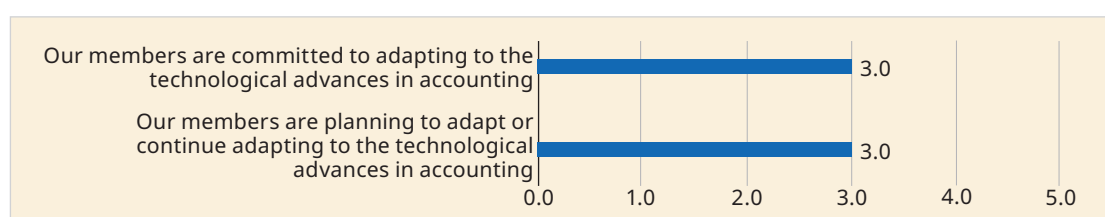


Figure 40 shows the respondent's view on the intention to engage. The respondent indicates that PAO members do plan and are committed to adapting technological advances to a moderate extent.

Figure 40: Intention to engage
(1 – Strongly disagree and 5 – Strongly agree)



In conclusion, the PAO and its members are aware of and utilize some of the listed technologies. They have a positive attitude towards technology adaptation; however, insufficient financial resources is a concern.

Institutions of Higher Learning

Five responses were received from institutions of higher learning in Lao PDR. Three respondents are public universities, one is a private university, and the remaining respondent is a college or vocational school. The representatives of four of the respondents are faculty members teaching the accountancy curriculum whereas one respondent is the head of the accounting department. Two of the institutions have been established for 20 years or more, while the other 3 have been established for less than 10 years.

One institution is internationally accredited, while three are accredited by the Ministry of Education of Laos and the fifth is accredited by the National University of Laos. The number of enrolled students in the accountancy curriculum ranges from 25 students to 600 students. Figure 41 shows the level of awareness of emerging technologies. The respondents were asked to rate their level of awareness of 11 emerging technologies, where '1' is "not

aware at all” and ‘5’ is “fully aware”. The technologies which receive the highest average score are cybersecurity and artificial intelligence (both 2.8), followed by cloud computing (2.6). Overall, the results show limited awareness of the technologies.

Figure 41: Level of awareness of selected emerging technologies
(1 – Not aware at all and 5 – Fully aware)

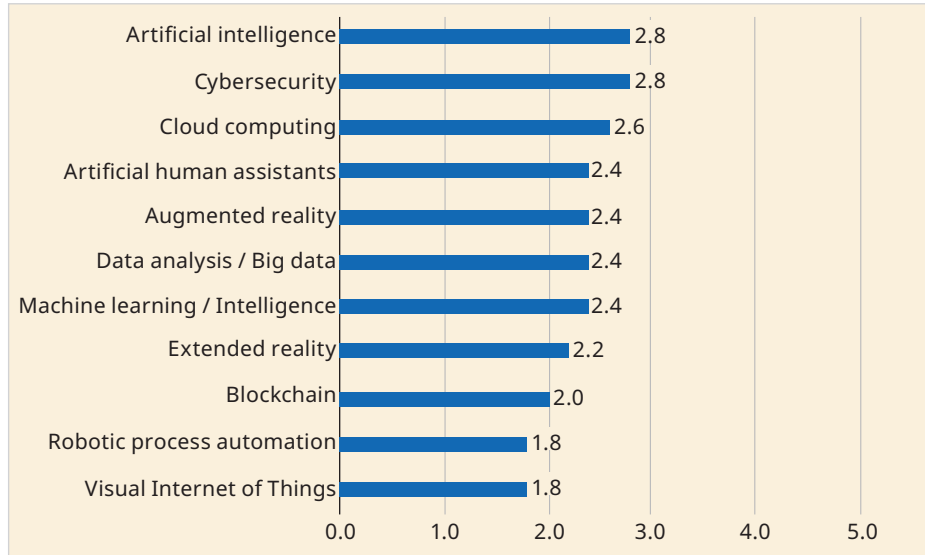
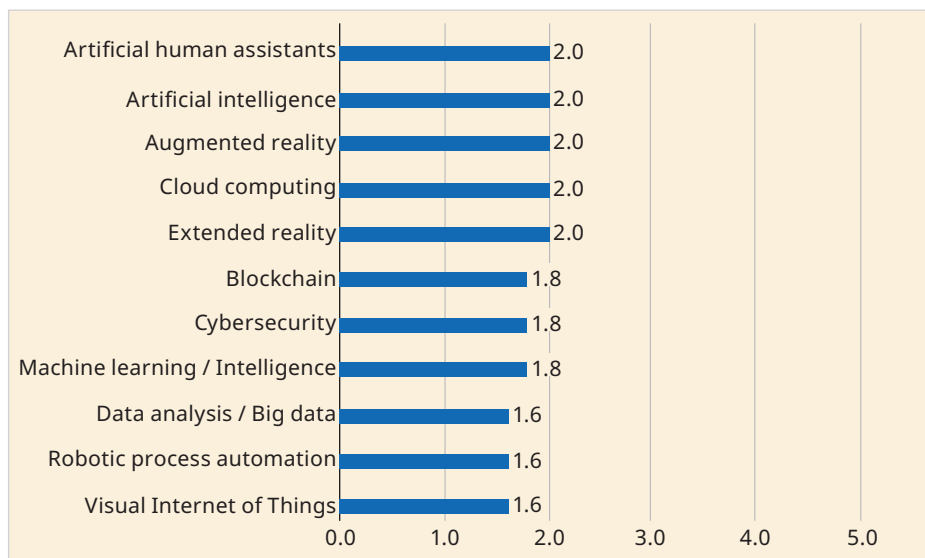


Figure 42 shows the respondents’ assessment of their institutions’ competency in teaching the selected technologies. Most of the respondents report that their institutions have the competency to teach most of the technologies at the foundation level. One respondent indicates there is competency to teach up to the intermediate and advanced levels in some technologies. It is interesting to note that one institution reports that it does not have the competency to teach any of the technologies at all. These explain the overall low average scores for all the technologies.

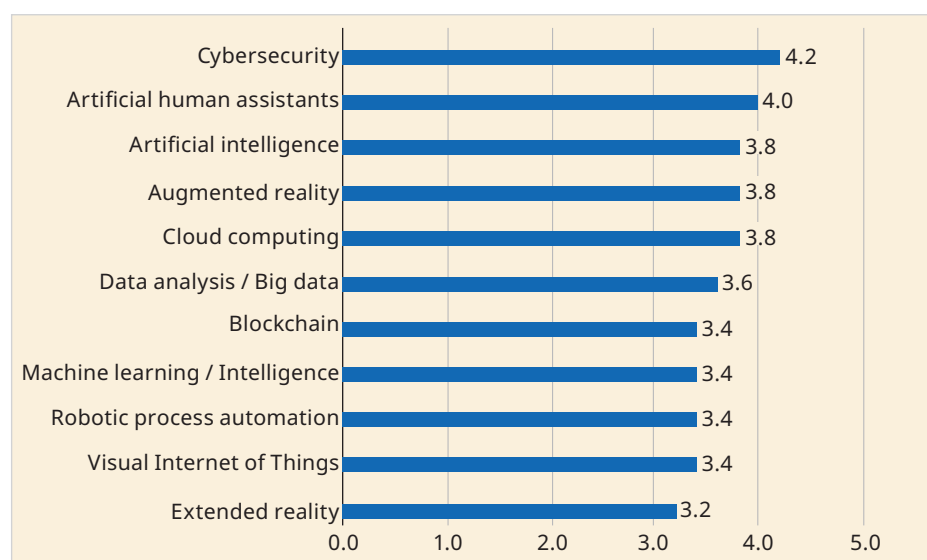
Figure 42: Level of competency to teach selected emerging technologies
(1 – None, 2 – Foundation, 3 – Intermediate, 4 – Advanced)



Despite the limited levels of awareness and competency to teach the technologies, most respondents indicates that these technologies are somewhat important to the accountancy curriculum. Figure 43 shows that the technology which is seen as the most important is cybersecurity (4.2). Artificial human assistant is also seen as important, with an average score of 4.0, while cloud computing, augmented reality and artificial intelligence receive an average score of 3.8.

Figure 43: Level of importance of selected emerging technologies to the accountancy curriculum

(1 – Not important and 5 – Very important)



As for the extent to which the emerging technologies have been incorporated into accounting courses, Figure 44 shows that the responses are in line with the competency of the institutions to teach the technologies, namely, very low scores. Two institutions reported that they have incorporated cloud computing and cybersecurity at an advanced level into accountancy courses. One of these institutions also incorporates an advanced level of artificial intelligence in its accountancy courses. One institution indicates that none of the technologies are incorporated into its accountancy curriculum.

Figure 44: Level of incorporation of selected emerging technologies into the accountancy curriculum

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

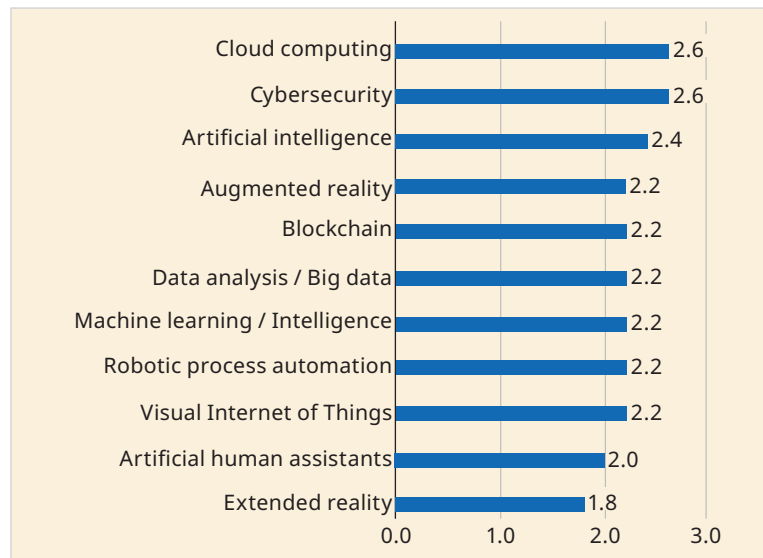


Figure 45 indicates that technological tools often used in the accountancy curriculum in the past three years were Microsoft applications (3.8) and accounting software (3.8). Video conferencing and group collaboration tools (3.6) and data analytics tools (3.6) were also used frequently.

Figure 45: The use of technological tools in the accountancy curriculum

(1 – Never used and 5 – Frequently used)

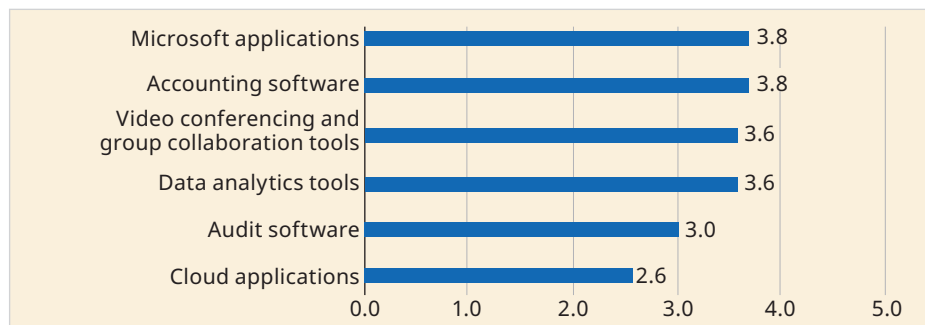


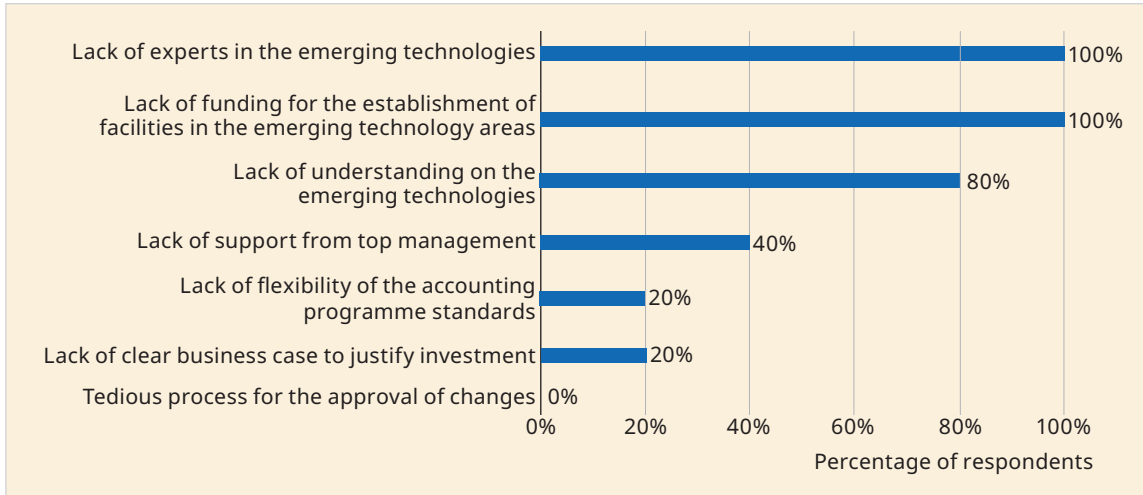
Figure 46 shows the barriers to incorporating emerging technologies into the accountancy curriculum.

Two key barriers are the lack of experts to teach emerging technologies (100.0%) and lack of funding for the establishment of facilities in the emerging technology areas (100.0%).

The lack of understanding of the emerging technology (80.0%) follows in third place.

Two institutions also report the lack of top management support.

Figure 46: Barriers to incorporating technology into the accountancy curriculum



In order to facilitate the integration of emerging technologies into the accountancy curriculum, respondents were asked the level of assistance required. Figure 47 shows that all respondents rate “opportunities for industrial attachment” (4.0) as highly needed. Three out of the five respondents also report that assistance is highly needed in “training in the emerging technologies” (3.6) and “training in curriculum design and integration” (3.4).

Figure 47: Level of assistance required

(1 – No need and 5 – Most needed)

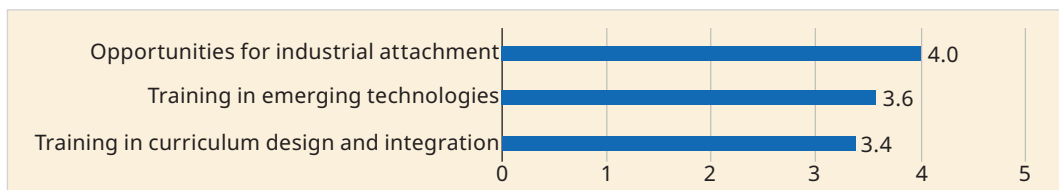


Figure 48 shows the responses to who is currently teaching the technology components in the accountancy curriculum. Three respondents (60%) report that accountancy lecturers are currently responsible for teaching the technology components. One respondent indicates that IT lecturers are currently doing the teaching while another institution reports the deployment of both accountancy and IT lecturers.

Figure 48: Who is currently teaching the technology components in accountancy curriculum

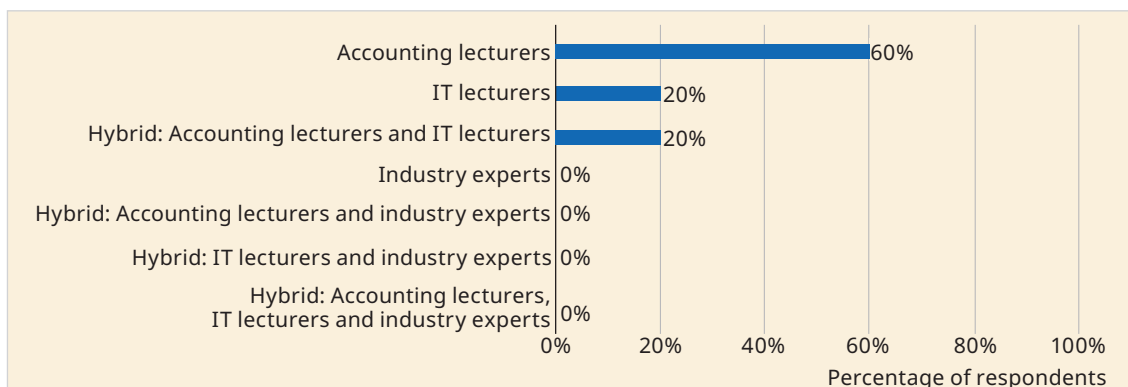
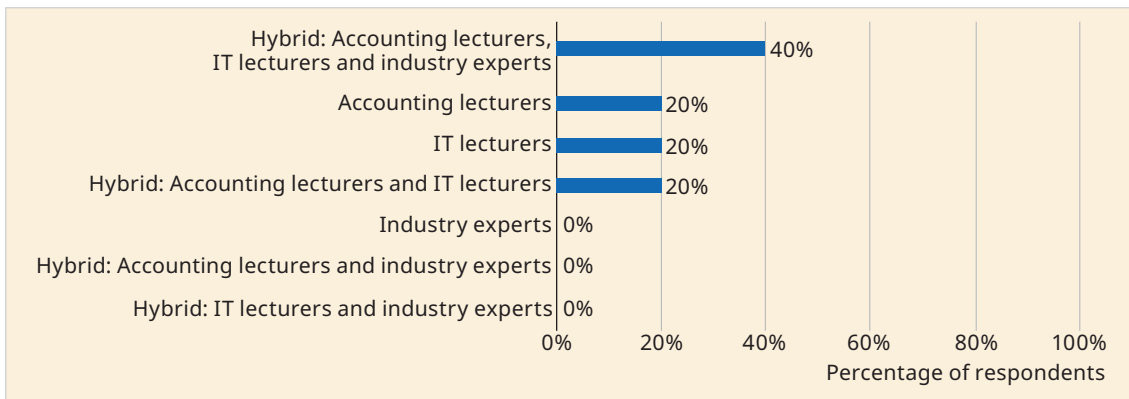


Figure 49 shows the responses as to who should teach the technology components in accountancy courses. The responses are varied. Two respondents indicated that a combination of accounting lecturers, IT lecturers and industry experts would be appropriate. However, One respondent says that it should be the responsibility of accounting and IT lecturers. One respondent indicates that it should be taught solely by IT lecturers, and one respondent suggests that accountancy lecturers should be responsible for the teaching. There does not seem to be any consensus as to who should be teaching the technology components in the accountancy curriculum.

Figure 49: Who should be teaching technology components in accountancy curriculum



The respondents were asked how emerging technologies should be integrated into the accountancy curriculum. Figure 50 shows that three respondents (60%) suggest that emerging technologies should be embedded in the existing accounting courses or modules, while two respondents (40%) indicate that they should be taught as a separate course or module.

Figure 50: How should emerging technology be integrated into the accountancy curriculum

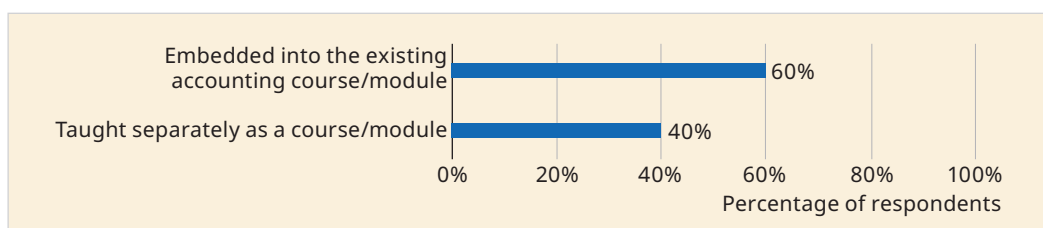
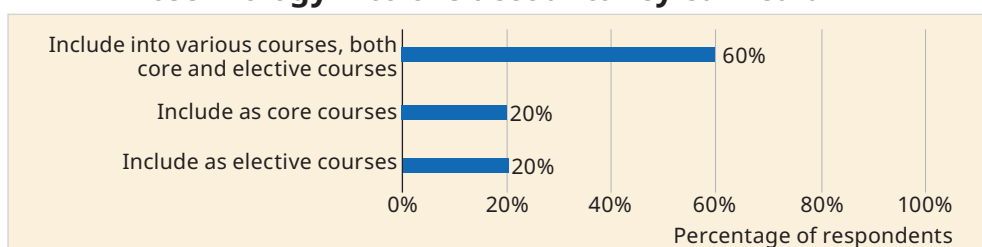


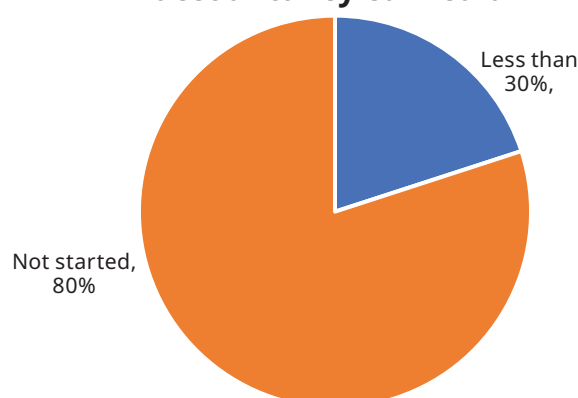
Figure 51 shows the responses to the most appropriate approach to incorporate emerging technology in the accountancy curriculum. One respondent indicates that the emerging technology should be integrated into the accountancy curriculum as elective courses, while one suggests that courses on emerging technology should be core courses. The majority are in favour of including technology in the various core and elective courses.

Figure 51: Most appropriate approach to incorporate emerging technology into the accountancy curriculum



The respondents were further asked the current stage of adoption of emerging technology in the accountancy curriculum. Figure 52 shows that four respondents (80.0%) state that they have not started on technology adoption in the curriculum, and only one respondent reports that the stage of adoption is at a mark that is lower than 30%.

Figure 52: Current stage of technology integration into the accountancy curriculum



In summary, institutions of higher learning in Lao PDR recognize the importance of integrating emerging technology into their accountancy curriculum. However, currently the integration is still at the basic level. In order to accelerate the integration process, financial resources, training and collaboration with experts in the industry are necessary.

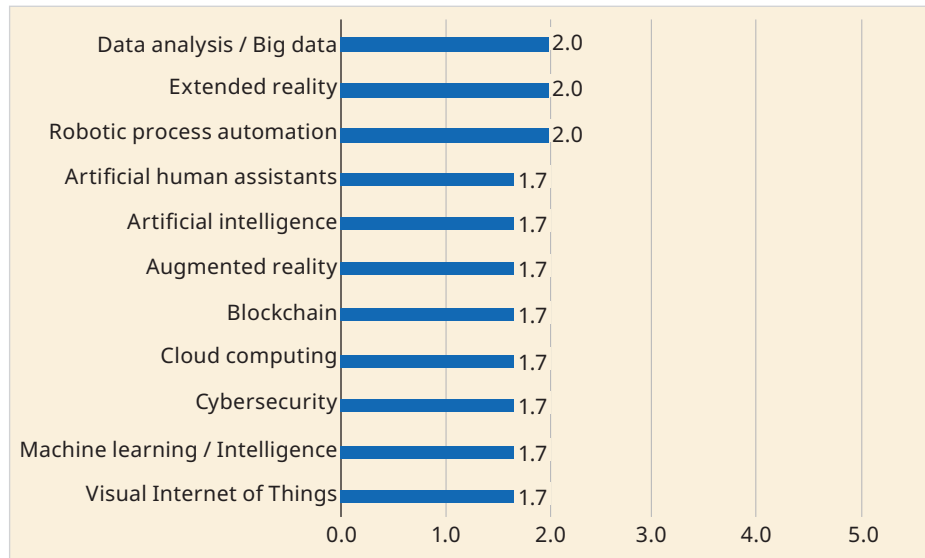
Accountancy practitioners

This section presents responses from accountancy practitioners. As previously mentioned, the LCPAA helped disseminate the link to an online questionnaire to accountancy practitioners in Lao PDR. In total, three responses were received. All respondents are from small firms with 1-2 partners/management staff and fewer than 20 staff members. All firms are limited liability firms providing accounting services. All firms have been in operation for less than nine years. While two of the respondents are the owner/top management of the firms, the third respondent is in middle management.

Figure 53 shows the level of awareness of selected emerging technologies by the respondents. Overall, the level of awareness of the technology is low. One respondent reports a moderate level of awareness (3 out of 5) for all the selected technologies except machine learning (2 out of 5). However, the other two respondents rate the level of awareness as “little aware” or “not aware at all” for all the technologies. The technologies which receive the highest average score are robotic process automation (2.0), extended reality (2.0) and data analysis/big data (2.0).

Figure 53: Level of awareness of selected emerging technologies

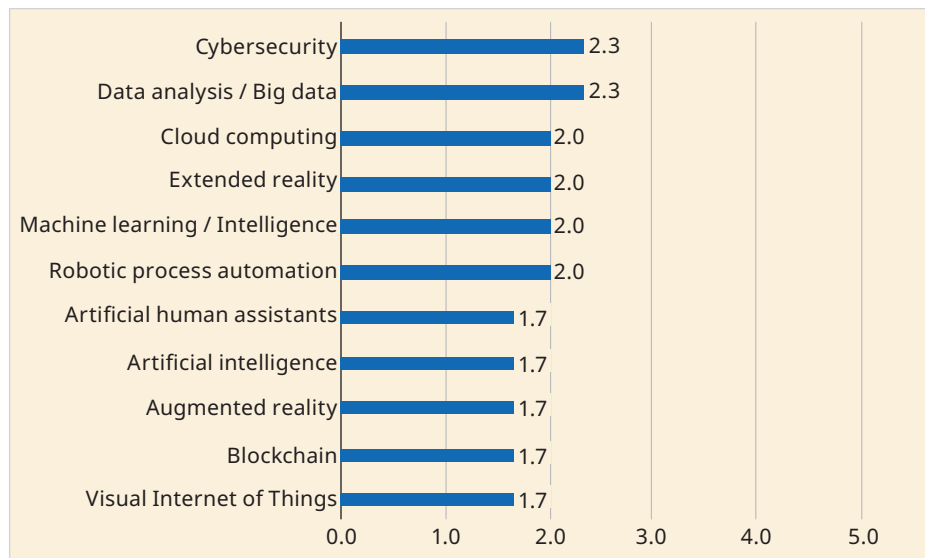
(1 – Not aware at all and 5 – Fully aware)



The respondents were asked about their views on the level of awareness of technology among staff in their firms. Figure 54 shows that the level of awareness is, at best, moderate. The technologies which receive the highest average score are data analysis/big data and cybersecurity.

Figure 54: Level of awareness of the selected emerging technologies among staff

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



The current level of utilization of technology is shown in Figure 55. While one respondent reports that all forms of technology are often utilized in his/her work, the other two respondents say that the technologies are not utilized at all.

Figure 55: Utilization of selected emerging technologies
(1 – Never utilize and 5 – Always utilize)

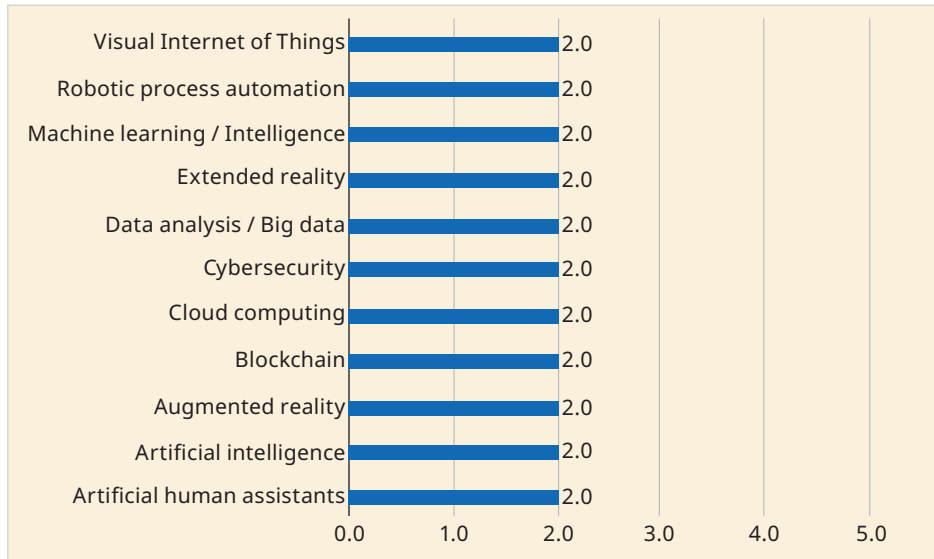
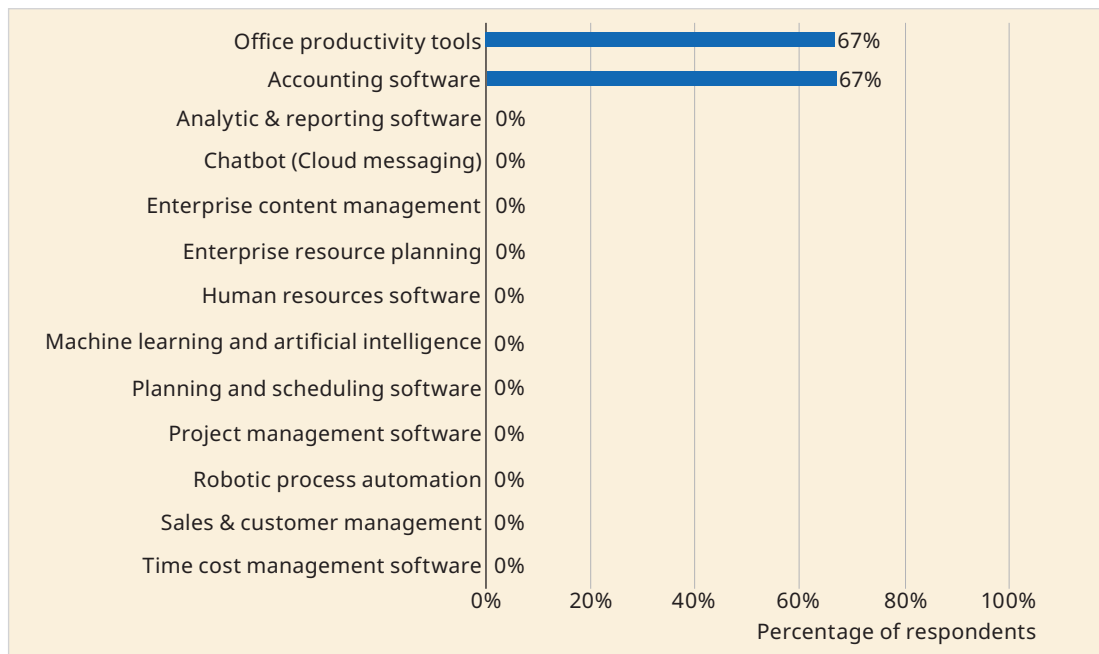


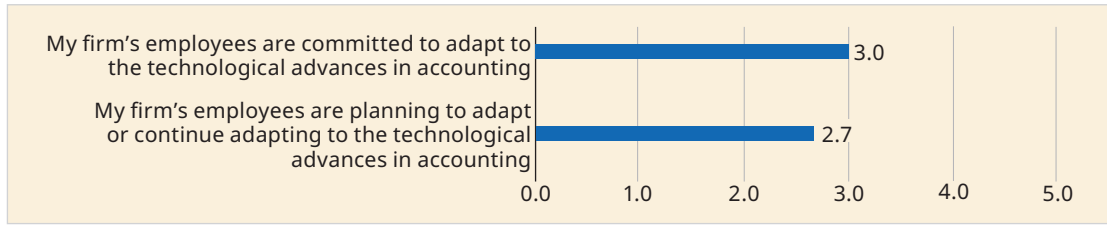
Figure 56 shows the systems and software adoption among respondents. Two of the respondents (66.7%) say that they use accounting software and office productivity tools. The third respondent is silent on the use of systems and software. In addition, none of the respondents indicate that they use Computer-Assisted-Audit Techniques (CAAT). This is plausible because all respondents are from accounting services firms and not audit firms. In addition, the firms are small in size.

Figure 56: Adoption of systems and software



In terms of planning and commitment to adapt to technological advances, the respondents rate the commitment to adapt slightly higher than the planning function, as shown in Figure 57.

Figure 57: Intention to engage in adaptation of technological advances
(1 – Strongly disagree and 5 – Strongly agree)



The respondents rate 'faster turnaround/response time' (3.33) and 'enhancing customer satisfaction' (3.33) as the highest expected benefits that can be derived from technology utilization. The results are shown in Figure 58.

Figure 58: Expected benefits from technology utilization
(1 – Strongly disagree and 5 – Strongly agree)

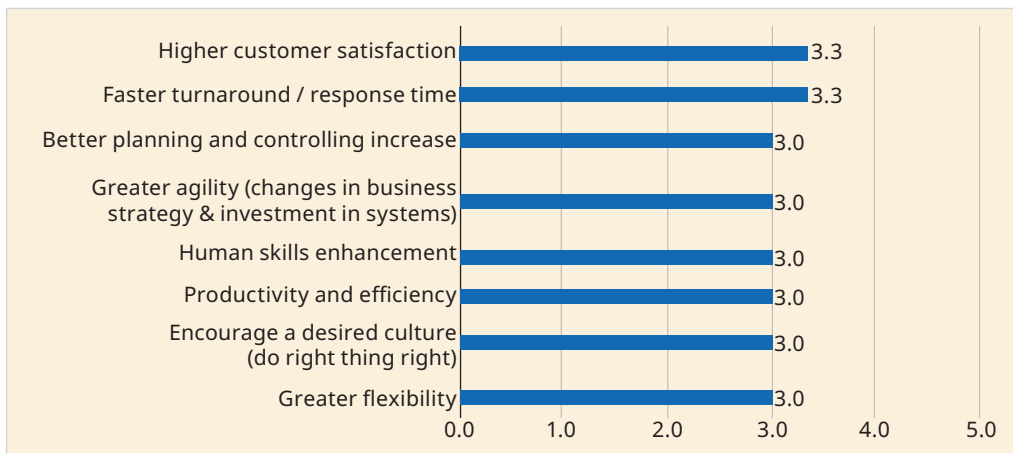
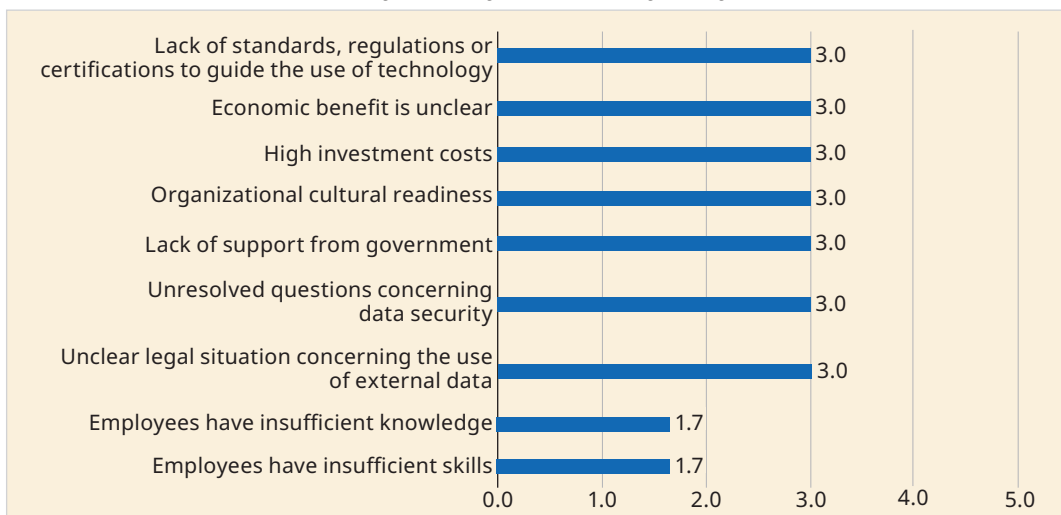


Figure 59 shows the responses concerning the challenges to technology adoption. The respondents are concerned about a number of issues, namely, the legal situation pertaining to the use of external data; data security; a lack of support from the government; organizational cultural readiness; high investment costs; unclear economic benefits; and a lack of standards, regulations or certifications to guide the use of technology.

Figure 59: Challenges to technology adoption
(1 – Very unlikely and 5 – Very likely)



Despite all the challenges, respondents express a positive attitude towards technology, as is shown in Figure 60. The respondents tend to agree that their firms find it rewarding to adapt to technological advances. They also suggest that their firms will benefit from and can create more value by adapting to technological advances.

Figure 60: Attitude towards technology

(1 – Strongly disagree and 5 – Strongly agree)

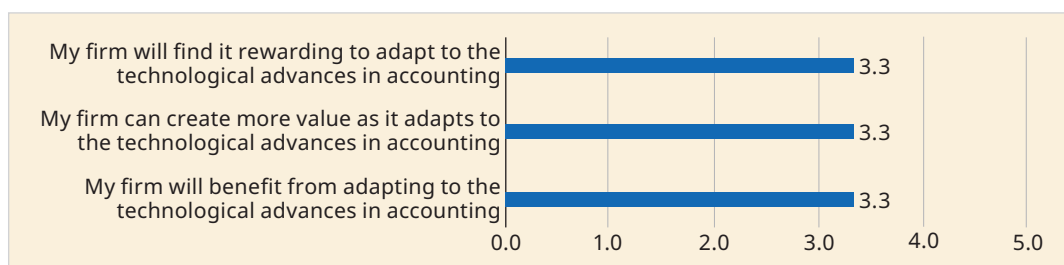
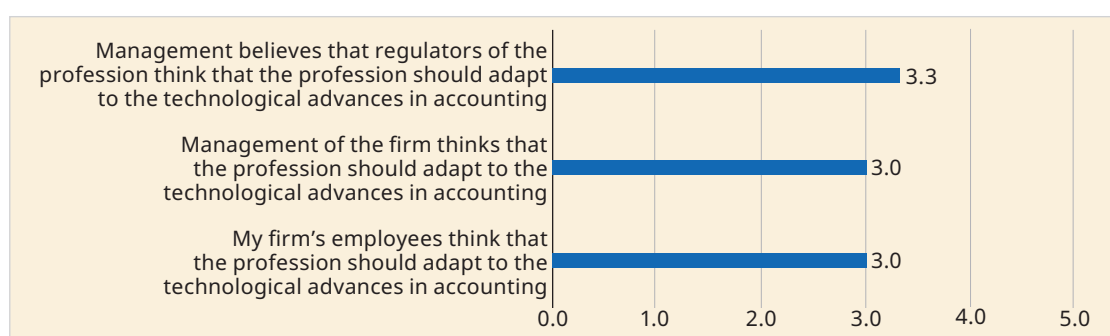


Figure 61 shows the responses on the subjective norm by the respondents. Although the respondents show a positive attitude towards the adaptation to technology, it is interesting to note that two of the respondents indicate that the management and employees of their firms may not think that the profession should adapt to technological advances. Their responses are slightly positive.

Figure 61: Subjective norm

(1 – Strongly disagree and 5 – Strongly agree)



Responses relating to the readiness for technology adoption, are shown in Figure 62. All respondents indicate mild support that their firms have financial resources to adapt to technological advances in accountancy (2.0). However, one respondent affirms that his/her firm has adequate organizational resources, and that employees find it easy to adapt to emerging technology. Two respondents report that their employees are not able to access continuing professional development programmes related to technological advances.

Figure 62: Attitude towards the readiness for technology adaptation

(1 – Strongly disagree and 5 – Strongly agree)

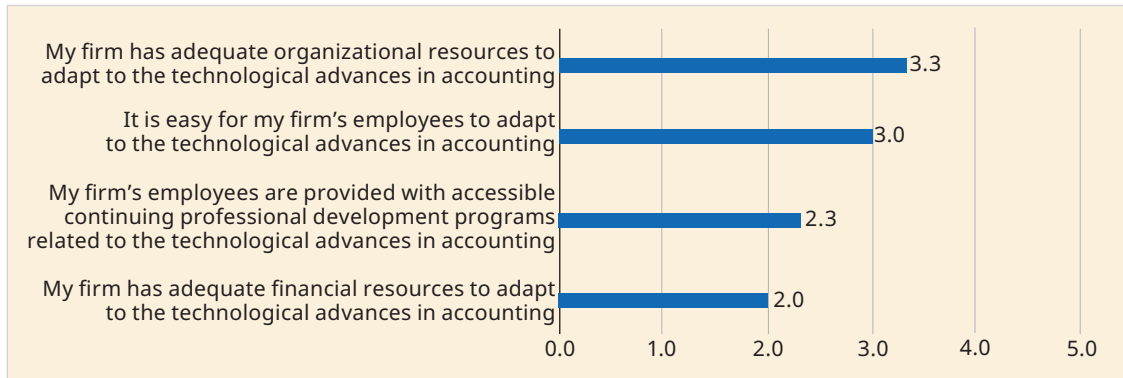


Figure 63 shows the respondents' perceptions of the technological preparedness of employees in their respective firms. Only one respondent reports that employees can utilize the relevant technology to solve workplace problems, are familiar with technological resources, are tech savvy and have sufficient technology skills, and are confident in integrating multiple technologies to enhance performance. The level of technological preparedness is around neutral (ranges from 2.3 to 2.7).

Figure 63: Level of technological preparedness: Manpower skills and knowledge

(1 – Strongly disagree and 5 – Strongly agree)

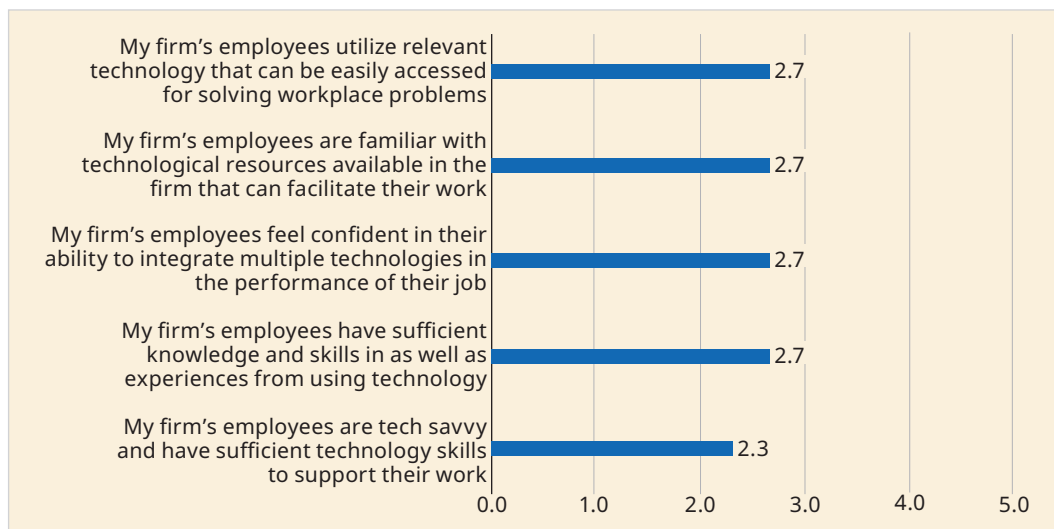


Figure 64 shows the level of technological preparedness with regard to investment. Only one respondent indicates that his/her firm allocates an adequate budget for human skills enhancement.

All respondents report that their firms have not acquired computer infrastructure to keep up with technological trends and changes, do not capitalize on network and connectivity infrastructure and do not allocate a certain amount of revenue for technology upgrading.

Therefore, the overall level of investment to ensure technological preparedness is below neutral (ranges from 1.7 to 2.3).

Figure 64: Level of technological preparedness: Investment

(1 – Strongly disagree and 5 – Strongly agree)

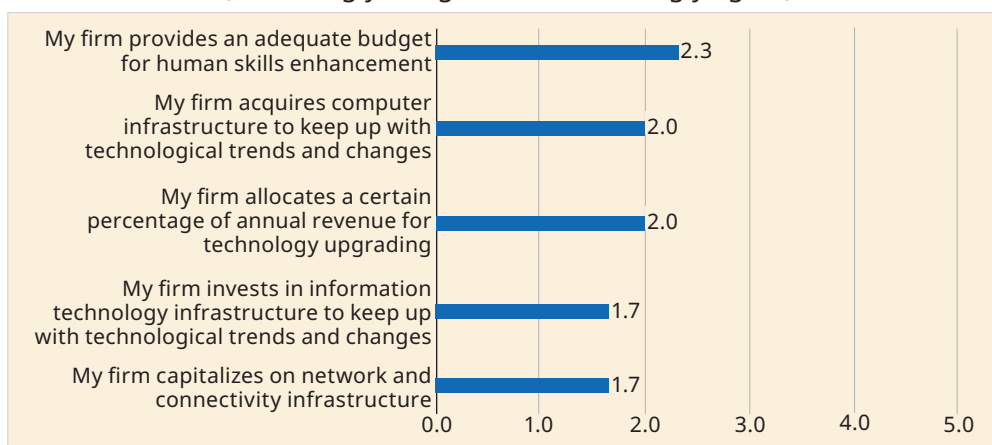
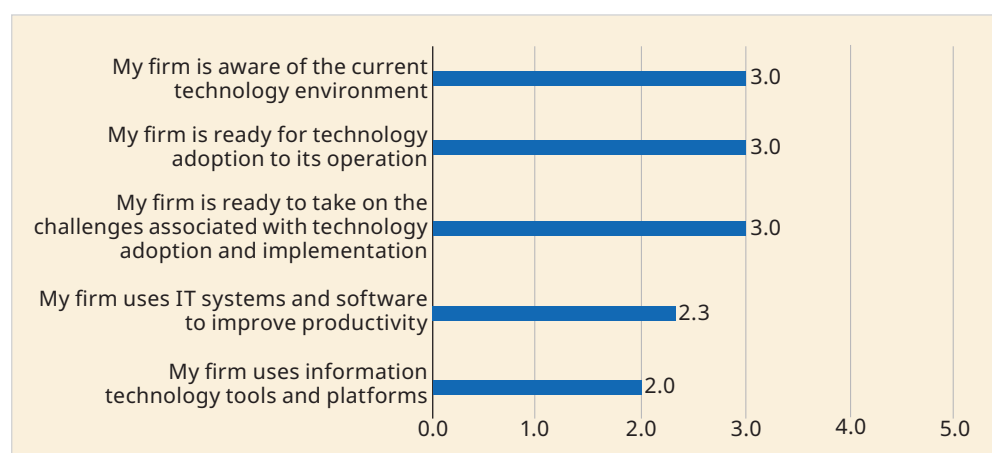


Figure 65 presents the respondents' views regarding the approach to technology. Only one respondent indicates that his/her firm is aware of the current technology environment, and that it is ready for technology adoption and to take on the challenges associated with technology adoption and implementation.

Figure 65: Technological preparedness: Approach to technology

(1 – Strongly disagree and 5 – Strongly agree)



To summarize, the levels of awareness, adoption and utilization of technology among accountancy practitioners in Lao PDR are limited. Respondents tend to see only moderate benefits from utilizing technology in accounting work. Important factors inhibiting the adoption and utilization of technology include a lack of financial resources, infrastructure, and technological knowledge and skills.

Discussions

The previous sections describe the levels of awareness, adoption and utilization of emerging technology in accountancy practices and accounting education in Thailand and Lao PDR.

Thailand

Findings from the study suggest that, in Thailand, management in accounting firms recognizes the importance and benefits of utilizing technology in their work. Firms have made substantial investments in technological infrastructure and have allocated resources to support the skill enhancement of their employees.'

The types of technologies that are extensively used are data analysis/big data, cybersecurity and robotic process automation.

Systems and software which are often used are time/cost management software, planning and scheduling, office productivity tools, human resources software, analytics and reporting software, specialized/customized audit software and generalized audit software.

Although respondents who are in management positions express positive attitudes towards the adoption and utilization of emerging technology in accounting work, concerns were raised regarding cultural readiness and the lack of standards and regulations to guide the use of technology in the firms.

Results suggest that management perceives that employees may see only moderate benefits from using technology in their work and may be committed to the adaptation to a moderate degree only.

Consistent with opinions from accountancy practitioners, PAOs in Thailand also believe that their members recognize the importance of using technology in accountancy work. However, in their view, some of their members may not be ready and do not have sufficient resources to embrace emerging technology.

As for institutions of higher learning in Thailand which offer accountancy undergraduate programmes, the level of awareness of emerging technology is moderate.

The technologies of which there is a high level of awareness are data analysis/big data, cloud computing and cybersecurity.

The level of awareness of each emerging technology among accountancy academics and practitioners is, to a certain extent, also moderate. This suggests that there could be significant knowledge sharing between accountancy schools and accountancy practitioners in Thailand.

Although Thai academics tend to be aware of various emerging technologies and recognize the importance of incorporating the technologies into the accountancy curriculum, the integration of these technologies remains limited at a foundational level only.

In addition, most institutions have only a limited capacity to teach these technologies. While most of the respondents suggest that collaboration among accountancy lecturers, IT lecturers and industry experts is needed to effectively deliver IT components in the accountancy courses, the participation of industry experts is currently limited.

This suggests closer collaboration is needed. PAOs could plausibly play a role in connecting accountancy schools with industry experts. Professional accounting organizations can also be a catalyst in organizing the necessary training for accountancy academics.

This helps to address the lack of understanding of emerging technologies and the shortage of experts in technology as has been identified. It is crucial to address the important factors inhibiting the integration of technology into the accountancy curriculum.

Lao PDR

Findings from the study on Lao PDR suggest that the levels of awareness, adoption and utilization of technology in accounting practices are low.

Accountancy practitioners perceive that the benefits of incorporating technology in their work are at a moderate level.

It is interesting to note that the opinions of accountancy practitioners are, to a certain extent, different from those of the country's only PAO. The PAO seems to have a more positive view of the awareness, adoption and utilization of technology among its members. Perceived benefits are also higher.

One of the plausible explanations for the differences in views is that accountancy practitioners who respond to the survey are from small companies providing accounting services only, but members of the PAO also include larger firms which may provide both accounting and auditing services.

The different scales of operations and different types of services may lead to different views on the importance of technology. Although the PAO perceives high benefits from utilizing technology in accounting practices, it also has some concerns that its members may have difficulties incorporating technology into their work. This is primarily due to a lack of knowledge and financial resources.

As for institutions of higher learning in Lao PDR, similar to accountancy practitioners, the level of awareness of emerging technology is low.

Competency to teach emerging technology is also lacking.

However, accounting academics recognize the importance of integrating technology into the accountancy curriculum. In order to ensure the integration of technology into accountancy studies, training on emerging technology and additional funding to support the establishment of facilities are vital.

Conclusion, recommendations and limitations

The study examines the levels of awareness, adoption and utilization of emerging technologies in accounting practices and accountancy education in Thailand and Lao PDR. An online survey questionnaire and interview methods were employed. Respondents are divided into three groups, namely professional accounting organizations, institutions of higher learning and accountancy practitioners.

Based on the findings, several implications can be drawn.

First, further efforts could be made to raise awareness of emerging technologies, especially the lesser-known technologies.

To enhance the knowledge of and facilitate the adoption of the lesser-known technologies, PAOs can play a central role. PAOs can be a platform to connect accountancy practitioners and academics to technology experts.

They can also be a catalyst for knowledge gathering and dissemination. Dissemination of knowledge can be done through various channels, including training courses, seminars and conferences, publications and social media.

Examples of organizations which have successfully adopted and utilized the technologies can be provided.

Seeing more success cases, accountancy practitioners will recognize the key benefits they can gain from adapting to emerging technologies. This can lead to a greater willingness to adopt and utilize the emerging technologies.

To enhance learning from success cases, professional accountants can provide support to academics to conduct more research on factors which accelerate or hinder the adoption and utilization of emerging technologies among accountancy practitioners.

The support can be in various forms, including financial support and connection and access to successful organizations.

By having PAOs as a knowledge centre, accountancy practitioners, particularly sole practitioners and small firms, and accounting educators can gain awareness and knowledge of emerging technologies without excessive costs.

In addition, in order to prepare accountancy students and young professionals to be ready to embrace emerging technologies, the ways in which accountancy curricula are taught may need to be changed.

Accountancy curricula may need to shift focus from merely imparting knowledge to developing the mindset and skills which are necessary for students to survive and excel in a volatile world.

As technology is changing rapidly, by the time accountancy students graduate, the technology they learn in the accountancy curricula may be outmoded. It is crucial that they are able to recognize the challenges, have a growth mindset and are well-equipped with skills to learn new things and acquire new knowledge. This may also involve cultivating an attitude of life-long learning.

Furthermore, it is crucial for accountancy academics to collaborate more closely with industry experts and academics from other schools, such as engineering schools. It is difficult, if not impossible, for accountancy schools alone to create adequate competency to teach technology.

However, relying solely on IT academics and experts could mean connections between technology and accountancy may be unclear.

It is, thus, important for accountancy academics to work closely with IT academics and experts to understand the emerging technologies and identify the implications these technologies may have for accountancy.

Thereafter, they can guide accountancy students to see linkages between technology and accounting.

It should be noted that although technology adoption and utilization may be beneficial for accounting practices, this by no means concludes that all technology should be adopted. Accountancy practitioners need to understand their own requirements and the benefits and limitations of each technology in order to choose the technology which suits their work.

As with any research study, this study is subject to several limitations, and therefore, the results should be interpreted with caution.

First, the number of responses is quite low in both Thailand and Lao PDR. For accountancy practitioners in particular, respondents in Thailand are from large international accounting firms, while respondents in Lao PDR are from small accounting services firms. Results reported in this study may, therefore, represent situations and

opinions in these two contexts only.

Secondly, this study relies heavily on responses from an online survey. Although some interviews were conducted and the responses therefrom incorporated into the analysis, an in-depth investigation using a case study approach could yield further insights regarding the adoption, adaptation and utilization of technology in accountancy work and education.

Finally, further discussions with other stakeholders, such as regulators and IT experts, could provide useful insights into how to promote the level of awareness of emerging technology and accelerate its adoption, adaptation and utilization in accountancy practices and education.●

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Appendix 12: Vietnam

Dang Van Thanh, Vietnam Association of Accountants and Auditors,

Pham Ngoc Hoang Thanh, Smart Train Academy,

Chuc Anh Tu, Academy of Finance (AOF),

Ho Yew Kee, Singapore Institute of Technology, and
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Nanny Dewi Tanzil, Universitas Padjajaran

Background

Vietnam has two professional accounting associations.

The first is the Vietnam Association of Accountants and Auditors (VAA) which was established in 1994 under Decision 12-TTg by the Prime Minister of Vietnam and formally named the Vietnam Association of Accountants and Auditors under Decision 35/2004/BNV as authorized by the Minister of Home Affairs. VAA has about 10,000 members¹.

The stated objectives of VAA are to “unite organizations and individuals involved in the accountancy practice to develop the profession; upgrade professional skills; uphold ethics for Vietnam’s management of economic and financial issues, and integration into the community of accountancy bodies around the world”². VAA has been a member of the International Federation of Accountants (IFAC) since 1998.

The second is the Vietnam Association of Certified Public Accountants (VACPA), established in 2005. Previously, VACPA was a professional association under the umbrella of VAA. However, in 2014, VACPA became the second Professional Accounting Organization (PAO) in Vietnam whose primary members are auditors and audit firms. Although membership is voluntary, all members of VACPA must hold a CPA certificate issued by the Ministry of Finance of Vietnam.

The objectives of VACPA are: “to develop the quality of accounting and auditing services; to preserve professional ethics; to enhance member value to be recognized by regional and international organizations; and to contribute to the transparency of economic and financial information in Vietnam in accordance with laws and regulations”³.

VACPA’s primary coverage of auditors allows it to administer “training and development for its members; work with the Ministry of Finance to draft technical standards for the profession, including the national Code of Ethics; and participate in both quality assurance,

1 Bouilheres, F., Lange, P., Scully, G., Yapa, P., and O’Connell, B. (2022). Professional accounting body affiliation in a developing country: the case of membership attraction in Vietnam. *Accounting Education*, vol 31(3): 294-321.

2 <https://www.ifac.org/about-ifac/membership/members/vietnam-association-accountants-and-auditors> accessed on 16 Aug 2023.

3 <https://www.ifac.org/about-ifac/membership/members/vietnam-association-certified-public-accountants> accessed on 16 August 2023.

and investigative and disciplinary activities, which are overseen by the Ministry of Finance²⁴.

This study documents the adoption of technology by the accountancy sector in Vietnam. The findings are arranged in three parts: Professional Accounting Organizations (PAOs), Accountancy schools of Institutes of Higher Learning (IHLs) and accounting firms.

Part 1: Professional Accounting Organization (PAO) – VAA

A survey instrument was sent to the VAA (“the respondent”) for the purpose of our study on technology adoption in the accountancy sector. The survey was answered by a member of the senior management of VAA.

As a professional body, VAA is supported by a full-time staff of less than 50.

The respondent was asked about its awareness of selected technologies and the responses are shown in Figure 1 below.

The respondent exhibits a high level of awareness of data analysis/ big data (5.0), artificial intelligence (4.0) and cloud computing (4.0).

The technologies of which the respondent has the lowest level of awareness include: robotic process automation (2.0), machine learning/intelligence (2.0), extended reality (2.0), augmented reality (2.0) and artificial human assistants (2.0).

Figure 1: Level of awareness of selected emerging technologies
(1 – Not at all and 5 – Fully aware)

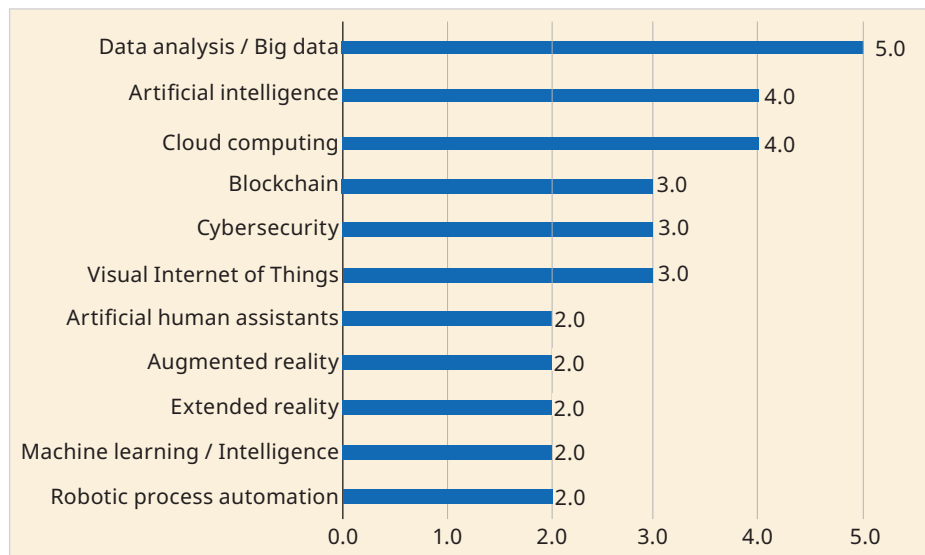
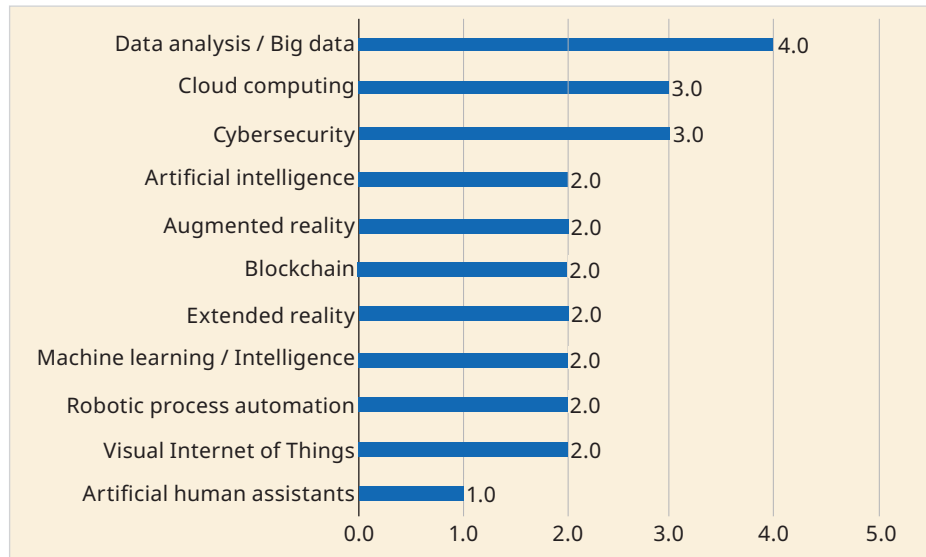


Figure 2 shows the responses to the level of utilization of the selected technologies. The level of utilization is lower for almost all the selected technologies compared to the level of awareness.

This reinforces the notion that utilization lags behind awareness and that much more needs to be done to convert awareness to utilization.

4 Ibid.

Figure 2: Level of utilization of selected emerging technologies
(1 – Not at all utilized and 5 – Utilized all the time)



The survey shows that even technologies with high levels of awareness (namely, data analysis/ big data [4.0], artificial intelligence [4.0] and cloud computing [4.0]) fall short in the level of utilization which is generally much lower (i.e., 4.0, 2.0 and 3.0 respectively).

Part 2: Accountancy schools of institutions of higher learning (IHLs)

A survey questionnaire was sent to various IHLs in Vietnam and garnered responses from 38 respondents.

a. Demographics of the respondents

Figure 3 shows the distribution of the respondents, the majority of whom are from public institutions (86.2%) while the rest are from private IHLs.

Figure 3: Respondents by types of institutions of higher learning (IHLs) by sector

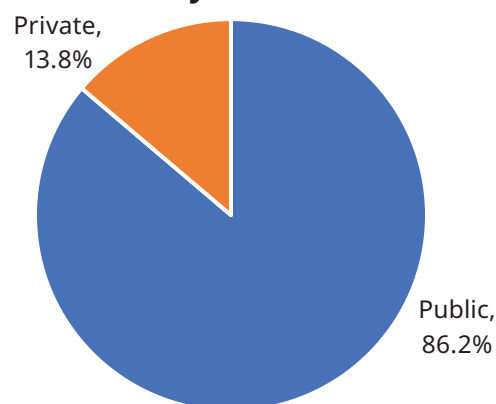


Figure 4 gives the distribution of the academic positions of the respondents.

The majority of them are teaching faculty (58.6%) while the rest of them are deans, deputy/associate/assistant deans and heads of programmes (41.4%).

The number of respondents and their distribution in terms of their academic positions would provide a good representation of the views of the IHLs.

Figure 4: Academic status of the respondents at the institutions of higher learning

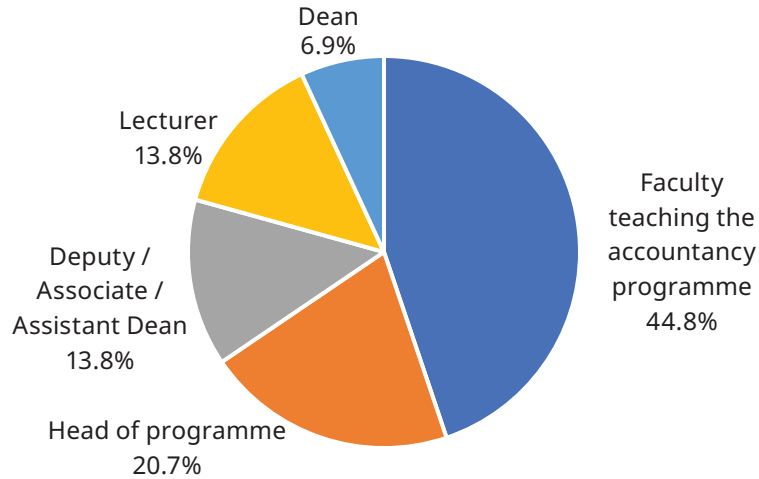
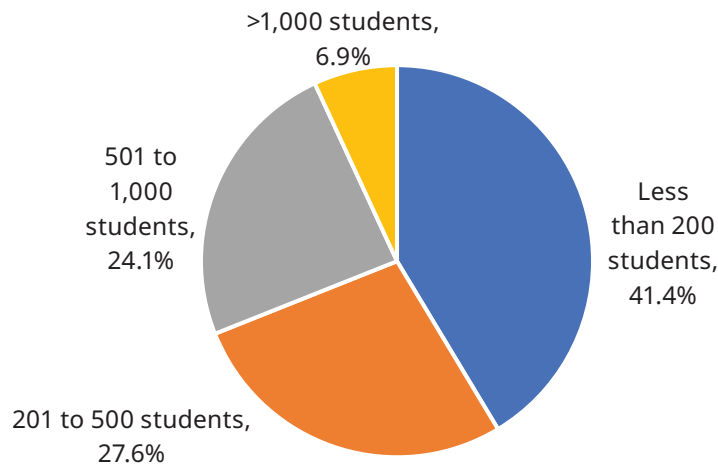


Figure 5 shows the enrolment numbers of the respondents' schools. The number of students ranges from less than 200 to more than 1,000. The respondents comprise both large and small schools.

Figure 5: Enrolment at Institutions of Higher Learning (IHLs)

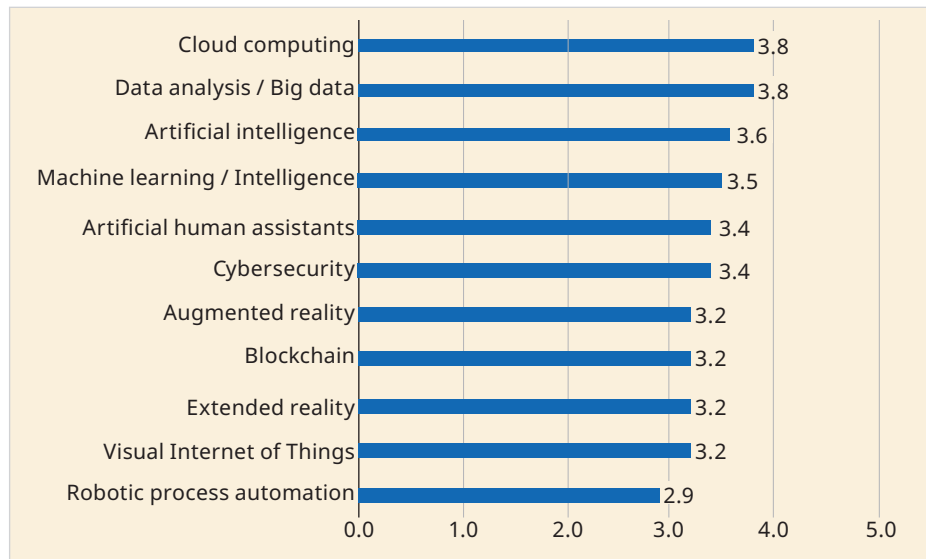


b. Awareness, competencies, importance and incorporation of selected emerging technologies

Respondents were asked about their awareness of the selected technologies. Figure 6 summarizes their responses.

Data analytics/big data (3.8) and cloud computing (3.8) enjoy the highest level of awareness and this is followed by artificial intelligence (3.6). Robotic process automation has the lowest level of awareness (2.9).

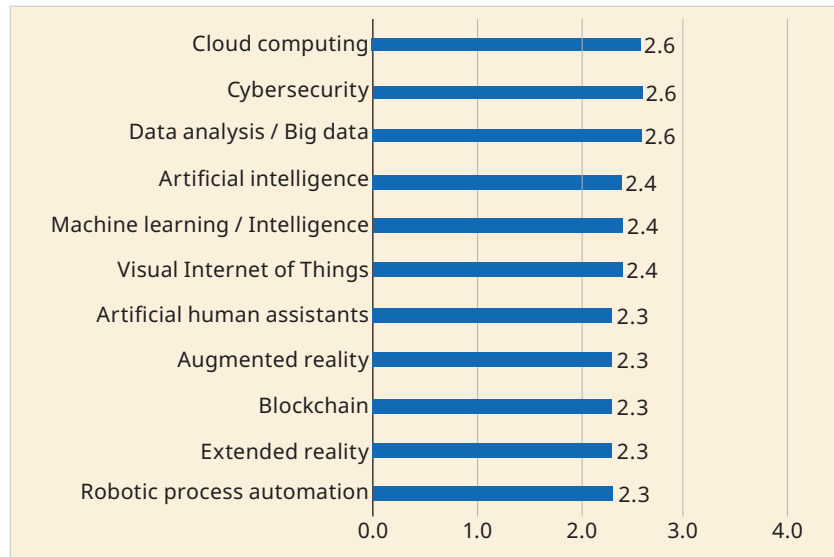
Figure 6: Level of awareness of the selected emerging technologies
(1 – Not at all and 5 – Fully aware)



The respondents were further asked about their level of teaching competency vis-à-vis the selected technologies and the scores given are consistent with the levels of awareness, albeit lower.

Therefore, it is important that accountancy schools should continually monitor emerging technologies as ultimately the level of awareness is an important starting point in influencing their level of competency in teaching those selected technologies.

Figure 7: Level of teaching competency in selected emerging technologies
(1 – None, 2 – Foundation, 3 – Intermediate, 4 – Advanced)



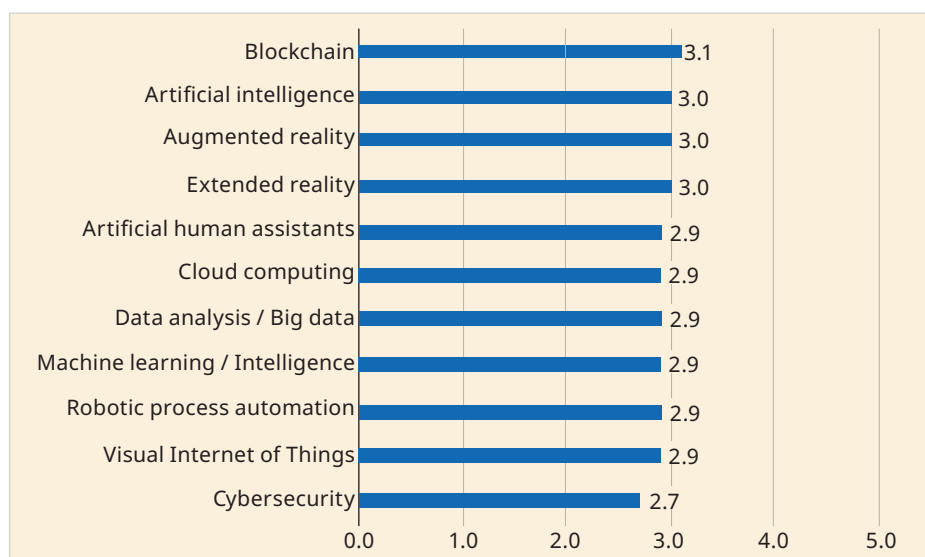
The respondents were further asked for their views on the level of importance of the emerging technology to be incorporated into the accountancy curriculum. Figure 8 contains their responses and blockchain is rated the highest (3.1) even though the level of teaching competency is among the lowest (2.3).

This signals the perception of the need to scale up the awareness and competency in this technology.

The same can be said for the next three highest rated technologies: extended reality (3.0), augmented reality (3.0) and artificial intelligence (3.0).

The responses suggest that the respondents are willing to consider the relative importance of new and unfamiliar technologies in their teaching curriculum.

Figure 8: Level of importance of selected emerging technologies to be incorporated into the accountancy curriculum
(1 – Least crucial and 5 – Most crucial)



When it comes to the level of incorporation of emerging technologies into the accountancy curriculum, the average rating is relatively low and this is shown in Figure 9.

The highest rated technologies are the same that ranked highest for awareness and competency: Cybersecurity (2.5), cloud computing (2.6) and data analysis/big data (2.7).

Figure 9: Level of incorporation of selected emerging technologies Into the accountancy curriculum

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

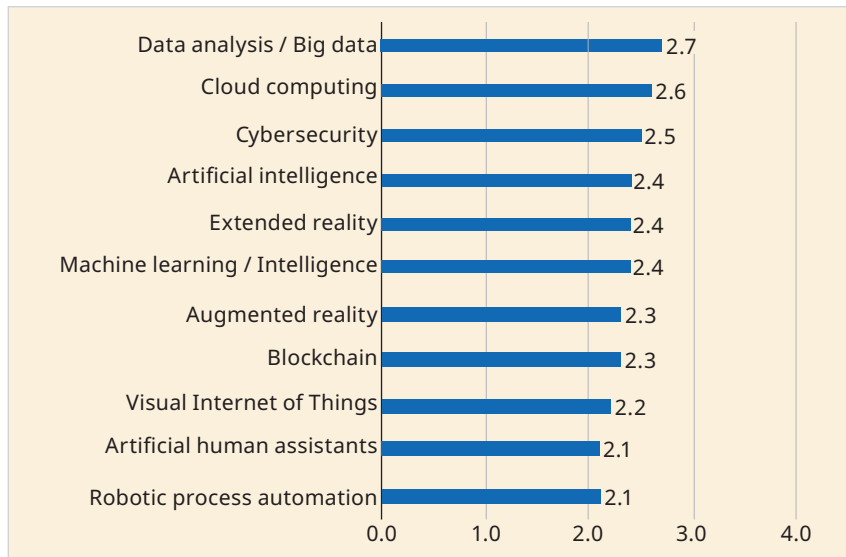


Table 1 collates the ranking of the 4 measures of technology adoption by the respondents: awareness, competency, relative importance and incorporation in the accountancy curriculum.

There seems to be convergence in the rankings for data analysis/big data, cloud computing and artificial intelligence.

The convergence is particularly strong for data analysis/big data and cloud computing. Surprisingly, robotic process automation has the lowest ranking overall.

Table 1: Ranking of the 4 measures of technology adoption – awareness, competency, importance and incorporation

	Awareness		Competency		Importance		Incorporation		Average rank
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	
Data analysis / Big data	3.8	1	2.6	1	2.9	5	2.7	1	2.0
Cloud computing	3.8	1	2.6	1	2.9	5	2.6	2	2.3
Artificial intelligence	3.6	3	2.4	4	3.0	2	2.4	4	3.3
Machine Learning / Intelligence	3.5	4	2.4	4	2.9	5	2.4	4	4.3
Cybersecurity	3.4	5	2.6	1	2.7	11	2.5	3	5.0
Extended reality	3.2	7	2.3	7	3.0	2	2.4	4	5.0
Blockchain	3.2	7	2.3	7	3.1	1	2.3	7	5.5
Augmented reality	3.2	7	2.3	7	3.0	2	2.3	7	5.8
Visual Internet of Things	3.2	7	2.4	4	2.9	5	2.2	9	6.3
Artificial human assistants	3.4	5	2.3	7	2.9	5	2.1	10	6.8
Robotic process automation	2.9	11	2.3	7	2.9	5	2.1	10	8.3

The respondents were also asked to provide the list of software that they use to teach their technology courses.

Table 2 summarizes the software used.

The list suggests that IHLs in Vietnam use an extensive range of software in their teaching of technology in their accounting programmes.

It is to be noted that for data analysis/big data, the number of listed software is the largest.

Table 2: Software used for teaching the selected emerging technologies

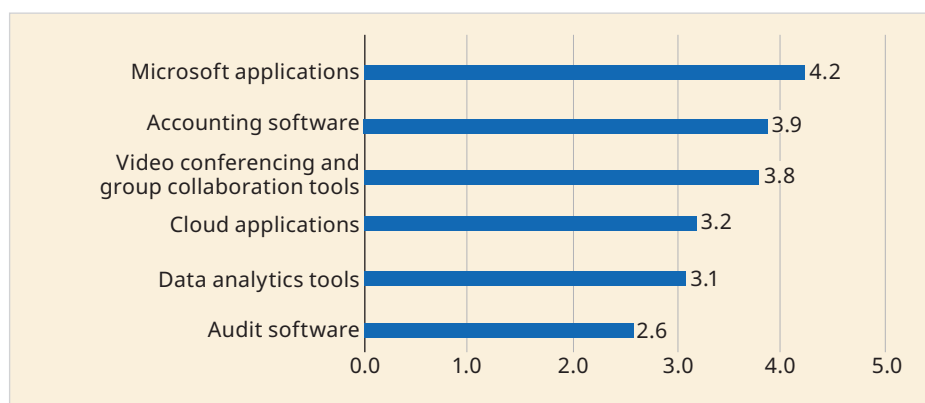
Technology	Softwares
Artificial intelligence	AI, Deep Vision, Docyt, Microsoft, MISA AMIS, Self-develop, Siri
Artificial human assistants	AI, Blue Dot, Google Assistant, microsoft, MISA, AMIS, Self-develop
Augmented reality	Accounting software, AI, ELSA Speak, Kahoot, Microsoft HoloLens, MISA AMIS
Blockchain	AI, Cortana, Hyperledger Fabric, Microsoft, MISA AMIS, Self-develop
Cloud computing	AI, AWS, FAST, Google Drive, MISA AMIS, Public Cloud
Cybersecurity	AI, Bitdefender Internet Security, BKav, Microsoft, MISA AMIS, Windows Defender
Data analysis / Big data	Big Data (Softwares), AI, Excel, Fiinfro, FireAnt, MISA AMIS, Power BI, R, Python, Self-develop, Skytree, Softwares, SPSS , STRATA
Extended reality	Accounting software, AI, Microsoft, MISA AMIS, Virtual Reality, Vuforia
Machine learning / Intelligence	AI, Engineering and Manufacturing, MISA AMIS, Projector, Self-develop, Softwares, STRATA, TranS, Xero
Robotic process automation	AI, Augmented reality, Microsoft, MISA AMIS, UiPath
Visual Internet of Things	AI, MISA AMIS, Mixed Reality, Powerpoint, ThingWorx

The respondents were asked how much of a selected suite of technology tools is currently used or has been embedded in the accountancy curriculum in the last three years. The responses are summarized in Figure 10.

From Figure 10, it seems like the most popular tools are Microsoft applications (4.2), followed closely by accounting software and video conferencing (3.9) and group collaboration tools (3.8). Audit software has the lowest rating (2.6).

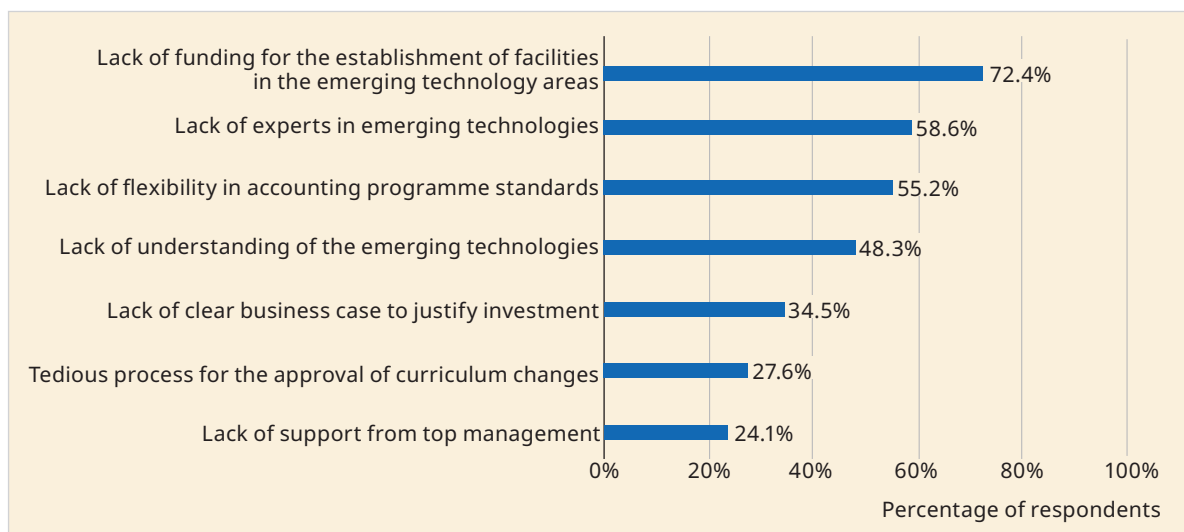
Figure 10: Technology tools used in accountancy curriculum

(1 – Never used and 5 – Frequently used)



The respondents were asked to identify the barriers they faced in adopting technology in their accountancy curriculum. Respondents were allowed to cite more than one barrier.

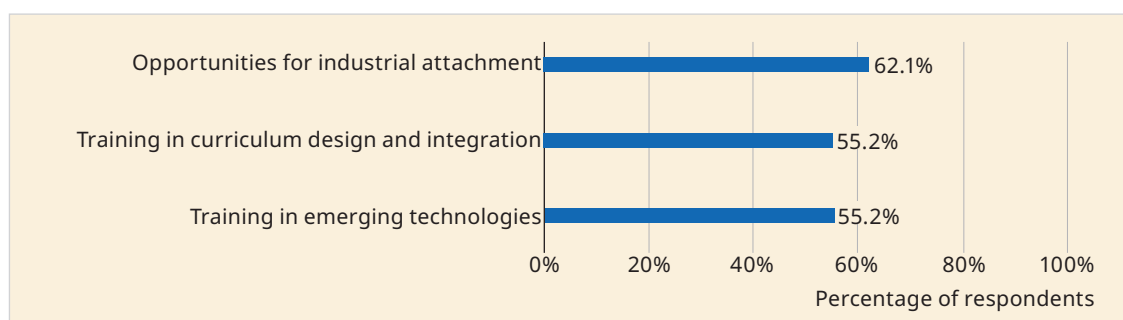
Figure 11 shows that 72.4% of the respondents indicate that the lack of funding for the establishment of facilities or acquisition of emerging technologies is a key barrier. 58.6% of them are concerned about the lack of experts in emerging technologies while 55.2% indicate that lack of flexibility in accounting programme standards is a barrier.

Figure 11: Barriers to adoption of technology in the accountancy curriculum

Having documented some of the barriers to technology adoption, the respondents were asked about the kind of help they would need to incorporate technology into the accountancy curriculum.

Interestingly 62.1% of the respondents believe that opportunities for industrial attachments may be helpful to incorporating technology into the accountancy curriculum. This is consistent with the articulated barrier of lack of experts.

It is one way to increase the pool of technology experts by learning from the industry. The majority of the respondents also agree that training in emerging technologies (55.2%), and curriculum design and integration (55.2%) are also important to help them incorporate technology into their accountancy curriculum.

Figure 12: Help needed to incorporate technology into the accountancy curriculum

The accounting literature propounds the view that technology in the accounting field should preferably be taught by accounting instructors who are experts or very conversant with the technology.

However, there is a severe shortage of such technologically-inclined accounting instructors.

Alternatively, technology could be taught by technology experts from the accountancy sector. These are also short in supply.

Finally, a hybrid approach is to bundle accounting instructors with IT instructors to co-teach the technology course. The advantage of this approach is to overcome the shortage of technologically-inclined accounting educators. However, the disadvantage of this hybrid

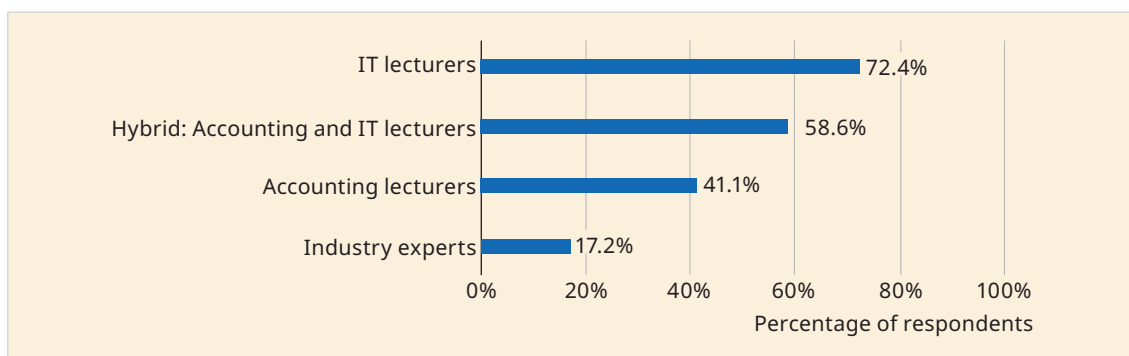
approach is that the technology portion of the accountancy curriculum could be taught without an accounting context and the knowledge domain can become disjointed.

Respondents were asked in what ways technology should be taught in accountancy schools, including who should be the main instructors.

Figure 13 shows the responses with regard to who should be teaching the technology component. Most of the respondents (72.4%) still favour designating IT lecturers to teach technology courses. 58.6% favour a hybrid approach in which the technology course is taught by both accounting and IT lecturers.

This may suggest that the respondents are of the view that there is a severe shortage of technology-inclined accounting instructors to teach technology.

Figure 13: Views on how to teach technology courses in the accountancy curriculum



For technology to be included in the accountancy curriculum, respondents were asked their preferred mode for teaching the courses.

Should the technology courses be taught as stand-alone technology courses or should they be embedded into the accounting courses?

Both methods have their advantages and disadvantages.

A stand-alone technology course has the advantage of instructors drilling deep into the technology. However, the knowledge can be unrelated to accounting and suffers from a lack of integration with the accounting domain.

The other approach is to incorporate technology as part and parcel of the core accounting courses. This is ideal but it suffers from two major challenges.

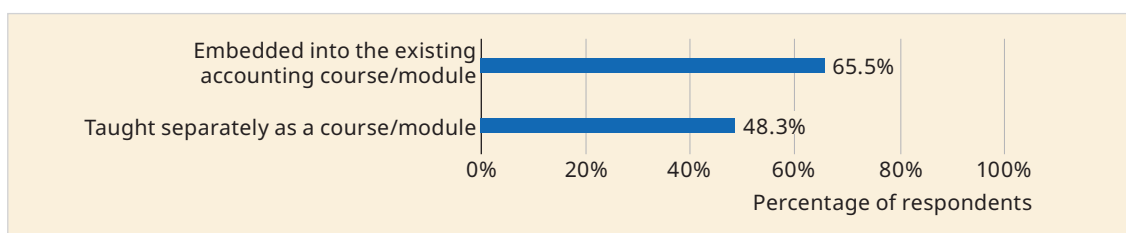
First, it is much harder to teach an accounting course with embedded technology. The danger too is that the course may end up having insufficient depth and coverage in both accounting and technology knowledge.

Secondly, it is very difficult to find accounting instructors who can weave technology effectively into accounting courses.

Figure 14 shows how technology is to be taught in the accountancy curriculum.

65.5% of the respondents prefer to teach technology in accounting courses in an integrated manner, for example, embedding data analytics into auditing while 48.3% of the respondents prefer technology to be taught separately as a course/module.

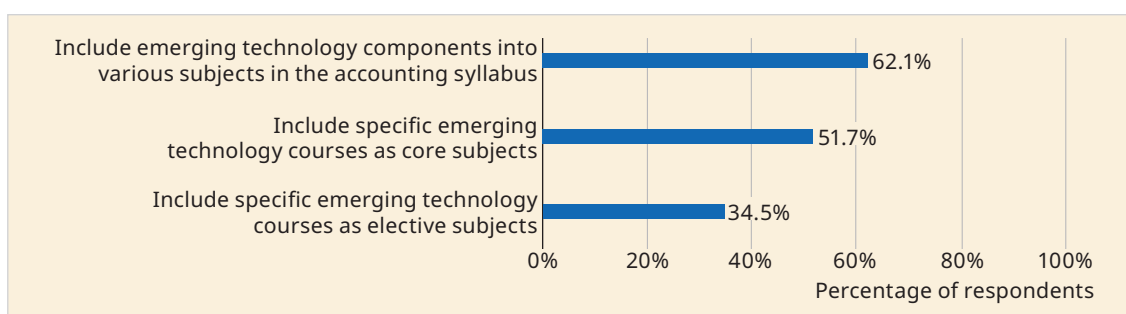
The responses would suggest that the favoured approach is mixed rather than leaning strongly towards one particular mode.

Figure 14: How technology is to be taught in the accountancy curriculum

Given a general preference to embed technology into existing courses, it is not surprising that a majority of the respondents prefer to include emerging technology into various courses in the accountancy curriculum (62.1%) rather than having them as specific courses either as electives (34.5%) or as core subjects (51.7%).

This is shown in Figure 15. Yet again the evidence does not strongly indicate a dominant approach.

Therefore, there are multiple approaches to incorporating emerging technology into the accountancy curriculum.

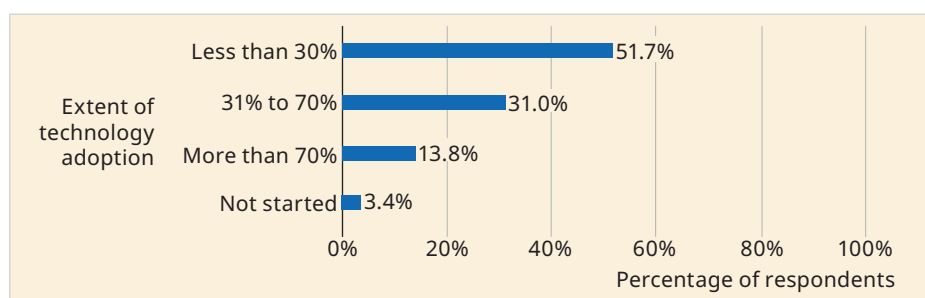
Figure 15: Incorporating emerging technology into the accountancy curriculum

Respondents were asked a final question on the state of adoption of technology in their accountancy curriculum.

Figure 16 summarizes their responses.

More than 50% of the respondents have adopted less than 30% of emerging technology in their accountancy curriculum.

Only a small percentage (3.4%) has not made any headstart. It is heartening to document that 31.0% have adopted between 31% to 70% of technology in their accountancy curriculum.

Figure 16: State of technology adoption in accountancy curriculum

In summary, the survey provides evidence that the IHLs in Vietnam are taking significant steps to incorporate technology into their accountancy curriculum.

The level of awareness is high, with activities carried out involving the selected technologies. The two main constraints are the lack of experts in technology and funding for the establishment of the needed infrastructure.

The majority of the respondents are of the opinion that industry attachment could be one way to ease the shortage of experts.

There is a general preference to weave technology into the accounting courses rather than conduct mere stand-alone technology courses.

Part 3: Accounting firms

a. Demographics of the respondents

A survey instrument was sent to accounting firms for their responses. There were 34 respondents and the types of firms they represent are shown in Figure 17. The majority of the respondents are limited liability partnerships (67%) while 12% are limited liability companies and 15% are partnerships.

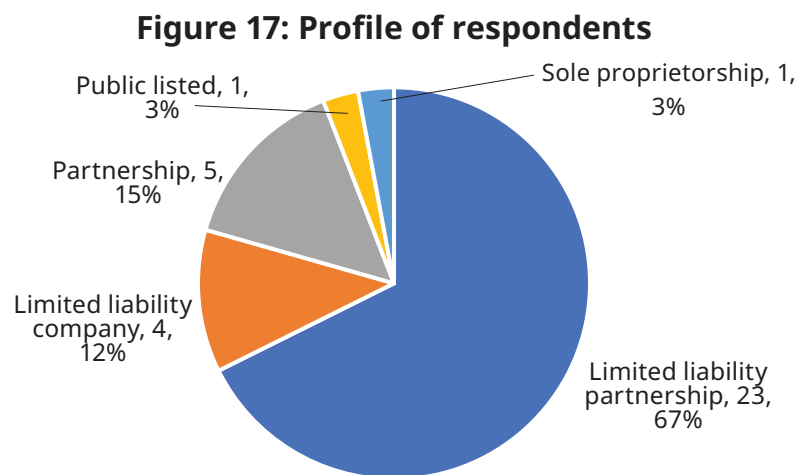


Figure 18 shows the corporate positions held by those representing the respondents in the survey. A large number of the respondents (79%) hold the following three positions: Owner/Practitioner/Partner (29%), manager/supervisor (26%) and senior auditor (24%).

This suggests that the respondents present a spectrum of positions ranging from junior auditors to owners or partners.

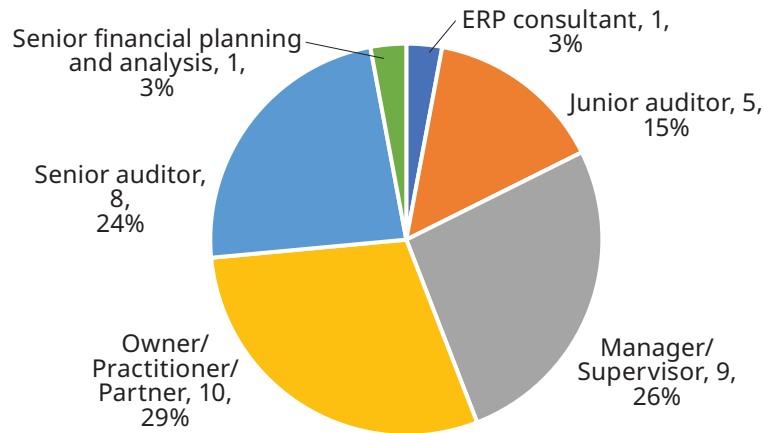
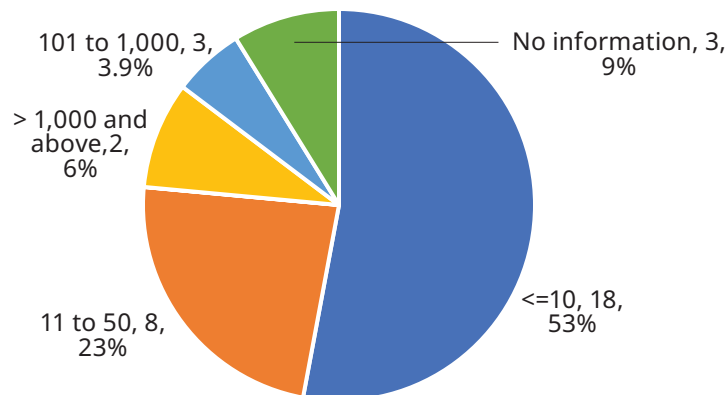
Figure 18: Positions of the respondents in their firms

Figure 19 provides an indication of the sizes of the firm size of the respondent firms. 53% of the respondents have fewer than 10 staff in their firm while 23% of the respondents employ between 11 to 50 staff.

Only 9% or 3 of the respondents have between 101 and 1,000 staff, and 6% or 2 respondents have a headcount of more than 1,000.

There were no respondents whose firm size is between 51 and 100 staff.

The distribution suggests that the respondents span a wide spectrum of small and large firms.

Figure 19: Number of employees in the respondent firms

The respondents also provide information on the number of accountants in their firms. Figure 20 shows that 29% of the respondents have between 11 and 20 accountants while 26% have up to 10 accountants.

On the other hand, 24% of the respondents hire between 21 and 40 accountants. Only 15% of the respondents have more than 50 accountants and only 6% or 2 firms employ between 41 and 50 accountants.

The distribution suggests that the respondents represent a wide spectrum of firms with both small and large numbers of accountants.

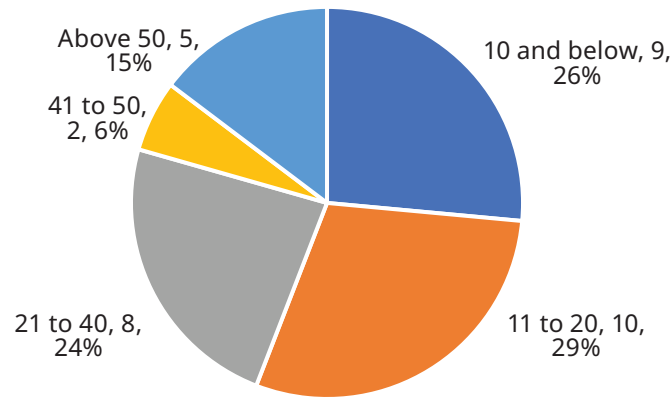
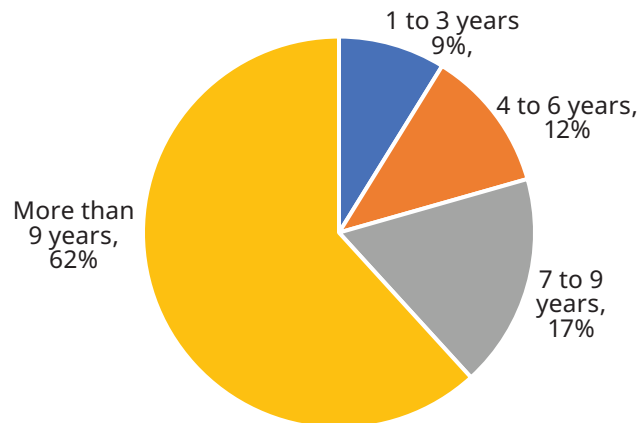
Figure 20: Number of accountants in the respondent firms

Figure 21 shows the distribution of the ages of the respondents' firms. The majority of the firms are more than nine years old (62%). The next largest share of firms falls in the 7 to 9-year bracket, namely, 17%. Another 12% and 9% of the respondents have operated for 4 to 6 years and 1 to 3 years respectively.

Figure 21: Age of the respondent firms

b. Awareness and utilization of selected emerging technologies

The respondents were asked to provide an indication of their level of awareness of advances in emerging technology pertaining to the accountancy sector.

Figure 22 provides a statistical summary of their level of awareness of 11 selected emerging technologies.

The 3 emerging technologies of which the respondents have the highest level of awareness are: data analysis/big data (3.8), cybersecurity (3.6) and cloud computing (3.6).

The emerging technology that has the lowest level of awareness is blockchain (2.7). Generally, the level of awareness is above neutral (ie., neutral has a value of 3.0).

Figure 22: Level of awareness of advances in selected emerging technologies
(1 – Not at all and 5 – Fully aware)

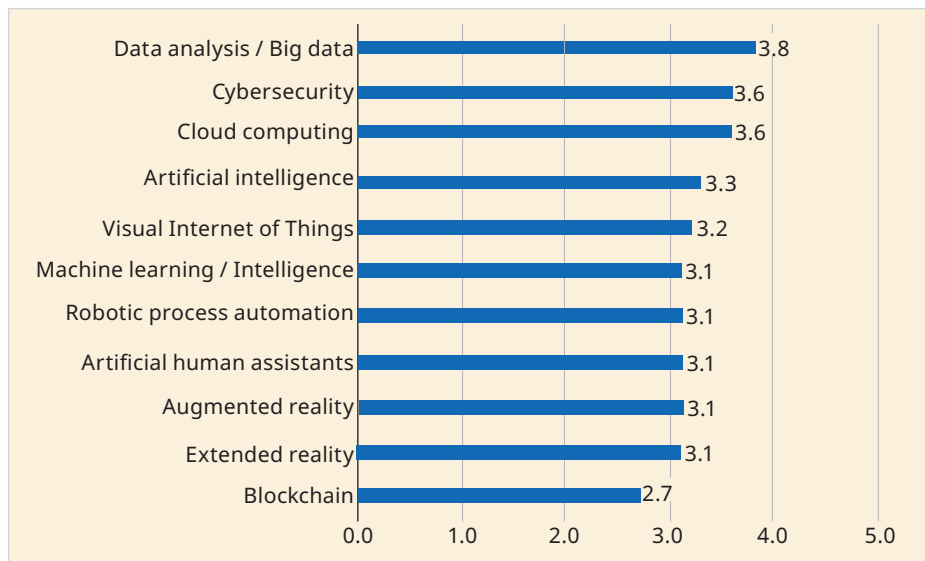


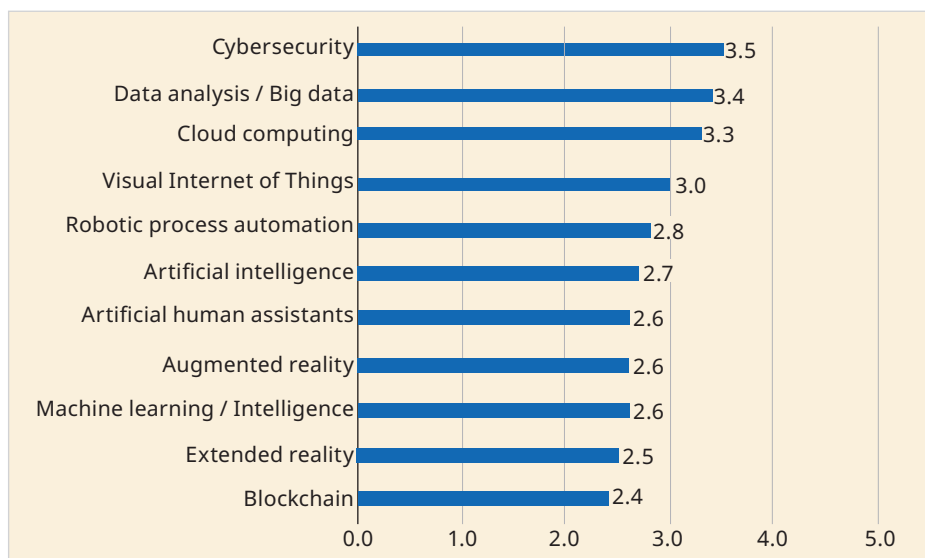
Figure 23 shows the level of utilization of emerging technologies.

The top three emerging technologies utilized are consistent with the level of awareness are cybersecurity (3.5), data analysis/big data (3.4) and cloud computing (3.3).

However, the level of utilization on average is lower than the level of awareness. This could mean that it is one thing to be aware of a technology but another thing to be utilizing the technology.

Blockchain (2.4) and extended reality (2.5) have a very low level of utilization which is consistent with their low awareness rating. With 3.0 being neutral, most of the emerging technologies are not well utilized.

Figure 23: Level of utilization of the selected emerging technologies
(1 - Not at all utilized and 5 - Utilized all the time)



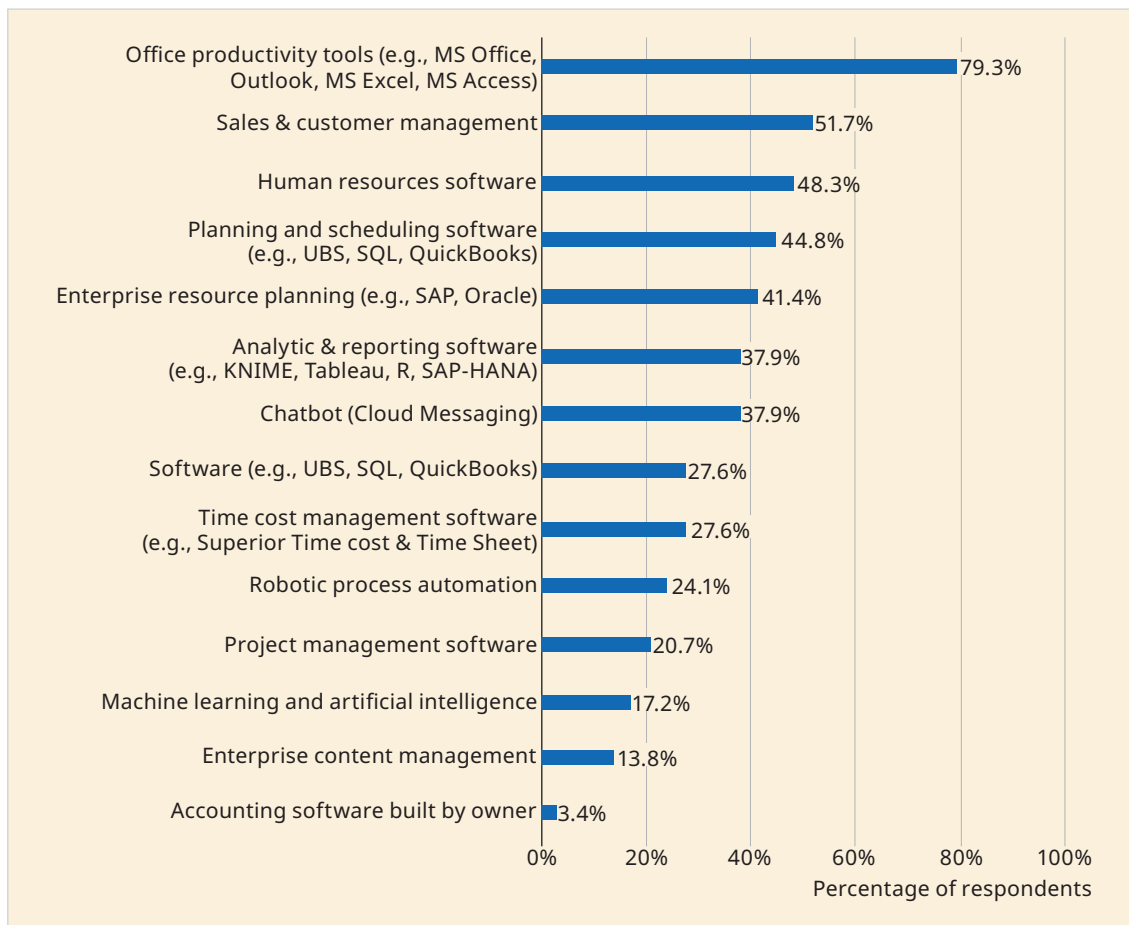
c. Systems and software adoption

The respondents were asked to provide their inputs on the type of systems and software which they currently adopt in their work.

Respondents can choose multiple responses. Figure 24 shows the list of systems and software adopted by the respondents.

The most popular software is the office productivity suite (79.3%), followed by sales and customer management software (51.7%). The rest of the software is used by less than 50% of the respondents.

Figure 24: Types of systems and software adopted



d. Computer-assisted audit techniques (CAAT) Adoption

Respondents were specifically requested to provide inputs on the adoption of computer-assisted audit techniques (CAAT).

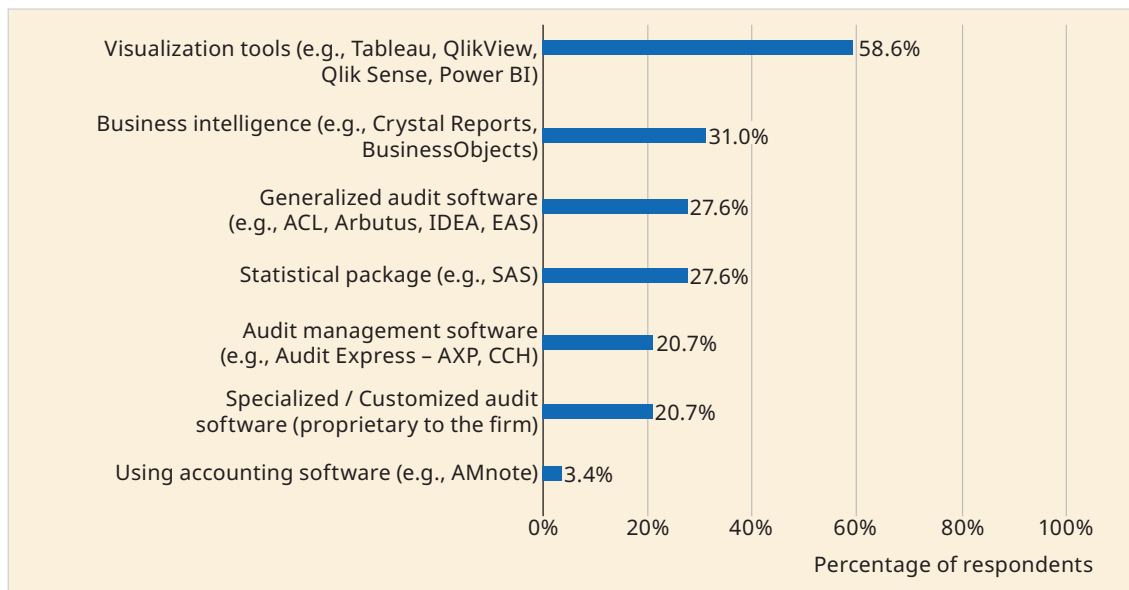
Figure 25 provides a summary of CAAT adoption.

Interestingly, the most popular computer-assisted audit techniques adopted are visualisation tools (58.6%).

These are followed by 31.0% of the respondents who use business intelligence software like Crystal Reports, and BusinessObjects.

Generalized audit software, like ACL, Arbutus, IDEA and EAS, is used only by 27.6% of the respondents.

Figure 25: Types of computer-assisted audit techniques (CAAT) adopted
e. Technological preparedness



The respondents were asked about their preparedness for technology adoption from three different dimensions: the approach to technology, manpower skills and knowledge, and investment in technology.

Figure 26 shows the respondents’ input on five statements regarding their approach to technology. The respondents are generally in agreement with the five statements. They seem to have a more than neutral outlook on the adoption of technology by their firms.

Figure 26: Approach to technology
 (1 – Fully disagree and 5 – Fully agree)

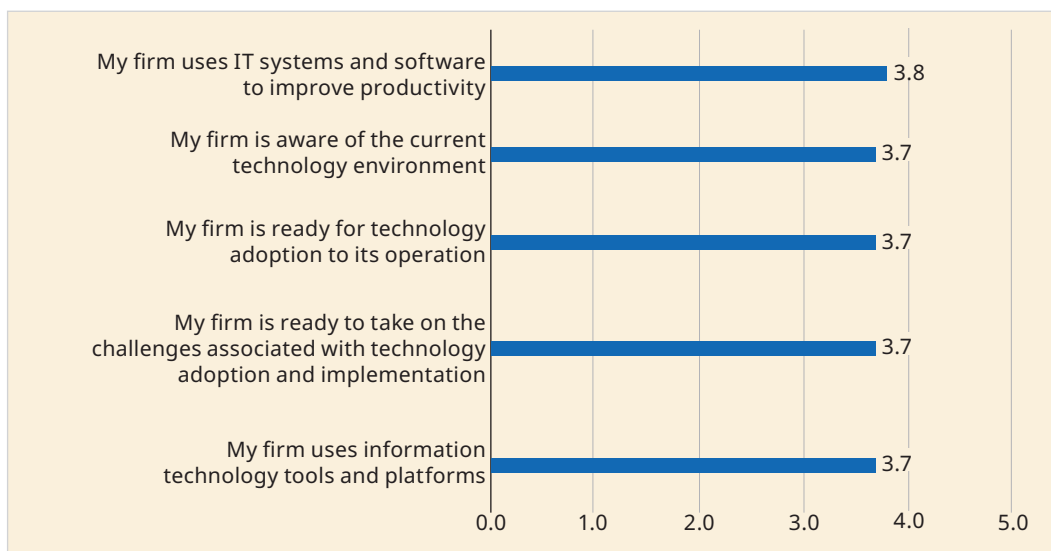


Figure 27 provides a summary of the feedback of the respondents with regard to their manpower skills and knowledge vis-à-vis emerging technology in the accountancy sector.

The responses are generally positive (ie., more than neutral with 3.0 being neutral) about their manpower's skills and knowledge.

They believe that their employees have sufficient knowledge and skills as well as being technology savvy with experience in using technology.

In addition, their employees are also confident in their abilities to deploy multiple technologies in their work.

The respondents express confidence that their employees are familiar with the technological resources available and can utilize the relevant technology in solving their workplace problems.

Figure 27: Manpower skills and knowledge

(1 – Fully disagree and 5 – Fully agree)

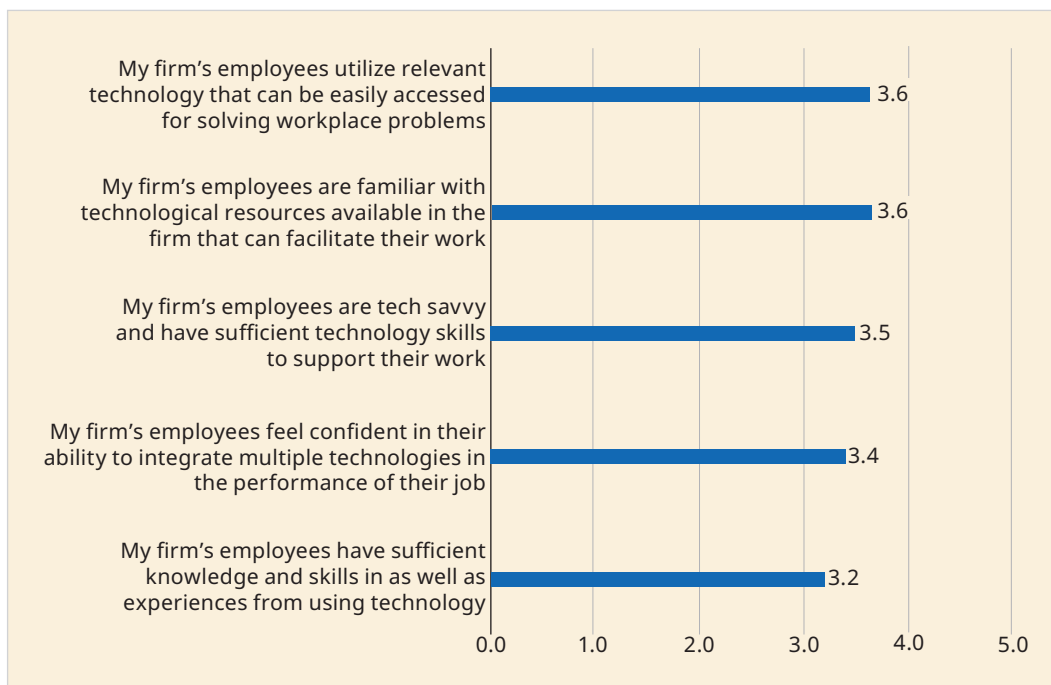
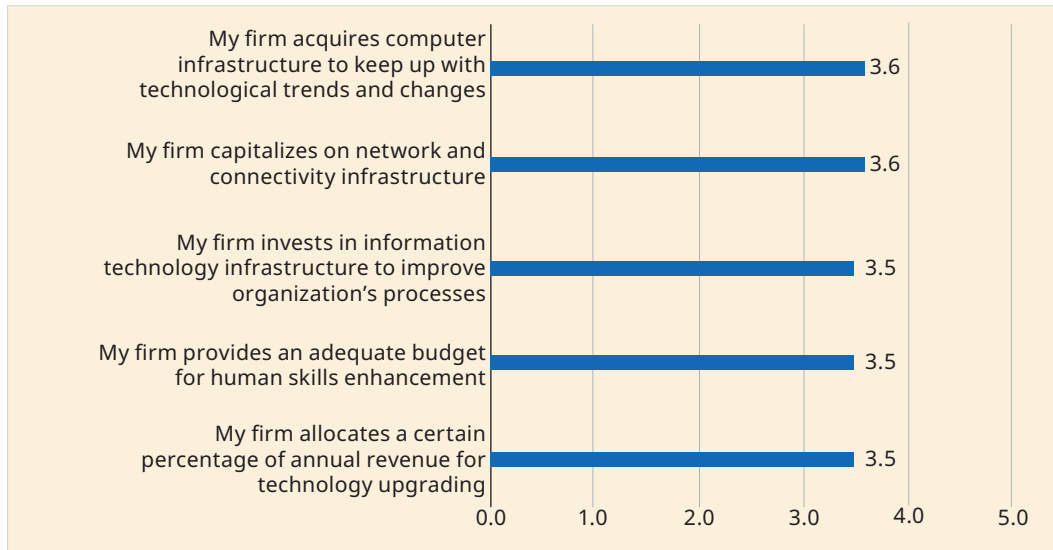


Figure 28 shows the respondents' feedback on their firm's investment in technology. The responses are again more than neutral (3.0) about their investment in technology.

They opine that their firms allocate an adequate budget for human skills enhancement. In addition, their firms invest in information technology infrastructure to improve their firms' processes and capitalize on network and connectivity infrastructure to keep up with technological trends and changes.

Figure 28: Investment in technology

(1 – Fully disagree and 5 – Fully agree)

**f. Planned behaviour towards technology adoption**

The respondents were further requested to provide responses to statements that help to assess their planned behaviour toward technology adoption.

The planned behaviour covers four key aspects: attitude, subjective belief, perceived behavioural control and intention to engage.

Figure 29 provides a summary of the respondents' feedback on their attitude towards adapting technological advances in accounting.

Figure 29 shows more than neutral responses (ie., greater than 3.0) from the respondents.

There is a positive belief that their firms will benefit from adapting to technological advances in accounting and adoption is expected to result in more value creation.

The respondents believe that they will benefit from adapting to technological advances.

Figure 29: Attitude towards adapting to technological advances in accounting

(1 – Fully disagree and 5 – Fully agree)

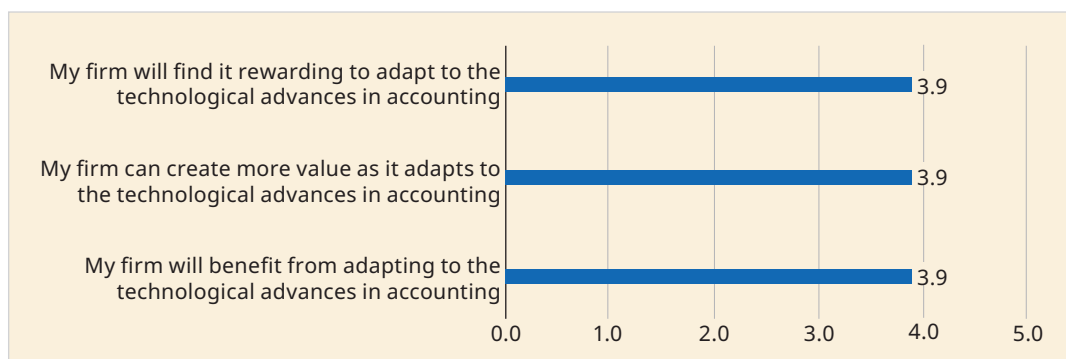


Figure 30 summarizes the respondents' feedback on their subjective belief about the adoption of technological advances for the profession and staff, and the regulator's view on adapting to technological advances in accounting.

There is a more than neutral subjective belief that regulators, the accounting profession and staff think that the adoption of technological advances in accounting is needed for the accountancy profession.

It seems that there is a subjective belief that technological advances benefit the accountancy profession.

Figure 30: Subjective belief about adoption of technological advances in accounting

(1 – Fully disagree and 5 – Fully agree)

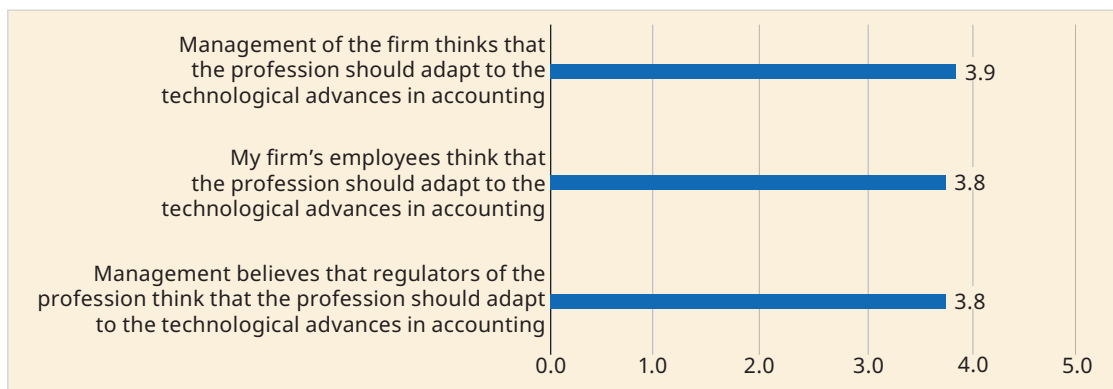


Figure 31 shows the planned behaviour of the respondents in tackling the adoption of technological advances in accounting for their firm.

Interestingly, the degree of planned behaviour is lower than the attitude and subjective belief in the adoption of technological advances as shown in Figures 27 and 28 respectively.

Respondents articulate their planned behaviour in a just above neutral manner (i.e., slightly greater than 3.0).

There is a general positive agreement on the planned actions that financial resources will be made available to enable employees to adapt to technology, and that employees will be provided with accessible continuing professional development programmes, availability of organizational resources and a belief that the employees will find it easy to adapt to technology.

Figure 31: Planned behaviour for technology adoption

(1 – Fully disagree and 5 – Fully agree)

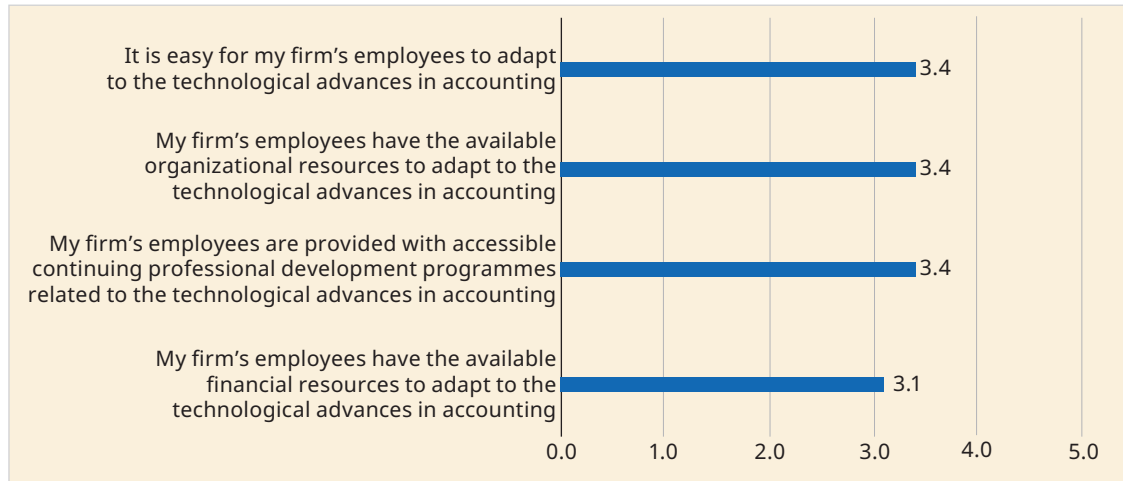


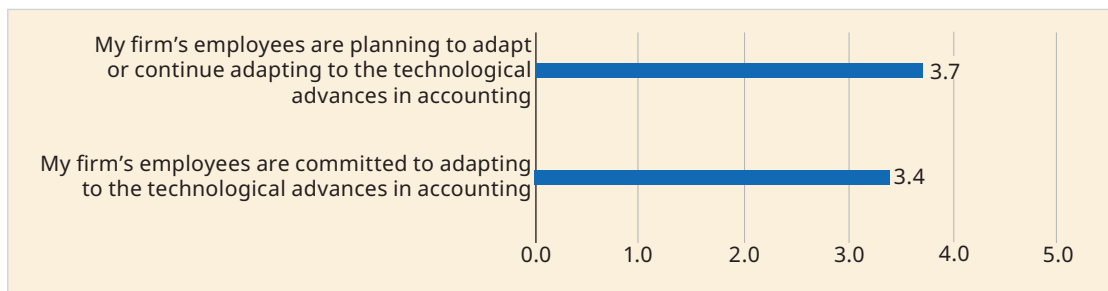
Figure 32 summarizes the respondents' inputs on their intention to adopt technological advances in their business.

The respondents believe that their employees are committed to adapting to the technology and that the employees are making plans to adapt or continue adapting to technology.

There is a slightly more than neutral view from the respondents with regard to technology adoption for their firms.

Figure 32: Intention to engage in adoption of technological advances

(1 – Fully disagree and 5 – Fully agree)



g. Expected benefits of technology adoption

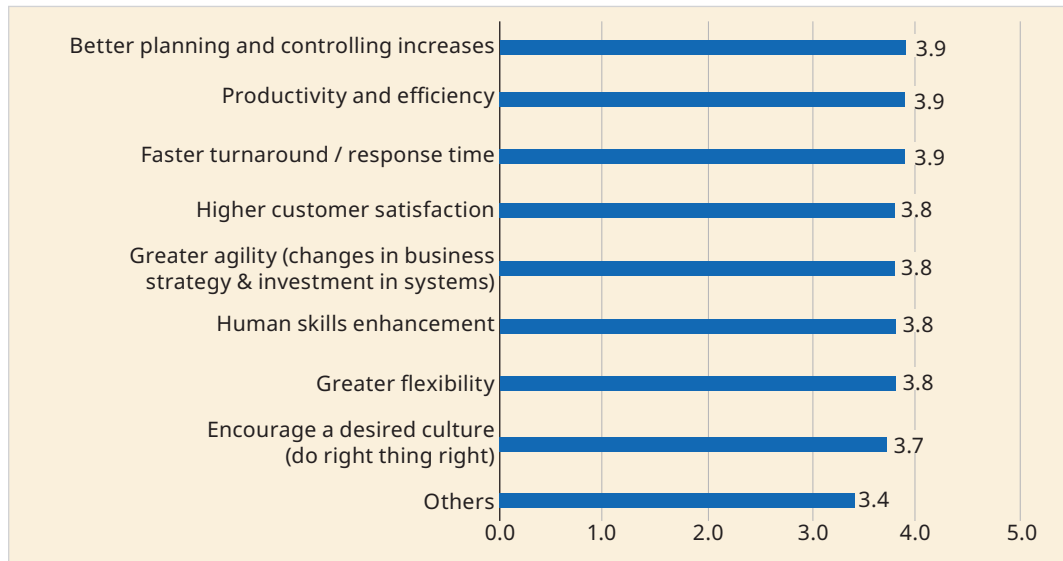
The respondents were asked to articulate the expected benefits of technology adoption. The list of benefits was curated from the accounting literature and industry dialogues. Figure 33 provides a summary of the respondents' feedback on the articulated expected benefits in the literature.

There are positive affirmations from the respondents on the documented benefits of technology adoption.

The most compelling reason is that the adoption of technology will result in productivity and efficiency gains (3.9) in the workplace with faster turnaround time (3.9) from improved planning and control (3.9).

The respondents also agree with other benefits which include: greater flexibility (3.8), human skills enhancement (3.8), greater agility (3.8) and higher customer satisfaction (3.8).

Figure 33: Expected benefits of technology adoption
(1 – Fully disagree and 5 – Fully agree)



h. Challenges to adoption of technology

The respondents were asked a final question on the challenges they face in adopting technology.

Figure 34 provides a summary of the responses.

The key challenge cited is the high investment costs (3.9), followed closely by insufficient knowledge of employees (3.6) and an insufficient number of skilled employees (3.6).

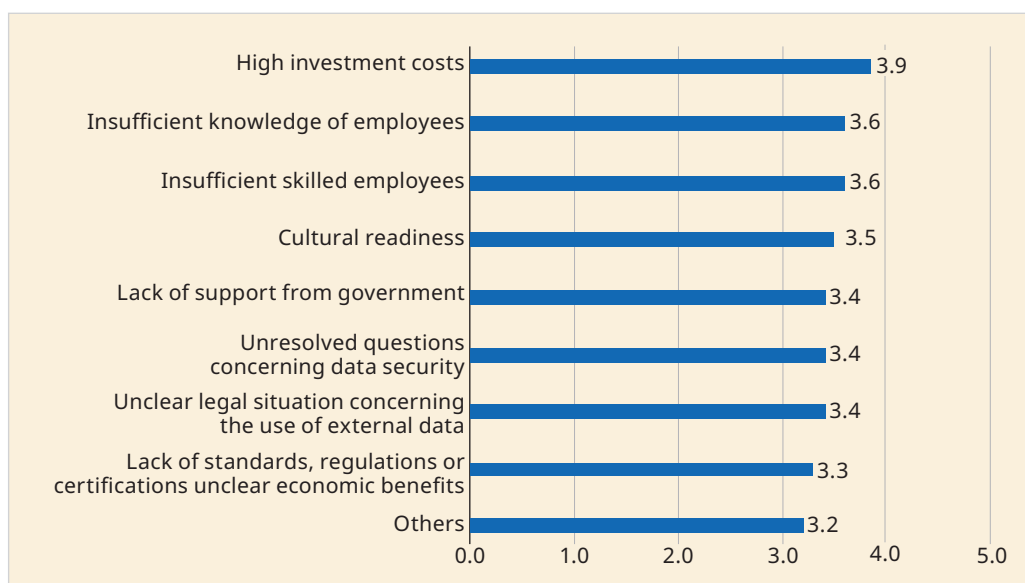
It may seem contradictory that firms are confident of the skills of the employees in technology adoption and yet rate insufficient skilful and knowledgeable employees as some of the biggest challenges.

The contradiction can be resolved by asserting that the firms are confident of their employees' skills and knowledge when it comes to handling technology but there is a significant shortage of such employees.

This is one of the pressing issues in the accountancy sector: a shortage of technologically skilful and knowledgeable employees.

Figure 34: Challenges to adoption of technology

(1 – Fully disagree and 5 – Fully agree)



In summary, there is a high level of awareness but a slightly lower level of utilization of certain technologies which are purported to be most useful to accounting firms.

These include cybersecurity, data analysis/big data and cloud computing. Accounting firms have a more than neutral view of the importance and approach to technology.

However, the key challenge is the availability of technologically skilled and knowledgeable manpower.

Accounting firms are willing to invest in technology as they believe that technology adoption will bring many benefits.

These include: productivity and efficiency, human skills enhancement, and faster turnaround/response time, among others.

All these ultimately benefit the firms through greater customer reach and higher profitability.

The greatest challenge to technology adoption is the high investment costs and the lack of skilful and knowledgeable employees.

Overall Summary

This study assesses perceptions of digital disruption in the accountancy profession from the perspectives of PAOs, accountancy professionals/firms and accountancy schools in Vietnam.

The findings will inform these stakeholders of the concrete steps and strategies needed to enable the accountancy profession to navigate digital disruption.

This study documents the views and perceptions of the three key groups of respondents of digital disruption to the accountancy profession: PAOs, accountancy schools and accountancy professionals.

The general findings are that all parties are aware of the digital disruption and are

taking steps to address it.

There is significant convergence regarding the types of technology which are most needed (cybersecurity, data analysis/big data and cloud computing) by all three parties.

These stakeholders plan to adopt these technologies that they believe are important to the accountancy profession.

However, the lack of instructors and employees trained in these technologies is one of the key barriers to technology adoption.

In addition, respondents are concerned about the high investment costs.

Nonetheless, they believe that technology adoption can generate a host of benefits which include: productivity and efficiency gains in the workplace with faster turnaround time due to better planning and control, greater flexibility, human skills enhancement, greater agility and higher customer satisfaction.●

